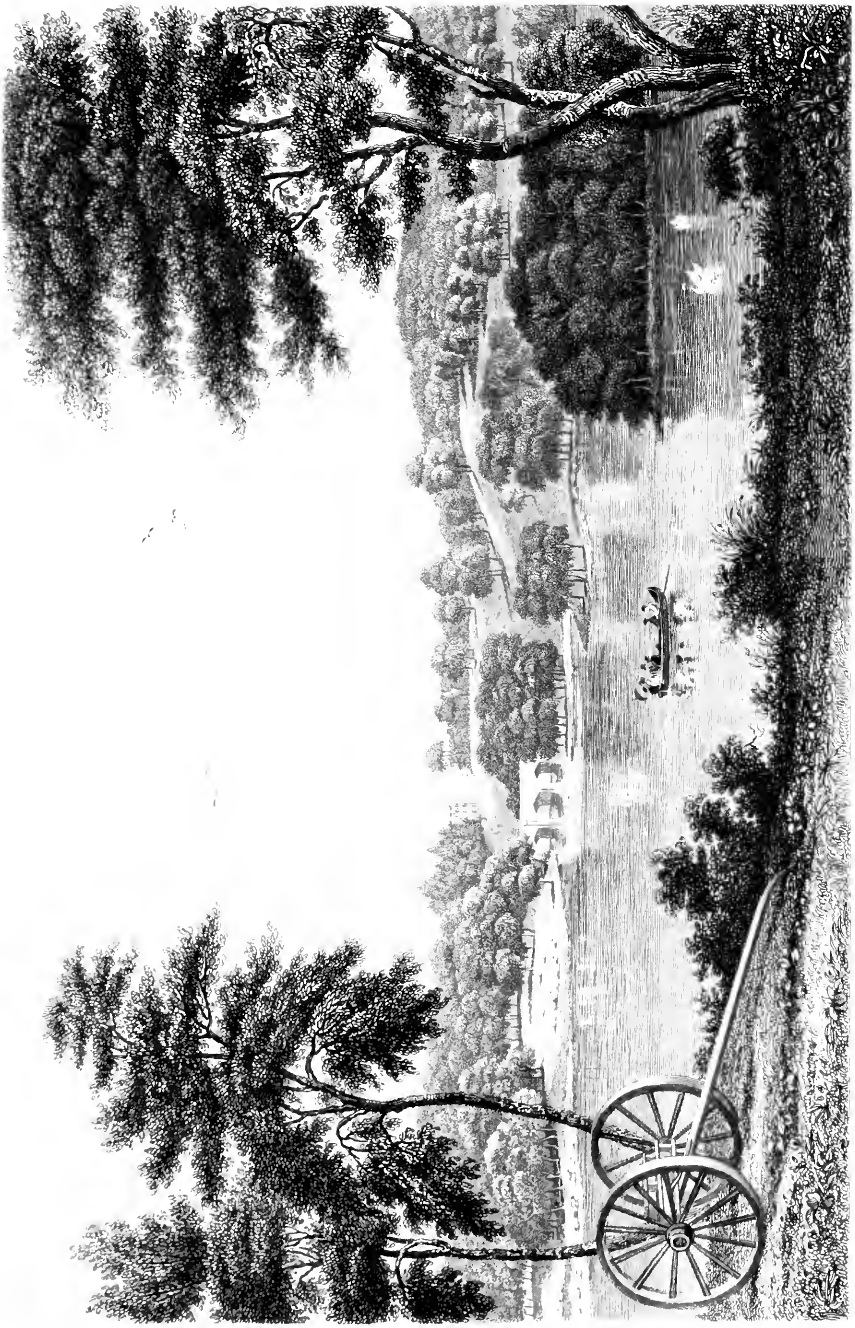

THE

PLANTER'S GUIDE;

OR,

A PRACTICAL ESSAY

ON THE BEST METHOD OF

GIVING IMMEDIATE EFFECT TO WOOD,

BY THE REMOVAL OF

LARGE TREES AND UNDERWOOD;

BEING AN ATTEMPT

TO PLACE THE ART, AND THAT OF GENERAL ARBORICULTURE, ON FIXED AND PHYTOLOGICAL PRINCIPLES;

INTERSPERSED WITH

OBSERVATIONS ON GENERAL PLANTING,

AND THE

IMPROVEMENT OF REAL LANDSCAPE.

ORIGINALLY INTENDED FOR THE CLIMATE OF SCOTLAND.

By Sir HENRY STEUART, Bart.
LL. D. F. R. S. E. ETC.

Imitetur ars Naturam, et quod ea desiderat inveniat, quod ostendit sequatur.
Cic. ad Herenn. III.

FIRST AMERICAN,
FROM THE SECOND LONDON AND EDINBURGH EDITION.

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TO

THE KING;

THE MUNIFICENT AND LIBERAL PATRON OF ALL THE ARTS,

AND OF THE ART OF

CREATING REAL LANDSCAPE

IN PARTICULAR,

IN WHICH HIS MAJESTY HAS GIVEN

SO SPLENDID AN EXAMPLE IN HIS OWN PRACTICE,

This Treatise,

BEING AN ATTEMPT TO APPLY

THE PRINCIPLES OF PHYSIOLOGY

TO

GENERAL AND PRACTICAL ARBORICULTURE,

IS APPROPRIATELY AND RESPECTFULLY DEDICATED,

BY HIS MAJESTY'S

MOST FAITHFUL SUBJECT AND SERVANT,

THE AUTHOR.

ADVERTISEMENT

TO THE AMERICAN EDITION.

In presenting this valuable work to the American public, the publishers are actuated by an ardent desire to see the useful principles so ably demonstrated by the intelligent author, brought into successful operation in this country. On his own property in Scotland, Sir Henry Steuart has accomplished the most wonderful changes, which appear more like the effects of magical influence, than the ordinary application of means which many possessed. His park contains about one hundred and twenty acres, of great diversity of surface, and of various soils, and in 1820, the entire number of trees of ancient standing, did not exceed between sixty and seventy: in that and the following year, by means of the Transplanting Machine, he added to his domain near seven hundred, which were scattered singly, or arranged in clumps and masses of different kinds, giving to the whole a rich and woody appearance. To produce these astonishing effects, which at once convert the most tame and uninteresting situations into a picturesque and glowing landscape, thereby anticipating forty years of a man's existence, the expense can be but a very minor consideration: about thirty pounds sterling per acre, or two hundred dollars may be assumed here as a fair estimation.

In Great Britain, this art may be presumed to be indispensable and invaluable; but in a great portion of the United States, the denuding propensities of the early settler has so constantly maintained an exterminating war against those boundless and magnificent forests which clothed the land from the rising to the setting sun, and his relentless axe has so nearly swept away, in the neighbourhood of towns and dwellings, those beautiful creations of nature, which in other countries are objects of affectionate interest, and cherished with feelings bordering on veneration—indeed, to such a radical extent has this obliterating crime been carried, that it might be a question, whether this art, for purposes of ornament, is not as necessary here as in England.

To the wealthy and the man of taste this work may be safely recommended as containing the best information on the subject on which it treats.

G. THORBURN & SONS.

New-York, Sept. 1832.
67 *Liberty-street.*

PREFACE

TO THE FIRST EDITION.

It might at first sight appear a needless task to undertake a formal treatise on an art, which almost all men practise, and profess to understand, were it not for the fact, that so few practise it with success.

The Removal of Large Trees, for pleasure or use, is an art of great antiquity. As a branch of arboriculture, it is well known to most modern nations: but it has remained still longer than agriculture, without any principles to regulate it, as chemistry and physiology, till of late years, have been confined to the recluse philosopher, and are little studied or understood by the active and the practical. I trust, however, that the time is not far distant, when arboriculture like husbandry, will engage the attention of some able physiologist, and be thoroughly illustrated in all its parts.

Meanwhile, it is the purpose of the present essay to treat chiefly of "Giving Immediate Effect to Wood, by the Removal of Large Trees," and to lay down the principles and explain the practice by which that desirable object may be accomplished. In doing this, it is obvious, that the art of GENERAL PLANTING must at the same time be taught, as both, being governed by the same general laws, should of course be practised on the same known principles. In removing wood for the purpose of creating real landscape, plants of a large size are necessarily employed; and, as such materials are far more unwieldy, and more difficult to manage, than those of ordinary planting, they require far greater dexterity, as well as greater science. If, then, it hold true in arboriculture, as it does in logic, that "the greater necessarily comprises the less," it is probable that the rules of general planting will in this way be more forcibly impressed on the reader's mind, than if they were studied in any other manner.

In order to render the Art of Giving Immediate Effect to Wood as intelligible as possible, I have, in the following pages, considered it under three general heads.

First: I have given a history of the art of removing wood, from the earliest times down to the present; from which it appears, that it has always been vague and fortuitous, at variance with what we know of the laws of nature, and the anatomy of plants, and, for the most part, both unsuccessful and expensive.

Secondly: I have attempted to discover some plain and rational theory, founded in nature and experience, for the guidance of the planter, and which may tend to raise it to the rank of a useful art.

Thirdly: I have endeavoured to deduce from this theory such a practice as shall ensure success, by in some sort precluding contingency; and also, to diminish the expense, by one half at least of the present amount.

In attempting these objects, I trust, that I have treated with due respect the opinions of preceding writers. Where I have, from deliberate conviction, been forced to differ from them, I have done it with regret; being aware of the uncertainty, in which all knowledge, on so obscure a subject as vegetable physiology, must ever be held, and in which, although much has already been brought to light, by the patient industry of the philosopher, much, I am persuaded, still remains to be investigated.

For the deficiencies of the present work I should wish next to say something, by way of apology, as I am conscious to myself how very greatly it stands in need of it. The fact is, it was undertaken at the desire of numerous friends, who approved of my system, which I have ventured to call the PRESERVATIVE, in order to serve as a manual for their own practice. Accordingly, about eighteen months since, the first section was written and printed, in order to convince myself, as well as others, that I was in earnest in undertaking the task; but it was soon after interrupted, and in the end thrown aside, for other avocations. Within these few months, the work was more seriously resumed. Each section was thrown off as soon as it was composed; and the consequence was, that some omissions, which appeared prominent, were to be supplied in the Notes, while others were found too extensive to be in any way supplied. As notes are not the most popular medium through which information can be communicated, perhaps it will appear but a small countervail to this statement to add, that most of the information applicable to general planting is contained in them, as well as that which relates to both horticulture and agriculture.

In this condition of the treatise, I submit it, imperfect as it is, to the candour of the reader; who, if he be a phytologist of research, or, still more, a planter of experience, will appreciate the difficulties which attend a new subject, and make some allowance for the execution under such circumstances.

In respect to the practical part, I must own, that, in treating it, I should have been disposed to enter much less minutely into detail, had I merely consulted my own judgment. But as those friends most anxious for the book, cried out most loudly for *detail*, and insisted that it was impossible to make it *too copious*, I have, for the purpose of gratifying them, introduced under this head so minute a statement of my own practice, that it may probably be considered as more suitable to private communication, or perhaps to oral discussion.

Presumptuous enough as I must appear to the English planters, in venturing to believe, that I could say any thing that is *new*, on a subject so familiar to them, or in reprobating some parts of their system, which, in an evil hour, I have termed the MUTILATING, I am not willing to add to my sins in this way, by seeming also to supersede their practice, and recommend something of my own, which they may think much worse, in its stead. The truth is, that for *facility of execution*, and *dispatch in the field*, my method may be sufficiently well calculated, in the limited scale of work which I have found it expedient to adopt, and I may therefore view it with a partial eye. But candour obliges me to admit, that in some respects it is inferior to the English system (for example, in wholly rejecting the upright position of the tree); and it would be unsuitable to the large and expensive style of work, which is often executed by that ingenious and opulent people, and in some instances with extraordinary success.

In these circumstances, then, it is proper to declare, that the whole of the practical part of the present work, and especially that which relates to the taking up, transporting, and planting of trees (that is, Sections VIII. and IX., and a part of Section VII. also), has been composed solely for the information of my own countrymen, and is intended to suit the narrower designs, and more limited means of the Scottish planters. Should the great planters of England, therefore, honour these pages with their notice, they will have the goodness altogether to pass over these Sections, as inapplicable to *them*, and to the greatly larger, and more important style of their works.

In conclusion, I must be permitted to observe, that the limited system, here advocated, stands perhaps on as high ground, in respect of *evidence* for its success, as any new theory ever brought before the public. When the reader refers to the able "Report of the Highland Society of Scotland," on the Woods at Allanton House (which appears in the Appendix), and there finds the mention of "feet and inches," as referring to the height, or the girth of the trees, he will, of course, reflect, that all size in the growth of plants is merely *relative*, and is to be judged by their relative advantages of soil and climate: Hence a shoot of two or three feet long, which removed trees are found to exhibit, in some of the openest exposures of Lanarkshire, must correspond to six or eight feet at least, in Hampshire or Devonshire, and so in proportion, in other English climates.

This being premised, I will beg leave, with becoming deference, under the shelter of a well-known name, and on a far higher topic, to put in my claim to offer some practical proof in favour of my system. When the late ingenious Dr. Kitchiner published his scientific and excellent work, "The Cook's Oracle," he broadly stated, that "It was "the only English cookery book, written from *the* "*real experiments of a housekeeper, for the benefit* "*of housekeepers.* * * That he had not given "one receipt that had not been *proved in his* "*own kitchen;* which had not been approved by "several of the most accomplished cooks in the "kingdom; and had not, moreover, been *eaten* "with unanimous applause, by a Committee of "Taste, composed of some of the most illustrious "Gastrophilists in the metropolis."

Now, although I sensibly feel how immeasurably less interesting Arboriculture must be held than Eating, or than what the Doctor learnedly calls "the Science of Gastrology," yet I presume to state, in imitation of so great an example, that the present is one of the few English books on Wood, which has been "written from the real experiments of a planter, for the benefit of planters:" That I have laid down no rule, and recommended no practice, that has not been "proved in my own park;" and of which the successful effects have not been "witnessed and approved, by a committee of both skill and taste, composed of some of the most distinguished planters, in this our ancient kingdom."

Allanton House,
29th November, 1827.

PREFACE

TO THE SECOND EDITION.

It is a singular circumstance, that the present attempt, how imperfect soever it may be, appears to have been the first made in our language, to apply the principles of physiology to practical arboriculture. Of writers who have treated vegetable physiology as a science there is no want. Of others, who have treated the art of planting practically, there are still greater numbers; and it shows in a striking point of view the neglected state of planting as an important art, that none of our distinguished chemists have as yet been induced to furnish us with some popular manual of arboricultural chemistry.*

* Like "The Elements of Agricultural Chemistry," by Sir H. Davy; but it would require some acquaintance with wood, as well as knowledge of science.

Amidst this dearth of information for the use of the young planter, and the extraordinary favour with which the Essay has been received by the public, I have spared no pains to render the present edition less imperfect, and more generally useful than its predecessor. I have embodied in the text as much of the matter of the notes and illustrations, as could well be done, without incurring the imputation of prolixity; and I have added as much to the latter, on the subject of *general planting*, as could properly be introduced, without seeming to deviate unreasonably into collateral discussion. On the important topics of different modes of planting; on pruning; trenching and draining soils; preparing composts; raising timber for the royal navy (including an examination of Mr. Withers's late plan for that purpose); improving park scenery by new arrangements, &c. short but separate disquisitions will be found, which I trust will add to the value of the volume. However, the first edition will by no means be *lost*, as it will usefully go to the gardeners and foresters of former purchasers.

Nevertheless, I am well aware, that Notes and Illustrations are not the fashion of the day, and that nine persons in ten, who perused, perhaps with interest the first edition of this essay, stopped short at once, as soon as the diminished type of the notes met their eye. In a word, characteristic dullness and interminable prosing are supposed to be inseparable from this species of composition. These things I sensibly regret, because I believe that the notes and illustrations form the *best part of the book*, and will be found most useful to the general reader. In fact, there was no other way, unless by short separate disquisitions, that information, on the various useful topics just now mentioned, could be conveyed.

Having said enough on the improvement of the matter in this edition, I should wish to make a few remarks on the probable progress of the art under discussion. It is with great pleasure that I observe the very general, and I may say universal, assent which has been given, and especially in England, where I least expected it, to the principles laid down in the present treatise. From this two things appear to be demonstrated; first, the truth and simplicity of those principles themselves; and secondly, the triumph which science, plainly deduced from the laws of nature, is sure to obtain, over prejudice or ignorance, however rooted or universal. Of the numerous persons of distinction, especially from the southern counties of England, whom curiosity or incredulity has lately attracted to this place, I believe there is not one, who has not been both pleased and surprised with the effects produced by the removal of wood of every sort, and all seem desirous to rival them in their own practice. But, as it appears to me, that there are several circumstances which might retard the progress of the art, and render the efforts of its most zealous pupils abortive, I shall beg leave shortly to state them, for the information of those who may feel interested in its success.

In the first place, it is to be regretted, that owing to the low condition of the art of planting in general, whether of great trees or small, the principles of phytology had not earlier been applied to it. Like digging or ploughing, it is still apt to be considered as a *mechanical art*, and no scientific investigation is thought necessary to illustrate or to regulate it. In Sections III. IV. V. VI. VII., I have done what I could to supply these defects; but no general effect appears to have been produced by it. Even the periodical reviewers, who have bestowed on the work so much flattering encomium, have not treated planting as an *art of science*.

The second circumstance which I shall mention, is the want of knowledge in the selection of subjects, as also in the preparation of the soil. Whatever progress planters may have made in other things, the important business of selecting subjects is nearly as little known and appreciated by them, as it was before the publication of this treatise. Among more than a hundred gentlemen, and their gardeners or overseers, with whom since that period I have conversed, all professing to have studied, and many to have practised the art with accuracy, not one appears to me to possess the remotest idea of the principles of selection.

Of the preparation of the soil they seem to know equally little; and *two* only of the whole number consider either the one or the other as attended with any *difficulty:* Yet it is such preparative processes that are the foundation and corner-stone of the edifice to be raised, and the indispensable conditions of the results contemplated. I find, however, that the management of the roots has much more seized the general attention, and that particularly, the use of cutting round them, so as to enlarge their fibrous developement, has been greatly overrated. The common impression seems to be, that when this operation (which is comparatively unimportant, and not always necessary) is once performed with diligence, the planter is released from the task of studying any one of the more useful branches of the preservative system.

The third and last circumstance, which I shall notice, is the obtaining a proper stock of subjects;* and that, I fear, is not deemed more difficult, or more important than the proper selection of them. Without a stock of trees of all sorts, commensurate to the planter's wants, no one can reasonably expect to create at pleasure a succession of real landscapes; because, for that purpose, trees in every variety of form, such as exist at this place, the high and the low, the massive and the light, the spreading and the spiral, should be at the absolute command of the designer. Gentlemen peruse my book, where they find a certain theory held forth. They perhaps visit the place, where they are surprised to see their idea of the theory

* I know no one in this neighbourhood who has so large a stock of beautiful subjects as Lord Morton, in the park at Dalmahoy. They are all finely *prepared by nature*, in consequence of the thinning system adopted by his lordship's predecessor. The late lord used twice a week to hunt a pack of small beagles over his plantations, from the time they were six feet high; and his rule for thinning, as he told me, was, "to give himself full room always to ride through them." This was at least a very *sporting*, if it was not a scientific, way of preparing his materials.

even *surpassed* by the practice. They then go away with the impression, that there is nothing so easy as an art, of which they do not think it worth while to study the principles, or even to provide themselves with *materials for the practice.*

Taking these plain facts and circumstances into view, and that of the general notice which the new art has attracted, it seems extremely probable that the *repute* it has so suddenly acquired, may eventually *prove the cause of its own failure.* Seduced by an account, however correct, of an effective and rapid field practice, of which the simplicity seems to equal the success of the execution, ignorant or superficial persons might be brought to believe that the latter is to be attained without any trouble to themselves. Uneducated foresters, or self-sufficient gardeners, might therefore, be set to work by them, to practise, or, more probably, to improve upon the preservative method; and thus what was begun in indolence or ignorance, would, in all likelihood, end in vexation and disappointment. But it is to *the imperfection of the system*, and not to their own unskilfulness, that such operators would be sure to ascribe an unfavourable issue.

In order to remedy, as far as may be, these evils, whether present or prospective, I have, at the desire of several English friends, endeavoured to get the art taken up in a *professional* way, by persons of good education, properly instructed. Those persons, it is proposed, shall assume the general name of ORNAMENTAL PLANTERS, and be competent to teach the art of "Giving Immediate Effect to Wood," whether in principle or practice. Each shall be attended by two skilful workmen or operatives who have been trained at this place; and by visiting different parts of the island, as their services may be required, both gentlemen themselves and their gardeners will soon become masters of a system, which, how carefully soever it may be delineated in description, can never be so thoroughly apprehended as by real practice.

Of such planters it is imagined, that two in number might suffice, in the beginning. *One* would, in all probability, find employment in this kingdom, and in the northern counties of England, in the parallel of Yorkshire; and *one* more in the districts south of the Trent, from which my principal visitors have lately come. Care shall be taken that the planters be instructed in the anatomy of plants and vegetable physiology; and I should be ambitious, that an acquaintance with the execution as well as the principles of landscape, were added to those necessary acquirements. This, it is conceived, would give to the new profession somewhat of that interest and elegance, which belong to all effects produced chiefly by wood. It would throw a character in some sort *doubly* creative over the whole undertaking, as it would enable the artist to sketch beforehand with his pencil such pictures, as he could afterwards realize, with nature's materials, according to the fancy of his employer. If no adverse accident occur to obstruct this design, I trust, that by the first week in January next, the planters may be ready to proceed on their arboricultural adventure, of which due notice will of course be given in a public manner.

Meanwhile, his Majesty has been graciously pleased to grant permission that this edition of the work shall be dedicated to him. It is true, that it was originally intended for "the climate of Scotland;" but as the laws of nature, and such systems as are deduced from them, are the same in all countries, and in all climates, it is probable that it may now be considered as an English book.

To every reader, therefore, such a dedication will appear peculiarly appropriate, as his Majesty is the only prince in Europe who, to a correct taste in the other fine arts, adds a perfect knowledge of one that is truly indigenous and English. In a former day, Lewis XIV., by the mere efforts of physical force, drew about great trees in the vicinity of Paris. In a happier age of arts as well as institutions,* we may now hope to see a British monarch, in the vicinity of Windsor, GIVE IMMEDIATE EFFECT TO WOOD on scientific principles, and thus rival the great masters of design, in his creations of real landscape.

* *Rarâ temporum felicitate.*—TACIT.

ALLANTON HOUSE,
10th October, 1828.

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* The Title of the Pamphlet is; "A Memoir addressed to the Society for the encouragement of Arts, &c. on the Planting and Rearing of Forest Trees, demonstrating the necessity of Trenching Ground, &c., and the powerful and profitable Effects of Manure."—Second Edit. London, 1826.

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THE

PLANTER'S GUIDE.

SECTION I.

IMPORTANCE OF ARBORICULTURE, AND OF ESTABLISHING IT ON SCIENTIFIC PRINCIPLES. ART OF GIVING IMMEDIATE EFFECT TO WOOD.

There is perhaps no epithet, by which the inhabitants of the Northern Division of this Island, in the present day, can be more appropriately distinguished, than that of a "Planting Nation," or, to speak with more correctness, a "Nation of Planters." All men now plant, who are possessed of land-property, from the wealthy 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 ability.

The vast sums which are annually laid out on this useful and ornamental object, would exceed belief, if fairly estimated, considering the limited wealth of the country, compared with that of England. Yet of trees the Scottish land-owner for the most part knows little, although he may possibly know as much as his English neighbours: but, like them, he lays out his money freely on the work, however executed, conceiving, and with justice, that he has done a great thing, if not for himself, at least for his posterity. Unacquainted with the history, properties, and culture of trees, he naturally enough sees with the eyes, and hears with the ears of his gardener; and, as the gardener, ninety-nine times in a hundred, knows nothing himself, it is "the blind leading the blind," in this important branch of rural economy. Sometimes the forester is the operating person, which is still more unfortunate; for this is generally a mere lopper and cutter of wood. In ordinary cases, he is much worse educated than the gardener, with equal pretensions as to arboriculture, and equal ignorance.

On the gardeners of Scotland it is not here intended to throw the slightest reflection, unless for wandering out of the line of their own profession. They are a class of men, possessed of superior intelligence, as well as superior respectability. They have done great honour to their native country, both at home and abroad. But this very intelligence should prevent them from engaging in a department, for which they know they cannot have leisure, if they duly cultivate their own, but which is often put upon them by the indolence, and still more by the ignorance of their employers.

The fact is, that of all land-produce Wood is the least studied and understood by the land-owners themselves, and, by consequence, the worst managed. To all estates this subject 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 their revenue. In an age, therefore, when every thing useful and ornamental becomes the subject of scientific investigation, and general study, it seems singular, that arboriculture should be at once so universally practised, and the physiological principles, which regulate it, so generally unknown.

The lords of the soil in this kingdom have, from time immemorial, been good sportsmen. Of late, they have become knowing agriculturists and cattle-breeders; and, as the tide of fashion has not long since set in from the south, in favour of the occupation last mentioned, and flowed even to fulness, so we may hope, that the knowledge of WOOD will ere long have its turn. Who, the most speculative, forty years since, could have anticipated, that the pedigree, form, and fat of sheep and bullocks should, in the present day, have become an interesting study with the gay and the fashionable? By a revolution in things as unexpected, we may conceive it possible, that a little botany and vegetable physiology, together with a thorough acquaintance with planting and arboriculture, may at length engage the attention of those, who are most interested in their success. Probably it will be found that no nobleman or gentleman will make a worse sportsman, a less scientific farmer, or a less successful cattle-dealer, for having some conversancy with wood, or being able to detect the ignorance of his own gardener or forester; and, should a knowledge of painting, or the principles of landscape be added, their elegant and attractive character will surely not derogate from these more popular acquirements.

TREES are, without doubt, the most beautiful objects that adorn the surface of the earth. They are nearly the most important production of the vegetable kingdom to civilized man. Without trees, the mountains and the plains, the lakes and the rivers would want their brightest ornament; and without them also, the most useful and the most elegant arts would be destitute of materials. Nature, in the beginning, bountifully supplied the earth with trees and forests; but a large proportion was necessarily cleared away, to admit of the cultivation of the earth. In process of time, as the wants of men multiplied, forests were cut down, and industry became indispensable, in order to furnish a supply. Hence, the planting and rearing of wood and timber-trees for that purpose, is one of the most important arts which can excite the attention and exercise the skill of a polished nation, and one especially, whose existence may be said to depend on the paramount superiority of its naval force.

It is a subject of regret that the art of planting in Britain has not hitherto been cultivated on principles of science. It seems surprising that the nation, to which the world is principally indebted for the application of physiology and chemistry to agriculture, should never have thought of applying those sciences to wood, and the British planters should still be as completely unacquainted with the nature and anatomy of plants, as they were in the days of Evelyn and Cooke. In fact, their ignorance would seem portentous and incredible, were it not proved by daily experience.* Thus planting is still regarded by many as a secondary branch of horticulture, unworthy of being separately treated, or attentively studied. By the institution of societies, where experiments are carefully recorded, and general conclusions deduced from well-authenticated facts, agriculture, within the last thirty years, has assumed a more regular form and character; and horticulture, by the same laudable means, promises ere long to rise to the rank of this her elder sister. We may, therefore, reasonably expect, that the time is not far distant, when arboriculture, being of the same family, will at length share the same distinction; that it will be taken out of ignorant hands, and engage the attention of the ingenious, and the scientific. It is to our southern neighbours that we have been indebted for our knowledge of most of the useful and elegant arts. Let us, in this instance, take the lead ourselves; and, by instituting A SOCIETY FOR THE IMPROVEMENT OF ARBORICULTURE EXCLUSIVELY, endeavour, in that department, to repay them some portion of those weighty obligations.

It must be acknowledged by every one, who has attended to the subject, that arboriculture is the art the most truly neglected in our whole rural management, and that it can never flourish, unless it be studied as a *separate profession*. Standing, as it certainly does in this country, next in rank

* NOTE I.

and consequence to agriculture, it will not do as an appendage to any society whatever, not even to the Highland, or Great National Society for the Encouragement of Arts and Manufactures in Scotland. But, were it fortunately placed under a *separate* and intelligent patronage, the fruits of so judicious an arrangement would ere long become apparent. Well-informed land-holders, useful foresters, and scientific nurserymen would speedily rise up, under the fostering influence of such a society. Facts as well as principles, which are now known only to the studious phytologist, would become familiar to all, whether owners of woods, or those engaged in their superintendence; and, while the properties of individuals were gradually rendered more productive, a great accession would be made to the general wealth and intelligence of the country.*

Gardening in its highest sense, or the art of creating or embellishing rural scenery, has, within the last century, been carried to considerable perfection in Britain, and has added one more to the number of the fine arts. It was first struck out by the genius of Kent, in the beginning of the last century, after having been long before imagined by Bacon, and finely delineated by Milton.† Subsequently, the art was assiduously cultivated by Brown, Repton, and others of that school, although not altogether on principles such as should have regulated it; and it is now nearly perfected, by the more correct judgment of Price, Knight, and Loudon. Whatever there was of unnatural or formal, whether borrowed from antiquity, or contrived by modern designers, is now banished from the English garden. The professors themselves of his own school have all followed Repton, in tacitly acknowledging the improvements of the age, and in advancing the public taste.‡

According to these enlightened principles, places and

* Note II. † Note III. ‡ Note IV.

parks, whether old or new, are now laid out. Where woods have stood for centuries, taste and skill have done much to display, and even improve their effects; and incredible labour and expense have been dedicated to the planting of new residences, where another age only can see the ideas of the owners realized. 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, *within the lifetime of the planter*, that is, giving it at once a magnitude sufficient for picturesque purposes.

Wood must ever be the grand and effective material of real landscape. Over the other materials of picturesque improvement the artist has comparatively little control.—With earth he cannot do much: rocks are by far too ponderous for his management; and water can be commanded, only in certain situations and circumstances. But trees or bushes can be raised any where; and there is no situation so utterly hopeless, as not to be capable of considerable beauty, from wood planted abundantly and judiciously. In a country, then, like Britain, where every luxury is purchased at so high a price, it may appear surprising, that some certain method of *obtaining the Immediate Command of Wood*, should still be a desideratum in its ornamental Gardening.

Few men begin to plant in early life, and what is long deferred, many, for that reason, omit to do altogether. He, who inherits or acquires a land-estate, is usually desirous to shelter and embellish it. The soldier or the merchant, the statesman or the lawyer, after a life spent in honourable exertion, generally retires to rural scenes, as capable of furnishing the most unmixed enjoyment to the decline of life. To view nature in the rich garb, with which taste and ingenuity now invest her, is always pleasing: but, as it is far more delightful to create than to contemplate, so it often happens that finished places, where scarcely any thing more is to be done, are not always sought after, by the active and the wealthy. New sites, therefore, are frequently preferred to improved residences, at which the mansion is yet to be built, the farm to be improved, and the park laid out and planted. All feel the pleasure of contriving their own accommodations, and imagining and composing their own landscapes; and they look forward with delight to the time, when they may witness the full accomplishment of the latter, by the wood arriving at maturity. By the planter himself, however, a gratification so exquisite can hardly be expected; and that discouraging idea cannot fail in some degree to cool his ardour, and damp his enjoyments.

To such persons especially, and to all men possessed of land-property, the Immediate Effect of Wood must appear a considerable object, if any method can be devised to obtain it with success and certainty. What, then, would such persons say, were they informed, that so obscure a practice as that of TRANSPLANTING could do this; that an *entire park* could be thus *wooded at once*, and forty years of life anticipated? The fact is, that the possibility of the improvement, and much more have been verified, by pretty extensive experience. Groups and single trees have been scattered every where in such a park at pleasure, in all sorts of soils and exposures, and applied to the composition or the improvement of real landscape. Instead of lopping and mutilating the trees, and sometimes altogether decapitating them (as has been the general practice,) the grand point has been gained of *preserving their tops entire;* so that, with subjects of whatever magnitude, *no loss of either spray or branches is suffered;* and, what is still more important, *no loss of health and vigour in the trees*, excepting for a short period, after having undergone the process of removal.

But, besides the various combinations and details of the landscape,* it has been found also quite practicable to apply

* NOTE V.

the art to the most *general* purposes of utility and shelter, whether in large towns, or in the country, by the transplanting of copse or underwood of any size or species. This is either formed alone into large masses, or it is intermixed with grove or standard trees, as circumstances in either situation may require. By these means some of the most interesting objects, both agricultural and ornamental, have been accomplished, at *a very moderate expense*, and brought within the reach, not only of the great and opulent, but of any person of limited fortune.—Such is the art, which is attempted to be taught in the following pages.

But the principles, on which it is established, imply a far wider range, and admit of a far more important application. The art of giving Immediate Effect to Wood is not merely an art of practice. It is founded on vegetable physiology, and the anatomy of plants, and constitutes one branch only of GENERAL PLANTING, which it is still more important to teach, on some principles of science. To carry the former into effect, it is obvious that, as materials of considerable magnitude are necessary, so difficulties are found, which do not occur in ordinary planting, and by doing greater violence to nature, it requires far greater dexterity, as well as greater science. To teach the art, therefore, of removing large trees, is to teach, in the most effective manner, that of general planting on physiological principles, which, as they are drawn from nature herself, cannot err, and accordingly, they furnish the only certain means of accounting for its failure, or teaching it with success. He, who can raise a tree from the seed to the state of valuable timber, whether for ornament or use, must possess a certain acquaintance with the habits of woody plants: but the man, who can remove trees of considerable age and magnitude at pleasure, must necessarily possess the same species of skill, and a knowledge of the laws of nature, to a much superior extent.

On a subject like this, which is wholly new, but not the less interesting to the British planter, I would earnestly entreat the attention and indulgence of the reader. It is not more than three score years since chemistry and natural history have been successfully cultivated among us, and applied to the improvement of the arts. The ingenious writings, and interesting discoveries of Mr. Knight, the President of the Horticultural Society of London, have done much to turn the public attention to vegetable physiology, as important to the advancement of horticulture. The late very able work of Mr. Keith, on physiological botany, has completely systematized the science; it has tended to correct the errors, and supply the omissions of former writers, and to bring forward, in one luminous view, both his own discoveries, and those of foreign nations.

Let us, therefore, hope, that the present attempt to bring vegetable physiology into notice, by applying it to the practice of Arboriculture, may not be less successful, than that of the applying chemistry to husbandry, which, to the astonishment of Europe, has rendered the cultivation of the soil *a new art* in modern hands. The culture of wood, as has been already observed, in point of rank and importance, certainly stands next to the culture of the soil, and, in point of attraction, it stands a great deal higher, from the delightful effects it every where produces; whether they are seen in the deep seclusion of the grove, the open richness of the park, or the endless charms of woodland scenery. Since the ladies of late have become students of chemistry, it is not too much to expect, that they will be ambitious of attaining proficiency in a science, so much more akin to their own pursuits; and that country-gentlemen, emulous to profit by so illustrious an example, will not suffer vegetable physiology to be any longer a desideratum, either in their own acquirements, or in those of their gardeners, their foresters, or their land-stewards. Thus, a new era will be brought about in British arboriculture, of which the most remarkable circumstance is, that it has not been brought about before, amidst the advancement of the other arts: and thus England, which, a century and a half ago, was the birth-place, and the cradle of vegetable physiology, will soon give lessons in planting as well as agriculture, to the rest of Europe.

Although, I trust, I am not too sanguine in these pleasing anticipations, yet I own, that I did not at first contemplate so important and extensive an application of the principles about to be laid down in this Essay. Neither was it in the contemplation of the committee of the Highland Society, or General Society for the Encouragement of the Arts in this Kingdom, which, some years since, examined my woods, because their attention was turned merely to the facts before them. The able report, at that time drawn up (and which will be found in the Appendix) relates solely to my *practice;* and they knew that it was deduced from experience, and from observations made on woods, for more than forty years. Yet it is with both pride and pleasure that I appeal to this report, for the correctness of the statement above given, of the powerful effects which the art in question is capable of producing; a statement that otherwise might appear unfounded in its facts, as well as extravagant in its pretensions. In the committee will be seen names of the first class, in the rank, literature, and general intelligence of the country; and the report itself is drawn up by the individual, the most highly gifted and distinguished of those persons, who is himself well acquainted with the subject of Wood.*

At the place from which these pages are dated, they found a Park of limited extent, and possessing no particular claim to beauty, but visited from curiosity by many persons, within the last ten years. It consists of about a hundred and twenty English acres, abundantly clothed with trees and

*Note VI.

underwood of every common species, by means of the transplanting machine; and exhibiting within itself a *practical illustration* of every principle laid down, and every theory held forth in this Essay. The single trees and bushes, in groups and open dispositions, amount to about seven hundred in number, exclusively of close plantations and copse-wood. Their size, when removed, was not great, the largest not exceeding from thirty to forty feet in height, and from three, or three-and-a-half, to five feet in girth, at a foot from the ground; but many of them were of much smaller dimensions. The height of the bushes or underwood removed was from four to ten feet, and consisting of every sort usually found on the banks and lakes of rivers. But size, in an art founded on scientific principles, is a mere matter of choice and expenditure; for trees of the greatest size are as susceptible of removal, as those of the least. It was desirable, however, as almost every thing was to be done here, in the way of Park-wood, to limit the operations to the smallest possible expenditure, consistently with producing some effect on the foreground, and middle distance of the landscape, and with careful execution.

Whoever will take the trouble to visit the place, will perhaps find his labour repaid, in examining the progress of an art, calculated probably to become as popular as any that has been cultivated within a century; as there is scarcely any one, in which so many persons in the higher and middle ranks are interested.

Considering the prejudices, which once existed against the art, and that the *great power*, of which it is susceptible, will with difficulty gain belief, it may be worth while to state a few facts as to its general application, which are as incontrovertible, as they may seem surprising to the reader. It is from no vain desire to exaggerate what has been done at this place, but merely to show the degree of progress, which the art has made, under the greatest disadvantages of soil and climate. It is also for the purpose of proving to those, who may engage in similar undertakings, that, whatever has been done well *here*, may, with equal industry, be done a great deal better in most other situations.*

There was in this Park originally no water, and scarcely a tree or a bush, on the banks and promontories of the present lake and river; for the water partakes of both those characters. During the summer of 1820 the water was executed; and in that and the following year, the grounds immediately adjoining were abundantly covered with wood, by means of the transplanting machine. Groups and single trees, grove and underwood were introduced, in every style of disposition, which the subject seemed to admit. Where the turf recedes from, or approaches the water, the ground is somewhat bold and irregular, although without striking features of any sort: yet the profusion of wood, scattered over a surface of moderate limits, in every form and variety, gave it an intricacy and an expression, which it never possessed before.

By the autumn of the *third* year only after the execution, namely 1823, when the Committee of the Society honoured the place with their inspection, the different parts seemed to harmonize with one another, and the intended effects were nearly produced. What it was wished to bring forward, appeared already prominent. What was to be concealed, or thrown into the background, began to assume that station. The foreground trees, (the best that could be procured,) placed on the eastern bank above the water, broke it into parts with their spreading branches, and formed combinations, which were extremely pleasing. The copse or underwood, which covers an island in the lake, and two promontories, as also an adjoining bank that terminates the distance, was seen coming down nearly to the water's edge. What was the most important of all, both trees and underwood had

* See the Report of the Committee of the Highland Society.

obtained a full and deep-coloured leaf, and health and vigour were restored to them. In a word, the whole appeared like a spot at least forty years planted.

The actual extent of surface, to which this cursory delineation refers, does not exceed from forty to fifty acres; but the intricacy and variety, created solely by various dispositions of *wood* upon an uneven surface, confer on it, to the eye, indefinite limits. In confirmation of this remark, the reader is referred to the frontispiece, where he will find a view of the Park here, taken in 1827, from the western side of the lake; it was soon after the planting of the steep bank or head in that quarter, as is designated by the transplanting machine, which is seen still remaining on the ground. The spot is nearly *opposite* to that, from which it was viewed by the Committee of the Highland Society. The whole of the Park thus delineated was wooded by the machine, whether in masses, or detached groups of trees, between the years 1816 and 1821, but chiefly in the latter, excepting only the distant or bounding lines of plantations, over which a few old trees are here and there seen to elevate their heads.

This view conveys much more distinctly to the mind, than any verbal description could do, the power which the art possesses of giving IMMEDIATE EFFECT to the scenery of a place, and even of giving it NEW scenery. It is an art, which will be duly appreciated by those who have studied landscape; and it will appear the more striking on a subject, which is tame at best, and, in the designer's phrase, of very limited "capability." What, then, would be the effect on other subjects, to which nature has been more bountiful, and whose general character is more interesting, or more romantic?

It has been said, (and in ordinary cases with justice) of the art of the painter, that it has a marked superiority over that of the designer of real landscape. The former, it is argued, can finish his pictures at pleasure; whereas the latter must depend, for the completion of his, on the slow progress of time, added to the uncertain effects of both soil and climate. But it clearly appears, that the position is disproved here, by the extraordinary power of the transplanting machine, the facilities of both artists being thereby placed nearly on an equality in respect to wood, the principal material in the formation of all landscapes.

With facts like the above, verified on such high and respectable evidence as that of the Highland Society of Scotland, we may venture to believe, that the practice of transplanting, as now improved, and raised to the rank of an art, is calculated to become far more generally useful than has hitherto been imagined. And further, it is probable, that it will form an important ally to gardening in its highest sense, and the most effective engine, which the designer has ever yet employed, to realize his landscapes.

SECTION II.

HISTORY OF THE ART, FROM THE EARLIEST DOWN TO THE PRESENT TIMES.

When we consider the singular beauty and usefulness of trees, it cannot seem surprising, that they should have been the favourites of mankind in all ages. That the polished nations of antiquity assiduously cultivated them, we have the most unquestionable evidence, both for horticultural and agricultural purposes. Theophrastus, who was the scholar of Plato and Aristotle, composed an elaborate treatise on the history and properties of plants, which, together with the remains of the Greek geoponic writers, has survived the wreck of learning, and evinces how great a degree of attention was bestowed on the subject, by that ingenious people.

Among the Romans, the cultivation of trees formed an early object of study. By the laws of the twelve tables, the cutting down or injuring them was an offence, which was visited with severe penalties.* Cato, Varro, and Columella wrote particularly on both fruit and forest trees; and Varro, who was contemporary with Julius Cæsar, enumerates more than fifty different writers on rural affairs (of which Arboriculture was a constituent part,) who in his time were held in estimation.†

In this state of rural information and intelligence, it was natural for men to form the wish to give immediate effect to trees, and thereby anticipate the slow progress of time, in

* Note I. † *De Re Rust.* C. I.

bringing them to perfection. Accordingly, the practice of removing them of a large size, instead of being, as is generally supposed, a modern invention, lays claim to the honours of a high antiquity. When the Greeks or Romans wanted to designate any thing that was impossible, or at least extremely difficult to be performed, they said, that it was like "transplanting an old tree;" and their usual way of applying the adage clearly shows, that their experience of the success of the operation was not greatly different from our own, at this moment.*

In presenting to the reader a cursory view of the progress of the practice, from the earliest times down to the present, it is plain, that we are too little acquainted with the state of arts and manners in ancient times, to be able to draw very copiously from what has been called the classical ages. The Greeks certainly were unacquainted with the painting of landscape, notwithstanding the surprising height to which they carried other departments of the art, and consequently with the picturesque effect of trees. At Rome landscape painting was first practised, only in the time of Augustus;† and, indeed, it does not seem to have been cultivated in any striking degree, by this extraordinary people, at least, if we may judge from the specimens found at Herculaneum and Pompeii, at a later period of the empire. The ancients, although they sufficiently understood and cultivated wood, applied it much more to useful, than to ornamental purposes.

The transplanting of trees of a large size appears to have been of considerable importance to the Roman husbandman. Pliny, who wrote during the reigns of Augustus and Tiberius, speaks of elms twenty feet high, in the neighbourhood of Rome, being commonly removed into the vineyard, for the training of vines. They were planted, he says, in a trench called *Novenarius;* because they stood in it, nine feet

* Note II. † Note III.

every way from one another: which trench was three feet deep, and as many broad, or more, with a bank of earth raised round the stem, like the seats used by the peasants in Campania; a judicious contrivance, both for supporting the tree, and protecting it from the effects of drought, during the first season after removal. Witch Hazels, he also adds, were transferred in the same manner, and indiscriminately from the nursery-ground, and from the open forest.*

The same writer, as well as Theophrastus, mentions, that it was a common practice to re-establish large trees, and particularly the Platanus, that had been blown down, and had their roots torn up, by the violence of the wind; and that this was effected, by skilfully replanting them, so as that the lacerated parts completely knit again and revived.† Moreover, Pliny speaks of a fir-tree, which, before it was transplanted, had a taproot no less than eight cubits long, that is, reckoning from the place, at which it was broken off in the taking up, but that a considerable part of it still remained in the ground. This extraordinary circumstance respecting the fir he seems to have taken from Theophrastus, who states it as a fact known in his time respecting the pitch-pine, and entitled to credit.‡

Cato, Varro, and Columella all speak of the transplantation of trees of various sizes. The younger Seneca informs us, in one of his letters, written from the villa of Scipio Africanus, but then belonging to an intelligent friend of his own, that he had there learned the method of successfully removing an entire orchard of old trees, as practised by the latter; that the trees, after the third and fourth year, produced an abundant crop of fruit, with the fairest promise of thriving luxuriantly, and continuing their shade to a late period. This, he adds, was an interesting lesson for him,

* Note IV.
† Hist. Nat. L. XVI. 31. Theophrast. Hist. Plant. L. IV. 19.
‡ Hist. Plant. L. II. 7.

at an advanced time of life, when men naturally wish to plant for themselves, although they generally do so for posterity.* Virgil, in the same way, in describing his old Corycian, takes care to celebrate his skill in the planting of wood of a large size, as one of the accomplishments of a Roman husbandmen.† But no ancient author, as far as I know, has left us any body of practical precepts, respecting the execution. The only two, who have handed down any thing like a description of it, are the younger Seneca, who lived in the time of Nero, and Anatolius, a Greek physician, and one of the Geoponic writers, who, according to the best critics, was contemporary with the Emperor Constantine.‡ These accounts, therefore, may properly be considered, as describing the Greek and the Roman methods of transplanting; and, as the subject is curious, it may be worth while to give their respective statements, in their own words.

Anatolius, as far as we can judge, possessed considerable skill in this department. "If (says he) you would remove a large tree to advantage, open a very deep trench or pit. (This planter, we may suppose, had a very porous subsoil.) Be careful to cut away the spray and smaller branches, but *without injuring the larger ones;* and also to *leave the whole of the roots entire and untouched.* Then place the tree carefully in the pit, covering up its roots with a quantity of good mould and manure. Observe, however, (adds he,) this special precaution; that, to whichsoever side it inclined or leaned at first, let it incline to the same side, in its new situation."‖ It is true, these directions are given for trees bearing fruit; but we may fairly conclude, that they equally applied to forest trees; and it would be well for modern planters, were their practice not more defective than that of Anatolius.

The account, given by Seneca of the Roman practice, is

* Note V. † Note VI. ‖ Note VII.

‡ Niclas, Proleg. in Geopon. p. 48.

greatly more circumstantial. "There are two methods (he says, in the letter above-mentioned,) according to which my friend plants his olive ground (*olivetum*.) The one is, by removing trees of a large size, and making the plantation at once: the other is, by planting sets of which the progress is necessarily much slower. According to the former mode, the first thing to be done is, to cut off all the branches, to the distance of a foot from the trunk. The next thing is, to do the same by the lateral roots, leaving nothing entire, except the body of the root, from which the fibres issue. The tree is next placed in the pit, with a sufficient quantity of manure, and mould is thrown in and consolidated, by the most assiduous pressure, and firm treading with the foot. Nothing, as my friend conceives, is more efficacious, than this way of giving solidity and consistency to the earth round the stem. It excludes both cold and drought, and preserves the tree from the ill effects of wind; as it is obvious, that the slightest agitation has a tendency to strain the tender fibres, and prevent them from striking properly in the ground, and going forth in search of their food. Last of all, before filling in the earth, he scrapes or cleans that part of the root, which is nearest the surface; because his idea is, that, from every part so treated and laid bare, new growths and fibres are immediately sent out. By the above process, as there are only three or four feet of the stem standing above ground, it is soon covered from top to bottom with new shoots; and no part of it appears stunted or hidebound, as such trees usually are, in old olive plantations.

"The other method of planting is, by means of sets, which are formed of stout branches, and put into the pits, in a manner similar to that above described. In selecting these, however, care must be taken, that they are covered with fresh and tender bark, such as young trees generally produce. It is true (as he observes,) the sets require much more time than entire trees, to arrive at maturity; but they become, in the end, not less beautiful and healthy, than if they had sprung from plants, which were raised in the ordinary manner."*

Notwithstanding this seeming nicety in the Roman practice, and the probability that it might have led to the establishment of principles, it is curious enough to perceive, that the art became retrograde, rather than progressive, in the hands of the Romans. Palladius, who wrote more than a century after Seneca, and nearly two after Varro and Columello, directs, in his work to be done in November, that, in transferring large trees, all the branches should be cut away, previously to their removal, and consequently the trees much more defaced and mutilated than after the Greek manner; a precept which seems to be but too faithfully observed by most planters of the present day.†

If we descend in our investigation to modern times, we shall not find that any considerable progress has been made in the art, beyond the knowledge of the ancient nations. The difficulty of transplanting an old tree still remained proverbial; and Baptista Mantuanus, who flourished in the fifteenth century, might well exclaim—

Heu, male transfertur senio cum induruit arbor!

After the revival of learning in Europe, gardening, and in some sort arboriculture, were among the useful arts first studied: but the rudeness of those early attempts at the former, gave no earnest of the excellence which it was afterwards to attain. It is a popular error to suppose, as is done by some, that our rectilinear gardens, our formal avenues, and elaborate topiary works were borrowed from the Dutch, after the accession of King William. On the contrary, they belong to a far earlier day. They were accurate transcripts, derived from antiquity, of the Roman garden, as we find it admired by Cicero, and described by Pliny, in the most polished ages

* Note VIII. † Note IX.

of the empire.* They were the style of garden, first brought to Britain by the Romans; and it prevailed universally in England, as we learn from both Hentzner and Plott, in the days of Queen Elizabeth.

The removal of large trees has been practised in Europe for nearly two centuries; and it is more than a hundred and fifty years since it was introduced into England. It seems to have come into vogue among the great and powerful, sometimes for the purpose of concealing a defect in their formal gardens, or perhaps for supplying or prolonging a favourite vista. But it was, for the most part, a mere display of expense and labour, adopted without plan, and executed without skill or science.

Among the earliest and most successful planters, on a great scale, was Count Maurice of Nassau, who figured as Governor of Brazil in 1636, when that settlement was in the hands of the Dutch. This prince was a man of taste and elegance, for the age in which he lived; and he adorned his palace and gardens there, with a magnificence worthy of the satraps of the east. Gaspar Barlæus, one of the best poets of his time, is the historian of the expedition; and he has given the narrative in a style, that, in some instances, will bear a comparison with the delineations of Livy or Tacitus.

The governor's residence was upon an island, formed by the confluence of two rivers, which are called, by Barlæus, the Capevaribis, and the Biberibis, and was named Friburg. Before the Prince commenced his improvements, as the historian informs us, it was a very hopeless subject; a dreary, waste, and uncultivated plain, without a tree or bush to shelter it; and, in a word, equally worthless and unattractive. Here, notwithstanding, he erected a splendid palace, and laid out gardens around it, of extraordinary extent and

* Note X.

magnificence. In the arrangement of the buildings, salubrity, seclusion, and horticultural ornament, were all studiously and tastefully combined. The choicest fruits of a tropical climate, the Orange, the Citron, the Ananas, with many others unknown to us, solicited at once the sight, the smell, and the taste; while artificial fountains of water, preserving the coolness of the air, and the verdure of the earth, rendered it a spot of peculiar attraction. In laying out the grounds also, such was the designer's skill, and the magnificent scale of the plantations and grass-plots, that no fewer than thirteen bastions and turrets flanked and defended the gardens, and promoted alike seclusion and security. And in order to complete at once, and give the Immediate Effect of Wood to so great a change on the face of nature, he removed to the spot no fewer than seven hundred cocoa trees of various sizes, of which some rose to thirty, some to forty, and some to fifty feet high, to the lowermost branches.

Of the success of the improvement last mentioned, no one but the Prince himself entertained the slightest expectation. Yet such, says Barlæus, was the ingenuity, as well as persevering labour displayed in the work, that the whole was accomplished with the most perfect success. Notwithstanding the immense size of the trees, which were of seventy and eighty years growth, they were skilfully taken up, under the Prince's superintendence. They were then placed on carriages provided with wheels, and conveyed over a space of from three to four miles in extent, and ultimately transported on rafts, across both the rivers, to the shores of the island. On being planted there, so favourable were both soil and vegetation in that genial climate, that they immediately struck root, and even bore fruit, during the first year after their removal. Thus, adds Barleus, the truth of the ancient adage was for once disproved, which says, that "It is impossible to transplant an old tree with success."*

* Note XI.

This, without doubt, was a singular example of successful transplantation, and not less singular, than certain and well attested. It was a splendid display of the effects of physical strength, and mechanical ingenuity, judiciously directed by absolute power; but it is useless as an example of either instruction or imitation. If we impartially subduct from it all that may fairly be attributed to a tropical climate, to the unlimited command of men and money in executing the work, and to the glowing colours of the historian in describing it, perhaps there will remain little more than what is both probable and natural, under ordinary circumstances.—Barlæus, beyond his general eulogium on the great ingenuity, gives no account of the details of the process. Indeed, he does not appear to have been very conversant with the subject of wood, from the wonder which he expresses, at the natural appearance of fruit, in the first season; as any gardener could have predicted the probability of the phenomenon, during the first year, together with the certainty of its ceasing, during the second.

Evelyn, although with no great accuracy, narrates the same story of Count Maurice, and adds, that instances of the practice, little less successful, had occurred in Europe. He states, that, about the middle of the same century, M. de Fiat, a Mareschal of France, removed huge oaks in this way, at the Chateau de Fiat.* The Elector Palatine, about the same time, also transplanted a number of great lime trees, from one of his forests near Heidelberg, to the slope of a hill, in view of the palace. Midsummer, it seems, was the singular time selected for the work, and De Son, a Frenchman, and "an admirable mechanician," as Evelyn records it, managed the execution. The soil of the hill (according to De Son's account given to Evelyn himself,) consisted of "a dry, reddish, barren earth," which probably with us might have

* Silva, Vol. I, p. 102.

been esteemed good turnip soil. Here, he says, they made great pits, for the reception of the trees. They then cut off their heads; and, having filled the pits with a composition of cow-dung diluted with water, and worked to the consistency of the finest puddle or pap, they immersed the roots in it, and carefully replaced the turf upon the surface, as before. These limes, as Evelyn adds, "prospered rarely well," exposed as they were, during the whole process, to the scorching rays of the sun. And this he justly considers as "a singular example of removing so great trees at such a season;"* or, in other words, that it is not easy to kill the lime, in whatever way you treat it.

But Lewis XIV. was, without doubt, the greatest transplanter of modern times, and the individual, whose example operated more powerfully than any other, in bringing the art into fashion in Europe, in the seventeenth century.—From the researches of the learned Jesuits and others, who, by this Prince's order, had rendered the classics familiar to the Dauphin, he learned, that the practice was well known to the Greeks and Romans; and he resolved to rival, and if possible to eclipse, whatever had been done in this way, by those distinguished nations.

Accordingly, among the stupendous changes, which he made on the face of nature at Versailles, and other royal residences, that by means of transplanting was not omitted. All the arts of ingenuity, and all the efforts of expense and labour were employed, in constructing machinery for so novel an undertaking. Under the direction of Le Notre, his favourite engineer in this department,† the most extraordinary feats in transplanting were performed, both at Versailles and Trianon. Immense trees were torn up by the roots, erected on carriages, and removed at the will and pleasure of the royal planter. Almost the whole Bois de Boulogne was, in

*Silva, Vol. I, p. 102, 205. †Note XII.

this way, said to be transported from Versailles to its present site, a distance of about two leagues and a half. To order the march of an army, was the effort of common men, and every-day commanders; to order the *removal of a forest* seemed to suit the magnificent conceptions of a prince, who, in all his enterprises, affected to act upon a scale immeasurably greater than that of his contemporaries, and who probably was the most powerful monarch in Europe, whether of his own, or of any other age. In the Bois de Boulogne, in spite of military devastation, the curious eye may still distinguish the traces of this extraordinary achievement, in the rectilinear disposition of the trees, which were removed on that occasion.

Respecting the success of the work, executed probably about 1670, it is not easy, at this distance of time, to speak with certainty. That the trees were lopped or mutilated, we are well aware; and that little science was employed, excepting in the mechanical skill, displayed in the transportation. Of the trees, therefore, many must have died, for want of roots, and of sap to support them, although their places were afterwards supplied; and many must have lost their tops, had they not been severely lopped, or altogether decapitated. The lapse, however, of more than a century and a half, a space far surpassing the age of man, has supplied these defects. While it has brought the trees to maturity, it has covered with oblivion all the imperfections of the process; and the former promise long to remain a monument of so stupendous an exertion of physical force.

Sturm, a German traveller, who visited France about the year 1730, relates, that the great transplanting machine, used on this memorable occasion, (*Die grosse Garten-Machine*,)* was still shown at Versailles, and it must long after have been seen by others. But from its late disappearance, we may conclude, that it was pulled to pieces, and the

* Sturm's Travels, p. 113.

iron-work probably converted into pikes, on the breaking out of the French Revolution.

Besides this celebrated effort in the vicinity of the capital, we should be inclined to imagine, from what is said by contemporary writers, that Lewis succeeded still better in the provinces, in giving Immediate Effect to Wood. At Mont Louis, a small town in the territory of Rousillon, at the foot of the Pyrenees, which he built and embellished, and which was named after him, he made the most surprising improvements of every sort. And unless the imagination of a poet of the time has too highly coloured the description, the transplanted groves, at this sequestered spot, rose with such sudden luxuriance, that the birds at once flocked to them, and, nestling among the branches, filled the air with their melodious notes;

> In nemus repentè natum
> Aves undique devolant,
> Nidosque ponunt, hospitis sub frondibus,
> Mulcentes teneris vocibus æthera.*

About the middle of the seventeenth century, as we learn from Evelyn, the practice of transplanting in the French way came much into use in England. No tree, he observes, was found to bear the process better than the elm, or recover sooner from its severity. He himself, he says, "had frequently removed trees of this sort almost as big as his waist:" but he first carefully "disbranched" them, leaving the whole summit entire. Men of rank and affluence, we find, about the same era, transplanted great trees of various kinds, with vast labour and expense; and a Devonshire nobleman in particular, whose name has not been recorded, removed oaks as large as twelve oxen could draw, for the purpose of supplying a defect in an avenue leading to one of his residences.†

The first attempt at any thing like knowledge in the art

* Commir. Op. Post. p. 41.

† Silva, Vol. I. p. 102, 125

was made by a Lord Fitzharding of this period. That nobleman, as it appears, was a contemporary of Evelyn's, and lord treasurer of the household to King Charles II. But his experiments were limited to subjects of far smaller magnitude. His method with the oak was, to select a tree of the size of his thigh, which probably might be about twenty-six or twenty-eight inches in girth. Having removed the earth, and cut all the collateral roots, he forced it down upon its side, so as to come at the taproot, which was immediately cut off. The tree was then raised up; the mould was returned into the pit, and the tree left standing, for a twelvemonth or more, until a fresh growth of roots and fibres enabled him to remove it with advantage. Another method was, after laying bare the roots, and leaving four main ones untouched, on the four opposite sides, in the form of a cross, for supporting the tree, to cut away only those in the intervals. The mould was then, as before, returned into the pit. After waiting a year or two, when the intervals became completely filled with fresh growths, the four cross roots, and also the tap, were then reduced, and the tree removed, "with as much of the clod about the roots as possible."* This ingenious process, which, in either way, saved the tree from decapitation, and consequently from disfigurement, has been deservedly recorded by Evelyn and Wise, and all succeeding writers.

It must be acknowledged, that there was great ingenuity, and some acquaintance with wood, displayed in these important improvements by Lord Fitzharding. As Grew had by this time written, and the researches by both that writer and Malpighi, respecting the anatomy and physiology of plants, had begun to be known all over Europe, it seems

* Evelyn's Silva, Vol. I. p. 102.—Wise's Mystery of Gardening and Planting, p. 91, 92.—Bradley, p. 89, 108, &c.—Dict. Rust. in voc. Transplanting, &c. &c.

surprising, that this ingenious nobleman should have stopped here. By advancing a step further, and applying those interesting doctrines to the art, he might have brought it to a state of certainty and precision, to which little could have been added by the industry of his successors. It was (to compare great things with small,) like the ill fortune of the Romans, in missing the discovery of the art of printing by moveable types, when, as their pottery indicates, they may be said to have possessed that of stereotype.

In this condition of the art of transplanting, it was still necessarily confined, for want of science to direct and simplify it, to the grounds of the powerful and opulent; and sundry devices were adopted by their gardeners, and other operators, to render the practice more efficient, and to reduce the expense within moderate limits. Although numerous oxen and horses were still employed, to drag the ponderous load of earth, on which their hopes of success mainly rested, yet sundry efforts of ingenuity were exerted, for the preservation of the roots; and, as the subjects were large, even the assistance of frost was called in, for that desirable object.—Soon after the fall, and before hard weather set in, a trench was opened of some extent, and at a sufficient distance from the trees, so as to undermine the roots. Blocks and quarters of wood were next placed in the excavation, to keep up the earth. The trench was then filled with water, which was suffered to freeze; and thus, an immense and weighty mass of earth and roots, bound firmly together by congelation, was conveyed with the trees to the situation intended. Here, however, it was previously necessary to preserve the mould from freezing also, by covering up the surface with fresh litter, to some distance round the new pit.

It deserves particular notice, that, in transporting these unwieldy subjects, no other than their erect position was contemplated by the inventors. By means of a vast wooden crane, strongly braced with iron, both transversely and longitudinally, with ropes and pullies to work it with effect, and of which the former were passed under the roots, these enormous masses were raised from the ground, and placed upon a platform with very low wheels; when, after being dragged by the united strength of men and horses, it was let down into the new pit, by similar apparatus.* These were gigantic operations, and such as required machinery of the most powerful and expensive kind. It is not a great many years, however, since feats of the same description were performed at Blenheim, and other large English places: and it sometimes happened, when the excavation was made at an uncommon distance from the trees, and a sufficient mass of earth obtained for supplying the roots with nourishment, that the tops were preserved from decay. But we may easily suppose, that planters only, like a governor of Brazil, or a German elector, would undertake the execution.

From the time of Evelyn to that of Brown (the well-known professor of landscape gardening), that is, for a period of about threescore years, we hear little of transplanting in England; and had it not been for the exertions of the latter, and for the kindred art, to which he gave so much celebrity, it might have sunk altogether into oblivion. That enterprising genius clearly perceived, that his fortune had placed him at the head of a new and popular school of design, which, from the novelty of its attractions, promised ere long to rival painting itself. As the new artists possessed already the privilege, not only of appropriating the colours, but even of working with the materials of nature, so they appeared to want nothing, but the power of giving immediate effect to their pictures, in order to facilitate the competition, if it did not altogether turn the balance in their favour.

With the view, therefore, of obtaining this decided advantage in the construction of his landscapes, Brown dili-

* Evelyn, Vol. I. p. 103.—Dict. Rust. *in voce* Transplanting.

gently applied himself to the improvement of transplanting large trees for park effect, and strove with great zeal to bring it into repute, among his noble and wealthy employers. Instead of maintaining the upright position of the trees during transportation, as had hitherto been practised, he devised the method of carrying them horizontally, and for that purpose constructed the Transplanting Machine, which, since his time, has been in pretty general use.

This efficient implement was, like most useful contrivances, of very simple structure. It consisted of a strong pole of considerable length, with two high wheels, and acting on an iron axle, which was placed at right angles to it. At the extremity of the pole there was a smaller wheel, that turned on a pivot, and was used for trees of more than ordinary magnitude. These two wheels were of great strength, made nearly upright, or, in the workman's phrase, very little "dished." A strong cross-bar was bolted on the axle, with a space in the middle, gradually hollowed out for receiving the stem of the tree, of whatever size it might be. According to Brown's method, the top was pretty severely lopped or lightened, and sometimes quite pollarded. The roots were next cut round, to the depth of the fibres, and only two or three feet out from the body, and the machine was brought up upon its wheels, as close as possible to the tree. The pole was set upright, and applied to the stem, to which it was then lashed in the firmest manner. By a rope fixed to the top of the pole, it was, last of all, forcibly drawn down, by several men's strength; and thus, the stem and the pole of the machine, forming a lever of great power, forced or tore up the roots from their under-bed, with as many fibres adhering to them, as escaped laceration; leaving the tree suspended horizontally on the cross-bar, and ready to be drawn away root foremost, as the artist might require it.

This, we must own, was no very gentle treatment of the roots, any more than of the branches. Yet Brown's improvement possessed the double advantage of contributing, by the height of the wheels, to the safety of the tree during the transmission; and, by materially increasing the dispatch, it proportionally diminished the cost of the process.

Notwithstanding the superior character, and elegant learning of Messrs. Price and Knight, and the weight which may be allowed to their authority, it is impossible for us to conceive, that Brown was as destitute of genius and talents, as they would willingly persuade us. The idea is clearly disproved, by the prodigious extent of his reputation, and of the works in which he was employed.* It will not, therefore, be thought too much to say here, that his genius was of that aspiring and ardent sort, which fitted him rather for bold design, than minute detail and patient investigation; and, as the character and properties of trees formed a study belonging to objects of the latter class, it could not very long detain his attention. Besides, he perceived, that it was by no means applicable to the execution of great outlines of Wood, how useful soever and effective it might become for the foreground, and the middle distance of the landscape. Be this, however, as it may, it appears, that the art received no further improvement at his hands, and seemingly as little at those of his successors. Even the ingenious contrivance of Lord Fitzharding to multiply the roots of trees, seems little to have attracted his notice. In transplanting, at the numerous places, which he improved or altered in England, this method was never resorted to. The process he followed was a very simple one, namely, to root up the trees by the shortest possible method, and convey them, in the speediest way, to their several destinations. He preferred, however, to work with his machine during frost, when earth, in masses greater or less, would adhere to the roots, and be readily lifted with them. As to severely defacing, and even pollarding

* Note XIII.

the tops, he conceived, that it carried with it its own apology: And such seems still to be the general opinion of planters, down to the present period.

These particulars, respecting the practice and machine of Brown, at one time the supreme dictator of taste in landscape gardening in England, were obtained from two of his pupils, the well-known Mr. Thomas White, who succeeded to a great part of his business in the northern counties, and Mr. James Robertson, who was sent down to Scotland, about 1750, to lay out Duddingston for the late Earl of Abercorn.* This task Robertson performed with credit to himself, exhibiting all the faults, and the excellencies of his master. After this his first essay, and making some important changes at Hopetoun House, and on the park at Dalkeith, he laid out Livingston, Dalhousie, Niddry, Whim, Moredun, Culzean, and other places in Mid-Lothian and Ayrshire; which, with the exception of Blairdrummond, were the earliest examples of landscape gardening in Scotland.†

At all, or most of these places, Robertson introduced the knowledge of the transplanting machine, together with the method of employing it, as interesting to landscape gardening: But few particulars are recorded of the progress made by either art, on this side of the Tweed. To a nation not inconstant nor volatile, and certainly poor, when compared with their present condition, it was no very easy nor grateful undertaking, to demolish at once their favourite terraces, their formal gardens, and other appendages of ancient grandeur, for a new-fangled art, of which Price wittily said, that Horace had long since described it in three words; for its leading merit consists, in exchanging squares and parallelograms, for circles and ellipses,

Mutat quadrata rotundis.‡

* Note XIV. † Loudon's Encyclopedia of Gardening, p. 79.

‡ Essays on the Picturesque, Vol. I. p. 230.

When such was the only master, under whom the art of transplanting was studied in Scotland, we shall not greatly wonder at the slender advances it has made, or rather at the ill success that has attended it, for more than half a century. In fact, it may be said, that it is, at this moment, in no better condition as to either skill or science, than Robertson left it, threescore years since. This artist (according to the account given by Hayes of his own practice,* which was borrowed from Robertson's) was not very nice in his selection of subjects, but took them indiscriminately, from close woods and open dispositions, just as either fell in his way; so that, if his method was bad, as we have already seen, his subjects must have been at least as bad as his method. As to the attempt to introduce a better, there is reason to think, that, more than thirty years since, I myself was probably the first planter, who made known in Scotland the mode of preparing the roots of trees, as practised by Lord Fitzharding; and I believe, it now passes with many, under the name of *my* method, to the prejudice of the ingenious inventor.

In a few years after the above period, Robertson was invited to Ireland, under high and distinguished patronage, viz. that of the Duke of Leinster, Mr. Conolly, Mr. Hayes of the Royal Irish Academy, and other persons of taste and fortune, leaving his business to be managed by his nephew George, and James Ramsay, one of the most promising of his pupils. Here also Robertson introduced the practice of removing large trees, which, under his new employers, appears to have come considerably into fashion. The machine of Brown was, of course, carried over with him to Ireland; and Mr. Hayes, in his meritorious tract on Planting, and the Management of Woods, gives an account of the implement, and the style of working it, as then taught, which entirely coincides with that above described. Brown's vigorous and short-hand method

* Practical Treatise on Planting.

of tearing up the trees by the roots, and rapidly conveying them to their new destinations, captivated the lively fancy of the Irish planters. Mr. Hayes is loud in its praise, and decidedly prefers the compendious process of the "Scottish Engineer," to the more elaborate preparations, and tedious contrivances of Evelyn and Fitzharding.* Thus, it happened oddly enough, that the Scotch, who themselves knew nothing of transplanting, should give notable lessons in the art, and have the honour of introducing it to notice and popularity in the sister kingdom;

Qui sibi semitam non sapiunt, alteri monstrant viam.

From this time, however, it appears, that it has made no advances among the Irish, as Walker, and others of their late writers, pass over the subject without notice.

The principal English authors, who, of late years, have treated of the art, are Boutcher and Marshall; and being both men of practical skill, as well as various knowledge, what they have written is deserving of particular consideration. About the time when Brown's reputation was at its height, that is, between 1750 and 1780, Boutcher, Nurseryman in Edinburgh, one of the most intelligent Arboriculturists that this country has produced,† with the view of promoting the fashionable art of the day, struck out what he conceived to be a considerable improvement in the method of removing large trees of all sorts. His theory was, to equalize, by a gradual and certain process, the roots and the branches of trees relatively to each other, so as to enable both to perform their functions successfully, and at any given period.

With this view, he commenced his training on plants just out of the seed-bed, and began to fit them, from the second year, for their ultimate destination in the lawn or park. After standing in the nursery, in the ordinary way, for a few

* Prac. Treat. on Planting, p. 41, &c.

† See Note II. on Sect. I.

years, they were removed to a second nursery; on which occasion, extraordinary care was taken to prune, dress, and shorten the roots. There they stood, two and three feet distant, for three or four years more. A third nursery, at still more open order, next received them, for a like space of time. A fourth, a fifth, and even a sixth removal succeeded, leaving the plants no less than ten and twelve feet asunder, but increasing in strength and symmetry, still more than they increased in height. At each and all of these reiterated removals, the roots as well as the branches were shortened and pruned, with extraordinary accuracy, and every attention was bestowed, to multiply and invigorate the former. When twenty feet high, or more, and of fifteen and sixteen years growth, the plants were supposed to be ready for ultimate removal, by conveying them, on men's shoulders, to their permanent destinations. By this elaborate course of training and discipline, all mutilation of the tops was to be avoided; and in this way he hoped so judiciously to second, and even direct the efforts of nature, as should render violence useless, and effectually preclude the errors, which haste or ignorance had hitherto committed.*

It is to be regretted, that this theory, which is sufficiently ingenious, is impossible to be applied to any practical purpose, although it contains valuable lessons for the planter of reflection. The time alone, which would be required for its completion, and the tedious preparation, and consequent expense incurred by the process (supposing it were even more faultless than it is), have probably prevented its being attempted by any one, except the ingenious projector.

Besides this, Boutcher had another plan, on which he seems to have highly valued himself, for removing trees of a large size, that "had stood long in woods and nurseries." But the very terms of this proposition, in as far as it regards

* Treatise on Forest Trees, p. 14—17, &c.

the previous situation of the trees, are almost quite enough to insure miscarriage; and no more needs be said about it than this, that it is a better edition of Lord Fitzharding's system, but with infinitely worse subjects. The roots were to be more elaborately trained, and in every way more scientifically treated; but entire decapitation is held forth as a leading feature in the plan, which that ingenious nobleman had the skill to avoid.*

The other author, to whom we have to refer, is Marshall, an intelligent and voluminous writer on Rural Economics, in the end of the last century. Marshall was by profession a West Indian planter; but, on coming home in 1775, he dedicated his attention to planting and landscape gardening, and in general to rural affairs, in all of which he displayed considerable skill. He is one of the few among our writers, who studied the removal of large trees as an art, and laid down rules to regulate the execution. His precepts, therefore, as well as his practice, are entitled to regard, not only from their own intrinsic value, but as they serve to bring down the history of the art nearly to the present day.

This judicious writer was too well aware of the difficulty and hazard of removing large-sized trees of any sort, to practise on subjects of great magnitude. For "thinning plantations," he says, "for removing obstructions, or hiding defects, or for raising ornamental groups or single trees expeditiously," he conceives that the practice may be recommended; but he declares it to be decidedly "the most difficult part of planting," and therefore is of opinion, that it is inapplicable to general purposes, and not often practised for any purpose, "with uniform success."†

At the various places, where Marshall was consulted, whether as a Landscape Gardener, or a surveyor of estates,

* Treatise on Forest Trees, p. 256—259.

† Rural Ornament, Vol. I. pp. 40, 41.

he frequently gave specimens of transplanting, and these were conducted with a skill, certainly unequalled by any one who had preceded him, and which no one who follows him will easily surpass, with the same sort of subjects. Yet it is surprising that a planter, so conversant with practice, a man too of talents and information like Marshall, seems not to have arrived at any acquaintance with principles. After succeeding in a manner superior to most others, was it not natural, that he should have inquired *why* he so succeeded? and that knowledge, enlarged by reflection, and confirmed by examples, would probably have led him to some general theory, that bore on practice, and suggested systematic improvement. Had he been more acquainted with vegetable physiology, and the anatomy of plants, he would have seen, that trees growing in *close woods*, and trees standing in the *open field*, are endued with very different properties; and that something of firmer stamina, and greater magnitude than what the strength of two or three persons could transport, was necessary for Park-wood, which we expect is to grow vigorously, and resist the elements, in open exposures.*

His judicious method, however, of preparing the pits; of putting his trees into the ground; of applying the mould, when so put; of preserving, distributing, and dividing the roots, obviously results from an attentive study of the difficulties of the art, and, as he himself states, from "real practice."† Still his subjects, like those of his predecessor Boutcher, were drawn mostly from close plantations, for the purpose of thinning them. They were, in the same way, conveyed on "men's shoulders;" sometimes also on handspikes; and on particular occasions, on "high timber-wheels." The roots he cut and multiplied, in the same careful manner as directed by Evelyn and Boutcher, but without the numerous removals

* Rur. Ornam. Vol. I. pp. 360, 361.

† Rur. Ornam. pp. 43, 356—361.

recommended by the latter; from whose treatise, however, he seems to have taken the whole of that process.

For the removal of saplings of twenty feet high and from nine to twelve inches in girth, his plan is of considerable use. In forming side-skreens near the mansion-house, in which grove and underwood are frequently united, it will not disappoint the planter. In new designs he will find it extremely serviceable, for raising the former, if in low and sheltered situations, where a propitious climate is created; and for producing a speedier effect, than can be expected by the ordinary methods.

Although Marshall had too much taste to wish to pollard, or utterly decapitate his trees, still, like most of his predecessors, he lopped and lightened the tops, in order to "proportion them (as he states) to the ability of the roots."* Had he advanced the roots *to the ability of the tops*, and preserved entire the fine forms of the latter, it would have been a more scientific system. But his method of giving gracefulness, and a sort of natural elegance to this operation, is so extraordinary, that it is worth while to quote it, for the amusement of the reader. "To head down a tree (he says) in the pollard manner, is very unsightly; and to prune it up to a mere maypole, so as to leave only a small broom-like head at the top, is equally destructive of its beauty. The most rational, the most *natural*, and, at the same time, the most elegant manner of doing this, is to prune the boughs in such a way, as to form the head of the plant into a conoid, in resemblance of the natural head of the Lombardy poplar, and of a size proportioned to the ability of the root. Whoever was the inventor of this method of pruning the heads of trees, deserves infinite credit. It only wants to be known, in order to be approved; and we are happy to see it growing into universal practice."†

* Rur. Ornam. Vol. I. p. 43. † Ibid.

In this anxious wish, I apprehend, no planter of taste will now probably concur: neither will he feel disposed to admire the "rationality, naturalness, and elegance" of the device of fashioning the fine heads of the oak, the elm, or the chestnut, after the manner of the Lombardy poplar, the most formal perhaps, and most unpicturesque of all existing trees. Yet, notwithstanding a few such absurdities, we must candidly admit, that Marshall was a planter of great skill, and a writer of unquestionable diligence, and, together with the judicious Boutcher, did more to improve the art, than all who had gone before, and probably all who succeeded him.

If there be any other work in our language, or in any of the languages of modern Europe, in which the art is treated in a *perceptive* way, or in a way that furnishes any important materials for bringing its history down to our own times the work has escaped my search. Miller, one of the best arboriculturists and phytologists, that England has ever produced, informs us, that in his time, that is, in the beginning and middle of the last century, the transplanting of large trees had come much into fashion in England. Planters, he says, were "in too great haste" to anticipate the slow but certain effects of time; and by unfortunately adopting the worst possible methods for their practice, they were far less assured of attaining the end they had in view (or, more properly speaking, they were assured of never attaining it,) namely, the speedy acquisition of thriving trees, than if they had begun at once, by raising them from the seed. This failure he mainly attributes to the unnatural and unscientific method of lopping or lightening the tops, at the time of removal, which, as he affirms, is destructive alike of the health, and the value of trees. He truly observes, that, were planters fully aware of the doctrine of the circulation of the sap, and the curious anatomy of plants, they would perceive, that a tree is as much nourished by its branches, as by its roots. "For (adds he,) were the same severities practised on a tree of the same age *unremoved*, it would so much stint the growth, as not to be recovered in several years; nor would it ever arrive at the size of such, as had all their branches left upon them."*

He is, therefore, no advocate for the removal of large trees; and the reason evidently is, that he never saw it executed, but on principles utterly at variance with phytological science, and the law of nature respecting the growth of plants:—For Miller seems to have been well acquainted with their history and constitution, and with the beautiful action and reaction, which all their parts constantly maintain on one another.

Although it is pleasing to observe so much good sense, and so much sound science displayed, at so early a period of our arboricultural history, yet it is a curious fact, that neither the precept, nor the example of Miller produced any good effect, nor any material change in the general practice, and by consequence, any improvement in the art. The fact is, that from the days of Evelyn down to the present times, or more probably from the time of the Romans under Nero and Vespasian, the practice of the art has suffered no great alteration or improvement; and, with the best planters of England, it is still as much a matter of *physical force*, as it was with Prince Maurice of Saxony, or Lewis the Fourteenth.

I can speak partly from my own knowledge of the general transplanting system, now established in England and this country, and partly from the information, communicated by some of the most experienced planters of both countries, in asserting, that the method so justly reprobated by the judicious Miller, is in pretty general use. I will not affirm, that there is *no* planter, who preserves the tops of his trees entire: but the *ordinary* method still is, to transfer old trees, in the same way as nursery-plants, that is, by lopping off a third

* Miller's Gardener's and Botanist's Dictionary, *voc.* "Planting."

part, a half, and sometimes the whole of the top, erroneously conceiving, that both can be managed on the same principles.* They trust implicitly to the plastic powers of the trees, to replace these amputations with fresh wood, and to recover themselves from these severities: but they seem entirely to overlook two main objections, that can never be obviated; first, the length of time which the trees require to recover from any considerable curtailment of their heads, and the deaths and failures that occur, when they do not recover at all; and secondly, the complete loss of distinctive and peculiar character which ensues, by reducing the heads of the most different trees to one monotonous and formal figure.

In respect to the first objection, it is not easy to speak to it with perfect accuracy. In the superior climates of England, that is, the districts south of Yorkshire, and particularly the Devonshire, Dorsetshire, and Hampshire coasts, perhaps the candid planter will admit, that fifteen years at least would be necessary, to recover any great bulk of top, after severe mutilation. In the districts on the parallel of Yorkshire, and in the best Scotch climates, twenty and five-and-twenty would scarcely be adequate; and, in many parts of Scotland, they would never recover at all.

As to the second, and far more important objection, that their distinctive character as trees would be obliterated. Nature has given to different woody plants quite different and opposite styles of ramification of top. Some, such as the lime and the horse-chestnut, are heavy and formal; while the oak, the chestnut, and the elm are far more various and picturesque, and are finely calculated to receive great masses of light. But if these striking characteristics of the latter be destroyed by the axe, by what means shall they regain their former figure? To the painter, not less than

* Note XV.

to the landscape gardener, this loss would be unspeakable, were it carried to any extent. It is a fact well known to arboricultural observers, that no large subject, once pollarded, ever wholly recovers its natural and free conformation, under the most propitious circumstances of soil and climate; although it may acquire at last a bushy head, it becomes like the lime, a tree, which, unless on the foreground, is always formal and monotonous in landscape.

May we not then fairly conclude, that, in the art of giving Immediate Effect to Wood, there is sufficient room for the improvement of such a system? In any view, it will be thought of some moment, if the most beautiful and valuable of all vegetable productions can be saved from mutilation; if picturesque effect can at the same time be preserved, and many years of life anticipated.

In fact, it appears, that the best writers, of the last and present century, consider the art as purely mechanical and fortuitous, and founded on no fixed or known principles. Mason, in the most elegant didactic poem of modern times, in which an account of the art would certainly have been given, as an interesting branch of landscape gardening, had he regarded it as practical, mentions transplanting in a very beautiful way indeed, but quite incidentally, and merely as a mechanical art.

> Such sentence past, where shall the dryads fly,
> That haunt yon ancient vista?—Pity, sure,
> Will spare the long cathedral aisle of shade,
> In which they sojourn. Taste were sacrilege,
> If, lifting there the axe, it dared invade
> Those spreading oaks, which in fraternal files,
> Have paired for centuries, and heard the strains
> Of Sydney's, nay perchance of Surrey's reed.
> Yet must they fall; unless *mechanic skill*,
> *To save her offspring*, rouse at our command,
> And where we bid her move, with engine huge,
> Each pond'rous *trunk*, the pond'rous *trunk* there move;

A work of difficulty and danger tried,
*Nor oft successful found.**

From the expressions made use of in this beautiful passage, we are led to believe, that entire decapitation was implied in the process, and that Mason, who was himself a planter as well as a poet, considered the necessity as indispensable.

Pontey, one of the most extensive and successful planters now living, and also a landscape gardener of no small distinction, gives his testimony nearly to the same effect as Marshall and Mason. In a late Practical Treatise on this pleasing art (a work which was much wanted,)† after stating his anxiety to discover some certain method of giving a Speedy Effect to Wood, he gives up the point as unattainable, and has recourse to the miserable expedient of planting willows and poplars. Respecting the art under consideration, he candidly says; "I am no advocate for the removal of quantities of large trees, as the business is extremely tedious, and hazardous also. And after all, in cases of success, such trees for several years grow so slowly, as to remind one of the 'stricken deer.' It is, indeed, seldom that they harmonize with any thing about them."‡ This, we must own, is a judicious not less than an obvious remark, and of which no impartial person will deny the justice.

From the view, which has been thus taken of the art in Britain, it may probably be said, that it has advanced little within a century, whether in respect to skill or science. Of late years, however, some successful examples have been given of what may be called horticultural transplantation, that is, the removal of large shrubs and trees of an ornamental or exotic species. At the Royal Gardens of Kew, during the reign of his late Majesty, this was done on a

* English Garden, B. I. 318. † See NOTE IV. on Sect. I.
‡ Pontey's Rural Improver, p. 87.

considerable scale, and with extraordinary success; but I have not been able to obtain any detail of the process.

About three years since, Dr. Robert Graham, Professor of Botany in the University of Edinburgh, on changing the site of the botanical garden at that place, contrived to remove a vast number of plants of great rarity and value, and which, had they been lost, many years of the most diligent culture in the ordinary manner would not have replaced. Previously to the taking up, he followed the ingenious method of Lord Fitzharding, in cutting round the plants, which, properly speaking, should all have stood for two or three years after, in order to gain an accession to their roots: but, some local arrangements having deprived them of that advantage, a great part were suffered to stand only for a single season. Such, notwithstanding, was the extraordinary care bestowed upon them by the ingenious professor, and the skill and diligence of his gardener Mr. M'Nab, that the removals were executed with a safety, which could scarcely have been anticipated. In order to give still greater variety and effect to the new garden, forest trees also of various kinds, and considerable dimensions, some of them from thirty to forty feet high, were at the same time transferred from the old ground to the new.

The method adopted was, to raise as great a mass or ball of earth as possible with the plants, and that was carefully matted up, in order to preserve it entire. The plants were then put upon a platform with four very low wheels, in an upright position (as was practised in the time of Evelyn,) and transported about a mile and a half to the new garden. In removing the trees, owing to the immense friction, occasioned by the lowness of the wheels, ten and twelve horses were occasionally employed; so that the procession through the suburbs for many days, consisting of men, and horses, and waving boughs, presented a spectacle that was at once novel and imposing. The citizens of Edinburgh were surprised and delighted with the master of an art, which seemed more powerful and persuasive than the strains of Orpheus, in drawing after it, along their streets, both grove and underwood of such majestic size :

> Threïcio blandiùs Orpheo
> Auditam moderari arboribus fidem.

On arriving at the place of their new destination, where the ground had been prepared at great expense, and forced up to the depth of three feet or more, the trees and bushes were carefully planted. Numerous ropes, fastened pretty high from the ground, and extending from the stems to the distance of from twelve to four-and-twenty feet out, in the fashion of a well-pitched bell-tent, pinned them to the spot with immovable firmness, so that injury from wind seemed altogether impossible. In this way, as may be easily conceived, little or no loss of plants could be sustained by the operation :—The depth and richness of the soil ; the sheltered site of the garden, almost as low as the level of the sea ; the steadfastness of the plants, in consequence of their fastenings ; added to careful waterings daily repeated, almost precluded contingency.

As to the expense attending the process, it were needless as well as invidious, minutely to investigate it ; as it could be no object, in a Royal Institution, when compared with the successful preservation of plants of such uncommon value. A list of some of the most remarkable, with their several dimensions, will be found in the notes, and may interest the botanical reader.*

For this achievement in horticultural transplanting, the most splendid probably ever known in Britain, the learned professor is entitled to the highest praise. It shows what may

* Note XVI.

be done, in this art, by the united efforts of industry and ingenuity. Yet, although the whole was very ably and royally executed, and must prove interesting to others, placed in like circumstances, it furnishes no example for general imitation, or park practice. All the prominent difficulties, with which the ordinary planter has to contend, namely, want of climate and soil, and of genial warmth resulting from exposure to the elements, were here removed or obviated. The trees, in this favourite spot, were like the products of nature in the "Happy valley" of Rasselas, " in which all the blessings of vegetation were collected, and the evils extracted and excluded." To succeed, therefore, with removals on the open lawn, would require a different system, as well as very different subjects.

It now only remains to say something of the progress of the art, on the continent of Europe, within the last century ; and on that subject there is little to be told. The two countries, whose example, during this period, has been most generally influential, are England and France. Landscape gardening originated in the former country ; and it was naturally to be expected, that, with a character so attractive, so captivating to the imagination as well as the senses, the taste for it would soon be spread among her continental neighbours. It was justly remarked by Walpole,* a very accurate observer, that our style in this new art would never, in all likelihood, be brought into general use among those nations. The expense being suited only to the opulence of a free country, it is there alone that emulation could reign, among a number of independent individuals. The little princes of Germany, he observes, who spare no cost on their palaces and country residences, would be themselves likely to become our imitators, especially as their country and climate bear, in many respects, an intimate resemblance to our own.

* Anecdotes of Painting in England, Vol. IV.

It is now about threescore years since Walpole wrote, and it is remarkable how well his anticipations have been verified. While the French, in general, have little cultivated landscape gardening, a real taste for it has by degrees extended itself all over Germany, Hungary, Poland, and the northern parts of Europe. From this observation respecting France, I except, of course, a few places in the neighbourhood of Paris, which have been laid out in a superior way, in imitation of the English style, such as Arnouville, Courances, Marçeau, and, above all, Ermenonville, the pride of French gardening.* The rest are such examples, as Frenchmen might be expected to produce, of an art, which in its character is essentially and radically English.

The remarks of Walpole may, in a great measure, be applied to the art of giving Immediate Effect to Wood, as being one of the most important accessories to that of creating or improving real landscape. Since the time of Lewis XIV., there is no reason to think, transplanting has made great advances in France. The magnificent and expensive scale on which the efforts of that prince were conducted, rather discouraged than invited imitation or competition. The French nobility and gentry, in former times, never resided much on their estates; and the Revolution, which has changed many other things, has made little alteration on their taste for rural pleasures. What a man has not frequently under his eye, he feels little desire to improve or embellish. The freedom and freshness of natural scenery can have few charms for him, who is taught to consider Paris as the undoubted centre of all earthly enjoyment; and another century might pass away, ere a true-born Frenchman could either acquire or comprehend this species of British predilection. The art, therefore, of giving Immediate Effect to Wood, like that of creating real landscape, is now regarded,

* Hirschfeld, Theorie der Gartenkunst, Band V. p. 258—267, &c.

as heretofore in France, in the light of a mechanical process fortuitously practised, and little valued for either ornament or use.

Madame de Sevigné mentions, in one of her letters, that, at her country-seat "aux Rochers," they raised great woods, and transplanted trees of thirty and forty feet high. This account is very vague and unsatisfactory, as she says nothing of the means, which were employed to accomplish the work. But Madame de Sevigné probably told all she knew; and we may believe they did their best to follow the example set by the *Grand Monarque*, although with inferior powers of execution. At present, in France, as we travel along the roads, we frequently see trees of some size, which have been transferred, in order to decorate the sides of the former. Their mode of proceeding seems to be the same as that directed by Evelyn (who probably borrowed it from the French), namely, to raise the tree by the ordinary methods; to lop and disbranch it completely; and then, in planting it anew, to leave nothing but the summit entire. The small-leaved elm is the species of tree generally adopted for this purpose, in some districts, but in others, the walnut, the oak, and the poplar.

In Germany and Poland, it is altogether different with respect to national taste, and characteristic habits. The country residences of the great and wealthy are much more frequently inhabited by the owners; and, in Poland especially, they have been, of late years, laid out in a style more truly English, and with great magnificence. Notwithstanding a grotesque mixture, on some occasions, of that style with their former rectilinear features, their parks and pleasure-grounds often exhibit a rudeness and wild grandeur of scenery, which are rarely found in England, and which Wales or Scotland can scarcely rival. It is in such hands that the art of transplanting might produce the best effects; and there is no want of situations to profit by its assistance, were the art placed upon principles that could insure success.

As it is, we find, that it has already been practised on a large scale, by several of the German Princes. At Potsdam, Frederick II., and at Warsaw, the last King of Poland transferred some thousands of large trees, in order to embellish the royal gardens at those places. At Lazenki, in the suburbs of Warsaw, the well-known, but unfortunate Stanislaus, displayed that taste and ingenuity, for which he was so distinguished, in laying out the palace and grounds in a style, that, for luxurious magnificence, has perhaps never been surpassed, since the days of the Roman emperors. To this favourite spot he removed some thousands of trees and bushes, for the improvement of the park, which, together with the gardens, was frequently thrown open to the public. On these occasions, the most splendid entertainments were given to the court, and principal inhabitants of the capital, which are still recollected with feelings of delight. The method of removing the trees was, to lop and deface them in the ordinary fashion, and, of course, to curtail the roots, and then plant them in an irregular way, or sometimes leaning to one side, the better to imitate nature. Hence, after the interval of many years, late travellers have found, at all these royal residences, evident marks of such operations, in the mutilated appearance of the trees.*

The Czar Peter, and the Empress Catherine of Russia, made similar attempts to procure the Immediate Effect of Wood, at Zarsco-Zelo, and other palaces in the vicinity of Petersburg, on which operations immense sums were laid out, by those magnificent princes. The trees were usually raised during the winter, and removed in the time of frost, with vast balls of earth adhering to the roots, and cautiously placed in the same position as to the north and south, which they had previously occupied. On these occasions, the tops of the trees were severely reduced, and so completely disfi-

* Note XVII.

gured, that they seldom recovered the operation. The King of Bavaria, likewise, has of late made many removals at his summer palace near Munich, on the same defective principles, and with no better success. Count Potocki, about ten years since, at his seat of Talitzin in the Ukraine, seems to have been more skilful, or more fortunate. In order to please and surprise the Countess, his step-mother, on her arrival at home, after some months absence, he successfully removed a double row of lime trees, of more than twenty feet in height, as an avenue to the house.

The universal complaint, however, in all these countries, as among ourselves, is *the constant decay of the tops, in spite of previous mutilation ;* and that even, were that process successful in insuring the after-vigour of the trees (which it is far from doing), still their beauty would thereby for a long while be lost. It is true that time, the great restorer of defects, as well as destroyer of beauty, among the vegetable tribe, may partially cover these imperfections. But the Immediate Effect of Wood, and the delightful creation of park-scenery, are thus missed by the planter himself, as his subjects, for years, look like the sickly offspring of art, not the free produce of nature. It seems, therefore, evident, that some better and more scientific system is still wanting, for the advancement of transplanting ; a system, which should unite certainty of success with a moderate expenditure, in order to bring the art into general use.

Thus, I have endeavoured to give, as briefly as possible, the History and Progress of the Art of Removing Large Trees, from the earliest times down to the present. We have seen that it was a practice well known to the Greeks ; always considered as desirable, but next to impossible to be carried into effect, by that ingenious people : That, in the hands of the Romans, if it did not altogether retrograde, it was in a condition little better than that, in which the Greeks had left it : That in modern Europe it revived, with the revival of learning, and seemed for a while to advance, with the improvements of luxury: In the hands, however, of one of the most powerful monarchs that Europe ever saw, it did not rise beyond the rank of a mechanical art: And finally, in those of the most cultivated nation of modern times, a nation too, which has added one more to the number of the Fine Arts, it still remains a practice *without a foundation in fixed principles.* It is regarded, by their best practical writers, as wholly unfit for general purposes, as limited in its application, and hazardous and uncertain in its execution.

Yet, in this state of things, there is reason to suspect that a prejudice still exists, at least in England, against any attempt to supply these defects, and to raise it to the rank of a regular art. In either division of the island, the attempt will be deemed a bold one, and by some treated as altogether visionary. The only ground, on which I venture to look for a different result in my own country, is not laid in any fanciful theory, however ingenious, but in the laws of vegetation plainly applied to practice. In attaining the object, I shall strive, in the words of a great orator (which have been chosen to grace my title-page), "so to adopt the ministration of Art, as humbly to imitate Nature; to tread in her footsteps, wherever they are to be found, and to strike out a kindred path, wherever they are wanting." It is on such principles alone, that I can hope to communicate, to this neglected practice, some stability from arrangement, and some light from science.

SECTION III.

ATTEMPT TO SUGGEST A NEW THEORY, OR PRINCIPLE OF THE ART.

From the cursory view which has been given, of the rise and progress of transplanting, from the earliest times down to the present, it appears, notwithstanding the objections of some ingenious men, that it is an art worthy of an attentive cultivation; and that, if it could be established on principles, founded in nature, and confirmed by experience, it might, within a short period, become extensively useful.

The best informed phytologist, who has treated the subject, is the judicious Miller, the author of the Gardener's and Botanist's Dictionary; a work, which, in the enlarged edition of Professor Martyn of Cambridge, should be diligently studied by every planter of education. On the art in question this accurate observer has no formal disquisition; but in the article "Planting," he has introduced some strictures on the practice of removing large trees, as it was in his time prevalent, and some general objections to the art itself, which are deserving of attention. These, then, it would be proper to consider in the outset, before we proceed to inquire respecting the improvement of the art. His main objection to the then existing system (which, as we have seen in the foregoing section, is precisely that of modern planters) is that the lopping or mutilating the tops and side-branches of trees, and still more the decapitating of them, is utterly destructive of their health and growth; and that, whatever other advantages might be supposed to attend the art, that alone is sufficient to neutralize or counterbalance them. It was this weighty objection, brought forward by Miller, that first led me to bestow particular attention on the subject, and to seek for some general theory or principle, which, if founded on the laws of nature, as affecting woody plants, under different circumstances of climate and soil, might serve to regulate and improve the practice.

But, independently of all partial faults, that might be found with transplanting, as now generally practised, Miller objects to all transplantation whatever, whether of young trees or old. Every tree, he holds, in order to reach the greatest size and perfection, of which it is susceptible, should be raised at once from the seed: To remove it at all, is sensibly to deteriorate it. Therefore, it follows, that if, by removal when young, it suffer injury, it must, by the same process when old, suffer much greater injury. On this opinion of the expediency of sowing the seeds of trees, instead of transferring plants from the seed-bed to the nursery, and thence to the open plantation, he is not singular, as the doctrine has been supported, both before and since his time, by very eminent phytologists: While others, of no small weight and name, have as strenuously taken up the adverse side of the question, and maintained, that plants may not only be safely transferred from the seed-bed to the nursery, before being planted out, but that woods raised with such materials possess advantages, which those at once springing from the seed can never possess.* These different systems, within the two last centuries, have been widely propagated, and as keenly supported; and, as the mass of mankind never think for themselves, it so happens, that the art of transplanting has its friends and its enemies, its advocates and its opponents, among the learned and the unlearned.

* Note 1.

Without entering into so extensive and intricate a question as the above (which, however, might lead to many interesting details), let us see what the objections of so judicious a writer as Miller are, to the transplanting of trees of considerable magnitude; because, if we either admit those objections as relevant, or obviate them as unfounded, it will pave the way for some rational theory of the art.

The objections, brought forward by Miller, seem to be three in number. The first and radical one, as above noticed, is to the lopping or cutting off the tops or side boughs, or both, at the period of removal, as utterly ruinous to trees. This objection, he says, is obviously so well founded, that no one will stand up for the safety of the practice, who is acquainted with the way in which the circulation of the sap is carried on; for, in that case, he must know, that branches being organs just as essential as roots to the nourishment of trees, it must be doubly destructive to mutilate both, at one and the same time. If any one, he adds, doubt the fact, let him try the experiment on a healthy subject of the same age *not* intended for removal, and he will find, that mutilation will so stint its growth, that it will not recover till after several years, if it recover at all; and it will never attain the same size and figure, or produce the same sound and perfect wood as others, on which the branches have been left in an entire state. Or otherwise, let him make the trial on two trees of equal age and health, and cut the boughs from the one, while he leaves them, at the time of transplanting, on the other; in that case, the latter will be found to succeed far better than the former. Or, let him practise the same thing on two permanent trees of equal health and appearance; and the tree, of which the boughs are lopped, will not be found to make half the progress of the other, nor will the bulk of the stem increase, in nearly the same ratio.*

* Note II.

But, say the planters, who advocate the mutilating system, since the roots are severely curtailed by the operation of taking up, the branches must necessarily be curtailed in proportion, and suited to the ability of the roots, whose province it is to sustain the branches. If, however, there be any truth in the foregoing statement, and that it be reciprocally the province of the branches also to nourish the roots, that argument, how specious soever, must fall to the ground; for it is obviously calculated to make bad worse, by subjecting the tree to two evils instead of one, to which it must at all events be subjected. Besides, these reasoners are well aware, that, if they abstained from the lopping of the top and branches, and left them entire, the greater part would decay during the first season, for want of nourishment, to the utter discredit of their system. The objection of Miller, therefore, is perfectly unanswerable. It would be quite superfluous to add any further illustrations, however conclusive, drawn from the constitution or anatomy of plants, as these will more properly be brought forward in the sequel.

His second objection is, that, if trees be removed with large heads, it is next to impossible to maintain them against the violence of the wind, in an upright position, with the aid of supports or fastenings of whatever species. To this it may be answered, that almost all trees with large heads, have short and stout stems, with correlative roots; and at all events, that, by art skilfully employed, roots may be *increased to the ability of the tops*, and almost incredibly multiplied, if time be given for nature to second the efforts of art. Besides the nourishment, which is prepared by the leaves, sent down to the stem, and ultimately, by means of the branches, to such extensive roots, the branches and stem together serve to balance the tree properly against the winds; so that, when due precautions are used, an extensive top is an aid rather than an impediment to the progress of trees, and may be rendered advantageous, by a skilful planter.

The third and last objection is, that transplanted trees do not survive above five or six years, after being so injudiciously removed, as above described, and their boughs mutilated: That, in a particular instance, which Miller quotes, where oaks were so treated, and where they were found to thrive beyond all expectation, in the beginning, they yet died at the end of fifty years; whereas, according to the characteristic properties of that tree, they should then have been increasing in vigour. To which it may be fairly replied, that the occurrence of such miscarriages evidently proceeds upon the supposition, that the injurious practice of lopping the tops and side branches is *still* to be continued; when, on the contrary, by an improved practice, as soon as that cause is removed, the evils that flowed from it will be removed in consequence. As to the effects of fifty years growth on transplanted trees, it is not so so easy to speak: But at the place from which these pages are dated, some oaks, beeches, and limes are to be seen, nearly forty years after removal; and those trees have constantly exhibited progressive vigour in an extraordinary degree, and might now be taken for plants raised without removal from the seed.

Such are the objections against Transplanting, which have been urged by Miller, and which the reputation of the man, not less than the nature of the objections themselves, rendered worthy of particular notice. If we yield to the first objection, which we must do, as being quite conclusive; if we obviate the second and third, which, I conceive, has been satisfactorily done, perhaps we may venture to believe, that there is good ground for suggesting a rational theory of the art, such as probably would have been sanctioned by this intelligent phytologist himself, notwithstanding his prejudices, and, what is still more important, has been sanctioned by experience.

On considering the causes that have hitherto rendered this desirable object abortive, they appear to be of a twofold description. In the first place, they have originated in a general want of science in planters, which has naturally led them to a mistaken choice of subjects. And, in the second place, they have sprung from the belief, which most planters seem to entertain, that young trees and old possess similar properties, and that therefore, they should be removed on similar principles. But there is no doctrine more fallacious than this, and none which it is more important to refute. In a concise inquiry, which is about to be instituted, in order to point out some sound theory or principle of the art, both of these obstructing causes shall be kept in view, and illustrated in as clear a manner as possible.

If we take a survey of nature, in all the forms, under which existence is manifested, we shall perceive, with admiration, the wisdom of the Creator, in accommodating every animate and inanimate being to the economy of a universal and connected plan. By his incomprehensible power, every organized production is adapted to the place, which it is destined to occupy, in the world of life; and every organ of every living whole is curiously modified to the circumstances which affect the exercise of its functions, and to the conditions which regulate the development of its energies. Every organized substance is necessarily a living production. Every living production, whether animal or vegetable, tends naturally to perfect existence; and perfect existence is contained in the full development of all the parts or organs *through* which action is evolved, and consequently, *in* which life is realized: for life is manifested by action; and living vigour must be proportionate to spontaneous energy, in every being endowed with life.

But while every organic creation tends to full development, that is, to absolute energy, or the perfection of its species, still we find, that the organs, of which it is composed, are each reciprocally dependent on every other, for the possibility and degree of their peculiar action. At the same time, as these internal conditions of animated existence are severally dependent on certain external conditions, which again are not always fully and equally supplied; so it follows, that the life of every organized being is determined in its amount, and in the direction of its development, by the outward circumstances of its individual situation. For this reason we see, that every animal, and every plant is dependent for its existence, and also for its perfect existence, on conditions both internal and external.

From this reasoning it may be conceived, how the several parts of the living whole reciprocally act and react. They are, in fact, cause and effect mutually; and no one can precede another, either in the order of nature, or of time. Thus, in an animal, the digestive and the absorbent, the sanguineous, the respiratory, and the nervous systems are at once relative and correlative. In like manner, in a plant, the same reciprocal proportion is found to hold between the roots and the stem, the branches and the leaves: each modifies and determines the existence of all the others, and is equally affected by all, in its turn. And as their several parts, by means of their union, constitute the organic whole; and as their functions, by the same means, realize the complement of life, which the plant or animal exhibits; so it is evident, that every living individual is a necessary system, in which no one part can be affected, without affecting the other parts, and throughout which there reigns an intimate sympathy, and a complete harmony of perfection and imperfection.

Further; the external conditions of this internal development of plants and animals, are food, air, heat, and probably water; while light, according to most physiologists, seems to be a peculiar condition, indispensably necessary to plants.* Where any one of these conditions is not supplied, the

* Note III.

existence of life, whether animal or vegetable, becomes impossible; where it is insufficiently supplied, life is proportionally enfeebled or repressed. But, to limit our consideration to the vegetable kingdom, it may be observed, that where a loose and deep soil affords an abundant supply of food, where a genial climate diffuses warmth in an adequate degree, and where a favourable exposure allows a competent access of light (for air, being fully and universally given, may be thrown out of the case;) in these circumstances, a plant, if not mechanically injured, will vigorously exercise its functions, and attain the full development of its parts, thus realizing the absolute complement of life, to which it naturally tends. In the same way, when these conditions are stinted, the luxuriance of the plant is checked, in the ratio of that restraint, and the deficiency of the supply. Where any one of the external conditions is partially or inadequately supplied, the plant appears to make special, and even forced efforts to secure as much of the beneficial influence as it can, and to accommodate itself to the exigency of its situation. Thus, where light is admitted only from a single point, a plant concentrates all its powers, in stretching towards the direction of the light. Where light is shed all around, the plant throws out its branches on every side. In conformity with this principle, we find, that, in the interior of a wood, where the trees mutually impede the lateral admission of light, the tendency of each is upwards; and the consequence of this tendency is, that the plant is thereby not developed in its natural and perfect proportions, but is elongated, or drawn up to an undue height. It displays its ramification chiefly near the top; while the imperfection of its life is manifested, in the whole character of its vegetation. In open exposures, on the other hand, the tree developes its existence, in full health and luxuriance. It reaches a height, such as the soil and situation admit, and sufficient to allow the branches, which are thrown out on every side, to expand their leaves freely to the sun. Not being compelled to concentrate its efforts, in securing a scanty supply of one beneficial influence, all its proportions are absolute and universal, not relative and particular. In such circumstances, therefore, it may be considered as in a full and natural state of perfection.

Another condition of vegetable life appears to be an adequate degree of heat. Within a certain range of temperature, vegetation is positively promoted: below or above a certain point (the degree differing in different species of plants,) vegetation is positively checked. To speak only of the latter case, which is briefly expressed by the term cold, it is either produced by absolute lowness of temperature, or, in particular circumstances, by the generation of cold, through the effect of wind, and consequent evaporation from a moist surface; for trees in themselves have but little self-generated heat, above the surrounding temperature; and their chemical composition is such, that they do not congeal, unless the cold be of the severest sort, and many degrees below the freezing point of water. Some caloric, however, they probably possess, otherwise they would be killed in very hard weather, or rather, on the too sudden return of heat.*

Of the above accidents nature can modify the former, by accommodating different species of plants to different latitudes and elevations: against the latter, she adopts the plan of affording suitable protection to the individual. In the interior of woods, where the free current of air is intercepted, where stillness and serenity are maintained, and where each tree affords shelter more or less to every other, nature has little need to generate the provisions necessary to mitigate the injurious effects of evaporation. But in open exposures, and in the case of isolated trees, this effect must be assuaged, and is, in fact, to a certain extent alleviated, by various pro-

* Note IV.

visions or properties bestowed upon the tree itself. In the first place, a thicker and closer ramification of the sides and top is supplied, and a more abundant spray towards the stormy quarter, thereby furnishing a kind of clothing of leaves, in order to protect from cold both the ascending, and the descending sap-vessels: And secondly, a greater induration of the epidermis, and thickness of the cortical layers of the bark are provided; which, forming a bad conductor of heat, act as a still more effectual defence to the stem, by preventing the immediate and powerful application of cold, through the sudden subtraction of caloric, from the proper vessels of the inner bark.

In this economy, nature only follows the analogy which she displays, in modifying the influence of cold upon the animal kingdom. The quadrupeds, which are destined to encounter the severity of an arctic winter, are provided with thick and shaggy coats, to enable them to withstand the intensity of the cold; and all the richest furs, which man employs to supply his natural, or rather his artificial wants, are always furnished by animals inhabiting the highest latitudes, and killed during the severest frosts. What is still more illustrative of the point under consideration is, that the coats of animals, of which the thin and short hair is familiar to us in the temperate climates, such as the dog, the fox, and the ox, are all remarkable, under the polar regions, for their close, lengthened, and almost impenetrable fibre, as a secure barrier of non-conducting matter, to prevent the escape of their vital heat.*

In like manner, in all the other relations, we see nature especially accommodating the character of each individual plant to the exigencies of its particular situation. In the interior of woods, the wind can exert a far less mechanical effect on individual trees; and therefore, while they are

* Note V

positively determined to push upwards towards the light, they are *negatively* permitted to do so, by the removal of any necessity to thicken their trunks, for the sake of greater strength, and to contract the height of them, in order to afford the blast a shorter lever against the roots. But, with trees in an open situation, all this is widely different. There they are freely exposed to the wind, and the large expansion of their branches gives every advantage to the violence of the storm. Nature, accordingly, bestows greater proportional thickness, and less proportional elevation on trees which are isolated, or nearly so; while their system of root, which, by necessity, is correlatively proportional to their system of top, affords likewise heavier ballast and a stronger anchorage, in order to counteract the greater spread of sail, displayed in the wider expansion of the branches.

Every individual tree is thus a beautiful system of qualities, specially relative to the place which it holds in creation; of provisions admirably accommodated to the peculiar circumstances of its case. Here every thing is necessary; nothing is redundant. In the words of a great philosopher, who was an accurate observer of nature, "Where the necessity is obviated, the remedy, by consequence, is withdrawn."* If these facts and reasonings be correctly stated, the only rational theory of the removal of large trees consists, in prospectively maintaining the same harmony between the existing provisions of the tree, and the exigencies of its new situation, as had previously subsisted between its relative properties, and the circumstances of its former site. That such is the only rule, founded on the principles of vegetation, that can apply to all circumstances, and all situations, there cannot be a doubt. But, lest the foregoing reasonings should seem rather abstract and general, I will, in order to reduce theory to practice, attempt a more popular detail, and descend

* Note VI.

from the remoter to the more proximate axioms of the art. In doing this, however, our consideration may be limited to the vegetable kingdom.

Nature, as has been observed, has destined trees to grow, more or less vigorously, in all situations, from those of the thinnest groups in the highest latitudes, to the densest masses, and the most sheltered woods; and for this purpose, she has conferred provisions or properties upon each, which are severally adapted to such circumstances. Now, as the business of transplanting, generally speaking, implies increased exposure, it is proper to inquire more minutely into these provisions, so as to enable us to ascertain their peculiar appearance and character, and into the way, in which they affect the growth of trees.

With this view, it will serve little purpose to draw examples from ordinary plantations. Let us have recourse to ancient forests and woodlands, or to parks long since planted, in which the hand of man has either never interfered, or where the vestiges of his interference have been long obliterated. Here we shall find trees in every variety of situation, but endued with properties of the most opposite sort. Yet all grow with relative luxuriance, under the circumstances in which they are placed. Of trees in the interior of woods, setting aside all technical or phytological distinctions, the following are found to be the general characteristics: Stems upright and stately; bark glossy and beautiful; tops small, and thinly provided with branches; with roots, in the same way, spare and scanty, but in due proportion to the tops. In open exposures, on the other hand, the reverse of all this is the case. The characteristics of these are the following: Stems stout and short; bark thick and coarse; tops extensive and spreading; branches often reaching to the ground; with roots extensive like the tops, and throwing themselves out on every side. What, then, are we to conclude from these remarkable discrepancies between trees of the same species, although in different situations, but that nature, which orders nothing in vain, has bestowed these properties for wise purposes, and that they are the best calculated, respectively, to realize in those trees as great a complement of life, as their respective circumstances will admit?

This conclusion naturally leads us to a closer attention to the progress of wood, than is usually bestowed upon it. In infancy, that is, in the seed-bed or nursery-ground, we find, that all plants of the same sort are alike, or nearly so. But in a year, and, still more, in many years, when they go out to form plantations, they experience a great diversity of treatment, and are placed in soil of various qualities, and in various degrees of exposure. To these vicissitudes the plastic powers of plants in process of time accommodate themselves; so that in point of form, character, and properties of every sort, they must essentially vary from one another, and acquire the properties most suitable to such soils and situations. It is for this reason, that to establish any just analogy between the transplanting of young trees, and the transplanting of old, is utterly impossible, whatever may be believed by most planters to the contrary; because the circumstances in both cases being changed, the subjects under their influence change in consequence.*

In considering the characteristics of trees above mentioned, we should always bear in mind, that every production of nature is an end to itself, and that every part of it is, at once, end and mean. Of trees in open exposures we find, that their peculiar properties contribute, in a remarkable manner, to their health and prosperity. In the first place, their shortness and greater girth of stem, in contradistinction to others in the interior of woods, are obviously intended to give to the former greater strength to resist the winds, and a shorter lever to act upon the roots. Secondly, their larger heads,

* Note VII.

with spreading branches, in consequence of the free access of light, are formed as plainly for the nourishment, as well as the balancing of so large a trunk, and also for furnishing a cover, to shield it from the elements. Thirdly, their superior thickness and induration of bark is, in like manner, bestowed for the protection of the sap vessels, that lie immediately under it, and which, without such defence from cold, could not perform their functions. Fourthly, their greater number and variety of roots are for the double purpose of nourishment and strength; nourishment to support a mass of such magnitude, and strength to contend with the fury of the blast. Such are the obvious purposes, for which these unvarying characteristics of trees in open exposures are conferred upon them. Nor are they conferred equally and indiscriminately on all trees so situated. They seem, by the economy of nature, to be *peculiar adaptations* to the circumstances and wants of each individual, *uniformly bestowed in the ratio of exposure*, greater where that is more conspicuous, and uniformly decreasing, as it becomes less.

On the other hand, in the interior of woods, a universal tendency, for the reasons already stated, is observable in trees, to rise to the light, to attain greater altitude, to form far smaller heads, and taller, slenderer, and more elegant stems. Here is found a milder and more genial climate; in which, by means of the calm generated by shelter, vegetation is not checked by cold, and, at the same time, is undisturbed by the external impediment of wind. Here nature has no need, as in the case of exposures, to generate provisions necessary to mitigate the effect of evaporation, as has been above observed, or to endue each individual tree with distinct and appropriate means of defence against the elements. In this situation, the branches, and, in like manner, the roots are much less extensive and numerous, than in the former instance, and the bark of a thinner and finer quality; all plainly indicating, that the trees so situated do not require the same external protection. It is like the genial warmth of the seed-bed, or the nursery; but where there is freedom for the roots to expand without interruption, and for the leaves to prepare the sap, without being vexed by the winds. In fact, so extraordinary is the difference between trees of the *same* species, placed in the one situation, and in the other, that there is no visible point of resemblance between them, excepting the leaves. We may, however, perceive, that, as soon as the tops gain the summit of the wood, their branches are shortened towards that quarter, and both branches and spray are more thickly, though less vigorously thrown out, in order to supply a defence against the storm. Further, we find, that the outside rows, partaking in some measure of the situation of trees in exposures, obtain, in a proportional degree, the provisions adapted to such a situation, and by consequence, a corresponding conformation and external character.

It is a very curious fact, which has been verified by experiment, and is worthy the attention of the scientific planter, that these several properties or provisions, though once determinately acquired, are not fixed or permanent in trees. The vigilance of nature, if I may so speak, in adapting them to every vicissitude of external circumstances, is so conspicuous, as to dispose them gradually to divest themselves of the properties adapted to one situation, when they happen to be transferred to another, to which the opposite properties are more congenial. For this reason, if a tree of some size, which, in consequence of exposure, has *acquired* all the properties already noticed, as adapted to that situation, be transferred to the interior of the wood, it will, in a few years, *lay aside* those properties, and *assume* all the others which have been described, as peculiarly adapted to its new circumstances.* Thus, the law of nature seems to be, that shelter

* Note VIII.

and exposure, that is, heat and cold, have the power alike of diminishing or increasing, and of even alternately bestowing and taking away, what may be called the Protecting Properties.

It has been noticed above, that all trees, in open situations, uniformly attain the highest state of natural perfection, of which they are susceptible ; consequently it is by such trees, that the best, the toughest, and the most durable timber is produced. Yet it is interesting to observe the beneficence of Providence, in providing for the accommodation of man. Were it not for the way, in which the external conditions of trees in woods and close situations are modified, from whence could we procure the long and powerful beam, the straight, clean, and lengthened deal, and nearly all the wood that is employed, whether in civil or naval architecture?

On considering these different phenomena, and comparing them with other facts, respecting the growth of Wood, which daily present themselves to our observation, the following conclusions as adapted to practice seem irresistible, and are agreeable to the law of nature on this subject.

First, That, in a general view it seems evident, respecting the two descriptions of trees above mentioned, that each is furnished with a certain form, and certain provisions or properties, which are best adapted to the exigencies of its situation. That, for this purpose, the sheltered trees are always more straight, more delicate, and more lofty; the exposed more stout, more hardy, and more spreading ; better nourished by roots, and protected and balanced by numerous spray, and wide-extending branches.

Secondly: That, as the four protecting properties already delineated, as belonging to trees in open situations, are essential and necessary to the vigorous development of their existence, so they may be set down as indispensable prerequisites for those intended for transplantation, which generally implies increased exposure; and that, soil and climate being equal, such subjects will succeed the best, as are endued in the greatest degree with these prerequisites or properties.

Thirdly: We must infer, that the four opposite, or non-protecting properties, described as belonging to sheltered trees, which are not developed in their natural and perfect proportions, however fitted such properties may be for *them*, are unsuitable to removal, and are, on that account, not less studiously to be avoided by the planter, in the selection of his subjects. Indeed, in reflecting on the most striking instances of failure, it is observable, that such are always associated with these unfavourable properties.

Fourthly: It is plain, if we mean to succeed in transferring trees of any magnitude, in our lawns or parks, that we must endeavour to follow the example of nature, in ordering such subjects. The practical course, then, to be pursued is, to adopt the subjects possessing the protecting provisions or properties, wherever they can be found, and to communicate them to others, in which they are wanting, by the easiest methods. Another rule seems to be, that, in following nature, we may accommodate or adapt the principle to the particular circumstances and situation, in which we chance to operate: That, although we must rigidly adhere to it, as nature does, in severe exposures, we may yet proportionally relax it, as warmth or shelter is more or less afforded to our subjects: Or, as has been expressed with greater precision above, we must prospectively maintain the same harmony between the existing provisions of the tree, and the exigencies of its new situation, as had previously subsisted between its relative properties, and the circumstances of its former site.

Fifthly: If we adopt this principle, and follow it up with a judicious mode of execution, it seems evident, that the necessity of defacing or mutilating the fine tops of trees will be entirely superseded. *We shall obtain at once*, what the art, as hitherto practised, has not been able to obtain for us, the Immediate and Full Effect of Wood, that is, *trees complete and perfect in all their parts*, without the loss of the time required to replace the parts, when so defaced and mutilated. In this way likewise, a certain and successful practice will be established, instead of one that is fortuitous. To which it is pleasing to add, that the same system, that gives picturesque effect, conjoins utility with ornament; for by following it out, we shall insure to our trees uniform health, and progressive vigour, and, by consequence, sound and valuable wood.

Such is the general theory, which I venture to suggest, for the improvement of the art, and the guidance of the planter. The proposition, as I conceive, has been enunciated, and examined in its several bearings, with sufficient accuracy, in the foregoing part of this Section. The more brief and popular modification, now given, of protecting and non-protecting properties, is not perhaps strictly philosophical; but it is adopted merely on account of its simplicity, and for the purpose of accommodating the theory to practice. These properties, I am aware, are acquired by trees, solely in consequence of differences in their situation; and for that reason it might have been better, if terms could have been found, having a reference to what the tree is, or to the conditions that have made it so, rather than to any future uses, which the character thus acquired is considered to serve. But they may be defended precisely on the same grounds, as the terms "conducting" and "non-conducting," as applied to certain substances, capable of receiving and transmitting the electric fluid, which were first invented by Disaguliers, and have been since admitted into the philosophical nomenclature.

The above practical view, however, with the illustrations already offered, cannot well mislead us, as they are founded on admitted doctrines of phytology, and the laws of nature. If such a mode of execution be superinduced upon it, as shall furnish to the tree a competent supply of sap, at the critical period of removal, the art may be said to be established on *fixed principles;* and thus the results may be rendered as certain and successful, as the severity of the operation will admit. Of the general correctness of the theory there seems little doubt; but, like every other drawn from nature, it will be still further developed and improved, by observation and experience. I may, however, say, after considerable experience, that, in park-practice at least, it admits of few modifications, and no exceptions.

It is both interesting and important to observe, that the *principles,* on which this theory is founded, are the true principles of GENERAL PLANTING, and must equally govern every attempt at successful arboriculture; I mean the anatomy of plants, and the modifying of heat and cold to their various conditions and circumstances. It is a radical error to suppose, as is too often done by planters and gardeners, that heat is not as necessary to the infancy of a tender plant, as to a new-born and helpless animal; and that the former is not as ill adapted to resist cold, and an early and undue exposure to the elements, as the latter. The tree, as well as the animal, is an organized being endued with life, although its conditions of existence, internal and external, are differently modified: But, the striking analogy subsisting between them should be the guide of the planter's practice, and should never be absent from his mind. It is owing to this utter unacquaintance with vegetable physiology, which prevails among landowners, that the ill success of too many British plantations is to be attributed, and that Wood so seldom thrives, or repays the planter.

Were arboriculture, like husbandry, properly understood, and were the important sciences of physiology and chemistry applied, in the former art, to the study of facts, a very different return for the vast sums laid out in planting might certainly be expected. In this case, I do not say, that soils and climates could by any means be equalized, but their return in Wood, like that in crops, would become uniformly productive. Trees would be judiciously adapted to their appropriate soils, and, what is little less important, to their appropriate climates. The efforts of nature would everywhere be seconded, instead of being repressed or counteracted. An efficient management would supersede a fortuitous practice; and, in a word, science would be able to anticipate the result, which industry, without her assistance, could never bring about.

SECTION IV.

DEVELOPMENT AND ILLUSTRATION OF THE NEW THEORY OR PRINCIPLE.

In the foregoing Section, the principle or theory suggested for an improved practice in transplanting, has been considered as a new principle. But it does not follow from thence, that I either believe, or would persuade others, that I have made many new discoveries in phytological science. I have, on this occasion, merely deduced practice from speculation, and conclusions that are probably new, from facts, which others as well as myself must have long since observed.

Simple and obvious as the principle seems to be, if it have ever occurred to, or been acted on by others, the fact has not come to my knowledge. Of the general practice of this country I may speak with some certainty. I have both seen and heard a good deal of that of our English neighbours. I have made considerable inquiries respecting the practice of France, Germany, and the north of Europe; from all which it appears, that planters have not sufficiently attended to vegetable physiology, or to what the law of nature is, in respect to the effects of shelter and exposure on the growth of Wood. In one and all of these countries, trees are at once transferred from close woods or plantations to the open field, and full-grown or large subjects are, like young plants, more or less lopped and defaced, under the name of lightening the tops, at the time of removal. These things, together with the ill success almost always attendant on the common method, clearly point out, that the principle in question may be said to be altogether new to the public.

From the facts above stated, it is apparent, that there are certain distinct external provisions or properties in trees, called the protecting properties, which are conferred on them by nature, and which render them fit for resisting the influence of the elements, in exposed situations; and that there are certain other properties, termed the non-protecting, which render them unfit. Hence it follows, as already observed, that if, taking nature for our guide, we adopt such trees only, as are endued with the former properties, as subjects for removal, we shall have the best chance of succeeding in that hazardous task. In order to show, in the most intelligible manner, how this has been accomplished, perhaps the simplest course will be to endeavour to detail the progress of my own attempts at the object; earnestly requesting of the reader to forgive the appearance of egotism, with which such a detail must necessarily be accompanied. It is only from our own errors, or those of others, that we can hope to derive useful lessons in a process, of which the success is so much dependent on judgment and accuracy.

My first experiments, many years since, were made on subjects taken from plantations, in which the trees stood too close to one another. The plants, as might be expected, were straight and beautiful, although greatly drawn up by shelter towards the light, and deficient in lateral branches. But I expected, by removing a number of them, to attain the double object of thinning the plantations, and wooding the open field. During the first season, a few of the best-rooted survived the operation, and carried leaf well. Their tops were pretty severely lopped, or lightened with the axe, in the ordinary manner; and I was flattered with some prospect that they would ere long shoot forth with vigour. In a year or two, they became stunted and unhealthy, from causes now obvious, but which were unknown to me at the time. The remaining branches gradually dropped off. They were unable, even with the help of props, to resist the winds, and were in the end rooted out, as altogether irrecoverable.

Having discovered that subjects of quite a different sort must be resorted to, my next trials were made on trees standing in open glades, in grove-wood, which had been thinned out to wider distances, in hedge-rows, and the like, where the sun and air had freer admission. The trees in general here exceeded twenty feet in height. Their stems were stouter than those used in my first experiments. Their bark had none of the fine and glossy surface belonging to that of the others. Their heads were beginning to assume a more spreading form, and were tolerably well balanced. The roots in some were numerous, but in others scraggy and straggling, according to the nature of their previous rooting-ground, and the degree of exposure in which they had stood.

The plants from the hedge-rows, of course, exceeded all the others, in the possession of those properties, which I began to suspect were most essential; and they would have been the best subjects of any, had not their roots grown in a perpendicular direction, in consequence of the high mound of earth, on which the hedge was planted. But the tops of the whole I now resolved to leave entire and untouched, notwithstanding the universality of the lopping practice, and the confident opinion entertained, that it was indispensable to success.

At this early period, I possessed little skill in the business of preparing, or taking up the trees. I had no implements, beyond common spades and shovels, for the latter purpose: Neither had I any proper machinery, for safe and speedy transportation. A number of men, however, being set to work, sledges, trundles, carts, and even wheelbarrows were pressed into the service; by which methods, a few were removed with difficulty, and at a considerable expense.

Some years after this, I tried other subjects, from forest glades, or open spaces in the interior of woods, where the trees were much taller and handsomer. Their disposition having been pretty open, and the lightness of the soil affording good rooting-ground, their roots and fibres had struck more abundantly, than in the other subjects just now mentioned. Their bark, likewise, appeared more sound and healthy, and free from the coarse and rugged surface, which was remarkable in the hedge-row plants. For these reasons, they were the subjects from which I anticipated the most certain success. This took place more than thirty years ago.

It may easily be imagined, that, in these rude attempts, many deaths occurred, and that a small number only outlived the operation; but the lessons which were derived from them, after standing on the open ground for four or five years, were very instructive. I shall most probably surprise the young planter (as, indeed, I was surprised myself) by stating, that those, which I then found to succeed the best, were not what had shown the most numerous roots, as was conjectured, but what had acquired the thickest and coarsest coat of bark, and possessed the stoutest stems, if accompanied with branches and spray pretty thickly set. In the second place only came the plants from woody glades, of which the roots were so promising, and seemed to confer on them so great a superiority. In other words, it appeared to me, that the success of the trees, their new situation and soil being equal, was *in the ratio of their previous exposure*, and their consequent power of protecting the sap-vessels; which power seemed always commensurate to exposure.

Subsequently, various other experiments on a small scale were instituted, with such subjects as could be procured. But, in searching for these, I was necessarily confined to old and established plantations, which, although of some extent, and containing some variety of soil and climate, were yet imperfectly suited to the purpose. The important transplanting nurseries, which I afterwards formed, and which shall be treated of in the sequel, had, at this period, no existence, and the manifold advantages, since derived from them, were not then contemplated. Still a sufficient variety of plants, both in form and species, were obtained, so as to enlarge experience, and render the steps of its progress more interesting, and its results more satisfactory.

In these circumstances, I was naturally incited to inquire into the causes of such unexpected phenomena, to engage in the study of the anatomy of trees, and of vegetable physiology, or the doctrine of the constitution and properties of plants. And in respect to trees it is remarkable, that little or nothing was known of this science in Europe, until the close of the seventeenth century, when the first probable theory of the circulation of the sap was discovered. Indeed, it is only within the last forty or fifty years, that the science has been greatly cultivated in Britain: and it will be admitted as a striking proof of the fact, that, at this moment, few persons comparatively, and, what is still more surprising, few planters, are aware of the twofold course of the sap in trees, or of the method in which their juices are either elaborated or circulated. These studies, I found, threw great light upon the subject. Appearances, for which I had not been able previously to account, were now satisfactorily explained; and means were suggested for obviating difficulties, that otherwise seemed insurmountable.

It has been already stated, that there are four distinct external provisions, termed the protecting properties, which nature gives to trees in open exposures, and which distinguish them from others, standing in the interior of woods. The use of these properties is to enable trees to develop their existence vigorously, in spite of the external conditions, which are unfavourable to such development. Which of the four properties is really the most important for that purpose, it was not easy to determine, as they are all relative and correlative. They act and react in the most curious manner upon one another, each modifying and determining, as has been seen, the existence of all the others. To predicate, then, or affirm certainly, as to their respective usefulness in the Art of Transplanting, is, properly speaking, more fanciful than real. But from my own practice, I was disposed to rank them in the following order of preeminence:—FIRST, Thickness and Induration of Bark; SECONDLY, Stoutness and Girth of Stem; THIRDLY, Numerousness of Roots and Fibres; and FOURTHLY, Extent, Balance, and Closeness of Branches. I found, however, that it might safely be assumed as a rule, that the success of the planter, in this art, would be in the actual proportion, in which his subjects possessed these properties; and *vice versa*, that his failure would be in the proportion of their deficiency. It is manifest, on any other supposition, that we must believe Nature to act here in contradiction to herself, which is impossible; although her most obvious processes are many times misunderstood, by the blindness of man.

Such is the short history of my own progress, and of that plain and practical system, on which I have consequently acted. It is unencumbered with complex notions, or technical details. Its soundness has been proved, by the experience of many years. The principle has been occasionally relaxed, or stretched to the utmost, as circumstances of comparative shelter or exposure required; and the uniform success, attending the practice, leaves no room to doubt, that a similar system, if adopted by others, will secure similar results.

As it is of the utmost importance, to the young planter, to apprehend as much of vegetable physiology as immediately relates to this subject, so that he may be enabled to appreciate the above properties or prerequisites, I beg leave to call his attention to a few observations, which I shall make upon each of them. For this purpose, let us consider the relative nature and importance of these prerequisites, in reference to the art, and to one another, and draw such conclusions as may be useful, in throwing light upon the principle just now laid down.

FIRST: As to superior Thickness and Induration of Bark. The bark of trees is accounted by phytologists, as among the composite organs. It consists, first, of the epidermis, or external cuticle or integument of the plant; secondly, of the cellular tissue or parenchyma, that is, the soft pulpy substance, situated immediately under the epidermis, and constituting a sort of secondary integument; and thirdly, of a number of thin cortical and concentric layers, composing the mass of the bark; of which parts the innermost is denominated the liber, from its having been anciently used to write upon, before the invention of paper.* If the cortical layers be injured or destroyed by accident, the part is again regenerated, and the wound healed up, without a scar. If the wound have penetrated beyond the liber, the part is incapable of being regenerated; because, when the surface of the alburnum is exposed to the air for any length of time, there will be no further vegetation in that part. But if the wound be not very large, it will close up, first, by the production of new bark, issuing from the edges, and gradually narrowing the wound, and then, by the production of new layers of wood, formed under the bark, as before. If a portion of the stem only be decorticated, and covered with a piece of bark from another tree, the two different barks will readily unite. Hence, we are enabled to ascertain how far the liber extends; and hence also, the origin of grafting,

* Keith's Physiological Botany, Vol. I. p. 295.—Du Hamel, Phys. des Arbres, L. I. 3. 5.—De Saussure, Encyclop. Méthod. T. I. p. 67.—Also, Observations sur L'Ecorce, &c.

which is always effected by a union of the liber of the graft with the stock.*

"There is no fixed or definite period (as Keith observes,) that can positively be assigned, as necessary to the complete induration of the wood or bark, although it seems to require a good many years, before any particular layer is converted, from the state of alburnum to that of perfect wood."† In respect to bark, there is not any circumstance, which hastens this period so much, as the exposure of trees to the elements, even at an early period of their age. In the same way, as the action of the air multiplies or thickens the branches and spray, the cellular tissue and cortical layers are thickened, for the protection of the proper vessels. The inner layers being always the softest, the outer by this means gradually increase in solidity and thickness, and become visibly indurated; so that with some trees it even sloughs, and splits into chinks and fissures, as in the case of the sycamore, the elm, and the fir. In this condition, we may conceive, how well adapted such a mass of non-conducting matter is, to protect from cold the ascending, and still more, the descending or proper vessels, as already mentioned.

In order to assist the reader, in forming a clear conception of the great value of a proper thickness of bark to trees intended for removal, it will be necessary to inquire a little into the means, by which the sap-vessels minister to the sustenance of plants. In the warmer latitudes, the sap flows in certain plants, during the whole year; but in those that are more temperate, the functions of vegetables are suspended, or nearly so, during the winter season. Early in the spring, however, it begins to rise in woody plants, and continues to

* Senebier, Phys. Veget. T. I. pp. 177, 178.—Keith, Vol. II. p. 299. —Knight, Philosoph. Trans. 1803.—Ellis, Anat. Veget. in Suppl. Encyclop. Britan.

† Physiolog. Bot. Vol. II. p. 231.—See also Kieser, Organis. des Plantes, ch. II. pp. 95, 96, et seqq. Also p. 153, &c.

ascend, till it reaches the extremities of the branches. This sap is absorbed from the soil, by the extremities of the capillary rootlets, and conveyed upwards, through the vessels of the root, to the trunk. In its ascent, it rises only through the wood, and the alburnum, in tubes of various sizes, and is prepared or elaborated by the leaves. That process, according to some, is effected by means of an alternate contraction and dilatation of the sap-vessels, and still more, by a respiration perceptible and imperceptible in the leaves, which is peculiar to plants, whether woody or herbaceous, and by the action of the atmosphere: But, according to others, it is rather the exhalation from the leaves, than what is properly their respiratory functions, that effects the ascent of the sap. When this has taken place, the sap is then converted into the proper juice, or what has been by some called the cambium, that is, juice fitted for nutrition; and it descends by the returning vessels of the leaf-stalk, and the longitudinal vessels of the rind, or inner bark. Thus, the circulation is carried on by a double process, the ascending and the descending; whereby the vessels terminate downwards in absorbents, by which the fluids are received, and they terminate upwards in exhalents, by which those fluids are discharged. This doctrine of the two currents of sap was originally struck out by Malpighi and Grew: But the first who showed the organs of communication between the two currents to be the leaves, was unquestionably Darwin; a discovery, which the ingenuity of Knight subsequently extended and confirmed, and traced the existence of the circulation of the sap.

During the descent of the proper juice, it further appears, that each branch is nourished by the juice prepared by itself, and that the surplus, beyond what is required for that purpose, descends from the junction of the branch with the stem, and contributes to the increase of the stem, and at last of the roots, which originally supplied it. The descending juice is the efficient and proximate means employed by nature, for the support and nourishment of every part; therefore, to say that a tree is vigorous and healthy, is to say in effect, that it has an abundant supply of sap.*

The true constitution and anatomy of plants was first systematically brought forward, on the continent, by Malpighi. Grew, as it is on all hands admitted, made his phytological discoveries about the same time, without any communication with the Italian physician;† and both, without doubt, felt the impulse which had been given to the spirit of philosophical inquiry, by the genius of Bacon, who showed, how analytical and inductive investigation might be applied, in order to explain the phenomena of vegetable life. In the end of the seventeenth century, while these two eminent men flourished, vegetable physiology was still in its infancy in Europe: but in process of time, as that interesting science attracted the notice of the learned, their theory was confirmed by new facts, and more extended microscopical observation. To Grew and Malpighi succeeded various writers of different nations in the same track, De la Baisse, Hales, Bonnet, Du Hamel, Senebier, and others; until Hedwig, Willdenow, and especially Dr. Kieser of Jena, and Messrs. Knight, Ellis, and Keith, in our times, have by their ingenious labours thrown the fullest light upon the subject.

But the circulation of the sap is not a doctrine that has been universally adopted by phytologists, however reasonable it may seem from the analogy, which we see in other instances to subsist between the animal and vegetable kingdoms. About the middle of the last century it appears to have fallen into disrepute. Du Hamel refuted it with con-

* See Grew and Malpighi, Anat. Plant. passim.—Darwin's Phytologia.—De Saussure, Encyclop. Méthod.—Willdenow, Prin. of Bot. p. 85.—Knight, Philosoph. Trans. 1803, 1806.—Ellis, in Art. Veget. Physiol. in Supp. to the Encyclop. Britan.

† Note I.

siderable ingenuity;[*] and both Du Hamel and Hales, while they generally admitted that the sap both ascends and descends, denied the existence of a circulation. Within the last five-and-twenty years, however, the theory has been revived with great lustre, and seems now to be the popular one of the day. In fact, from the arguments as well as names, by which it has been supported, it bids fair to stand its ground in future. Mr. Keith, one of the clearest and best phytological writers we now have, is no ready granter of propositions; yet, in his late work, while he holds the balance of decision with an able and even hand, between the conflicting theories, he very nearly admits the existence of the doctrine.[†]

From this cursory account it is apparent of what vast importance it is to the planter to maintain the sap, and still more the proper vessels, in the due exercise of their functions, and to protect them from external injury, of which cold may be considered as the greatest. For this purpose, nature has wisely provided such trees, as are in open exposures, with a thick and coarse covering of outer bark, which forms a defence from the elements to the inner bark, in which the descending or proper vessels are situated.

Further: We know that heat is necessary to cause vegetation, as well as to continue it. Hence the wonderful effects of shelter, in close woods and plantations, in encouraging growth. All trees, during infancy, require a considerable proportion of warmth, to make them shoot freely, as is proved by comparing the striking difference in their progress, at different degrees of elevation or exposure. What is most remarkable in sheltered trees is, that several of the kinds, most delicate and tender while young, for example the oak, are found, when matured in a kindly temperature, to be the best adapted to resist the elements, and set their greatest fury at defiance.

[*] Phys. des Arbres, L. V. ch. 2.

[†] Note II.

In adverting to heat as essential to vegetation, it is particularly worthy of notice, as already observed, that the epidermis and bark of trees, drawn up by shelter, are usually thin, the former often smooth and glossy. The descending vessels, by consequence, as they lie under it, never fail to suffer severely, on being exposed to a cold atmosphere. It is greatly on this account, as well as from scantiness of roots and lateral boughs, that plantations sustain such extensive injury, on being suddenly thinned. Where that operation is performed in a gradual manner, it gives time for nature to prepare the trees for the change, by strengthening the coat of bark, and likewise by multiplying the roots, and thickening the spray and branches; and thus the proper vessels are prevented from being chilled by untimely exposure. The fact, though universally known, is never referred to the true cause, by common observers.

These considerations furnish ample ground to admire the wise provision of nature, in bestowing a much thicker, coarser, and more indurated covering of bark upon all trees in open exposures: for in vain might they possess every other property, if the sap-vessels were not sufficiently protected, and enabled to do their office. Were that to happen, through the thinness of the bark, there cannot be a doubt, but that the plants would become stunted and sickly, and both branches and spray would suffer injury in consequence, as we see happen to the generality of transplanted trees, which do not possess this protecting property. From all which it appears, that the health and protection of the proper vessels, by means of a due thickness and induration of bark, is an indispensable prerequisite in all subjects meant for removal, and that it is deserving of the rank here assigned to it.

Secondly: Girth and Stoutness of Stem. Next to thickness of bark, the fitness of the tree for removal greatly depends on this property. The stem or trunk of woody plants is classed by phytologists among the conservative organs. It is the part of the tree, in which its bulk and strength principally reside, and has been represented by Linnæus, as the *Caudex ascendens*, or root above ground; an illustration, as Keith truly observes, more fanciful than philosophical.*

The stems of trees are augmented in width by an annual layer, and in length by an annual shoot, springing from the terminating bud. The development of the shoot from the stem is not effected in the same manner as that of the root, by additions to the extremity only, but by the introsusception of additional particles, throughout its whole extent, at least in its soft and succulent state. The extension of the shoot, as Du Hamel justly remarks, is inversely as its induration, rapid while it remains herbaceous, but slow as it is converted into wood. Hence, moisture and shade are the circumstances of all others the most favourable to elongation, because they prevent induration, or retard it.† In close and confined plantations, therefore, where the external conditions of air and light are imperfectly supplied, the roots are correlatively proportional to the system of ramification. Trees so circumstanced push upwards to the light; and from the warmth, which their situation affords, their stems being thin and slender in proportion to their height, they are destitute of strength to resist the winds. The natural consequence is, that their roots are extremely apt to be shaken and displaced in the ground, and prevented from seeking proper food for the branches, and other parts of the tree.

Now, it is obvious, that it is these very properties, which are the least adapted to removal. Nothing but a stem stout and vigorous, and nourished by adequate side-branches, can obviate the evils above delineated. Supports or props,

* Physiolog. Bot. Vol. I. p. 43. † Physiolog. Bot. Vol. II. pp. 251, 252.—Kieser, Organ. des Plantes, p. 164. Also p. 166—168.

whether composed of wood, cordage, or any other material, are of little avail in giving stability. To a body rather deficient in proper strength, a rich and favourable soil may, after some years, give an augmentation of roots and lateral branches, and, in the end, a certain accession of strength to the body itself. But he, who would transplant with judgment, should consider a vigorous stem as a *sine qua non* in the beginning; as success otherwise must depend on accidents which he cannot control, and on advantages which he may not procure, at an after period.

THIRDLY: Numerousness of Roots and Fibres. Roots are also accounted among the conservative organs. The body of the roots of trees, says Malpighi, may be regarded as a production and elongation of the trunk beneath the soil, and is constructed of the same textures, disposed in the same manner.* Roots, like the stem, are augmented in their width by the addition of an annual layer, and in their length by the addition of an annual shoot, bursting from the terminating fibre; but they are elongated merely by the extremity. This is the general opinion of phytologists. It has, however, of late been called in question, and great ability has been displayed in making it appear, that the root is not elongated by the extremity, any more than the stem; or, if it be so, that the rule has numerous exceptions.†

As trees have no organs analogous to the mouths of animals, they are enabled to take up the nourishment, which is necessary for their support, only by absorption and inhalation, as the chyle is taken into animal lacteals, or air into the lungs. This, in the language of phytologists, is termed introsusception; and the former mode, of course, applies to the introsusception of non-elastic fluids, and the latter to that

* Anat. Plantar. p. 145.

† See Thompson's Annals of Philos. No. LXXVI.

of gaseous fluids.* The fact is, that the roots are much rather to be regarded as the mouths of plants, selecting what is useful to nourishment, and rejecting what is yet in a crude and indigestible state ; the larger portion of it also serving to fix the plant in the soil, and to convey to the trunk the nourishment absorbed by the smaller fibres, which, ascending by the tubes of the alburnum, is thus conveyed to the leaves.† Roots, moreover, by their vigour and numbers, must previously stretch out under ground, before the branches can extend themselves in the air ; and the progress of the latter development will, of course, be in proportion to that of the former. By the curious and beautiful way, in which almost every part of a tree modifies and determines the existence of every other part, as above noticed, the roots, in their turn, receive vigour and extension from the advancement of the branches.

It appears, that roots and fibres are found more or less extensive, in the ratio of the exposure or shelter, in which a tree is placed. In open situations, they are always strong and numerous, and they extend to a wide distance from the plant. This is indispensably necessary, notwithstanding the short and powerful stem, which a tree so situated usually displays, in order to enable it to resist the elements, and to provide sustenance for the great expansion of top, with which such a tree is sure to be furnished. Hence may be seen the great importance of numerous roots and fibres, in removing trees of any magnitude. It is supposed by some, that the roots of trees so placed, if of considerable age, after having exhausted, before their maturity, all the pabulum in their immediate neighbourhood, will at length be found searching for food, at a distance from the trunk, equal to the height of the trees themselves. At all events we are aware.

* Note III.

† Keith, Vol. II. p. 246. Also pp. 90. 250.

that, even with trees of a youthful age, the roots and branches are coextensive with each other; or rather, that superior extent is generally found on the side of the roots.

In the more confined parts of the forest, the reverse of this usually takes place, from the warmth generated by shelter, and the injurious effects of evaporation being obviated. Here roots, and especially fibres are of far less extent and strength, and also fewer in number, than in open positions; and hence the risk, arising from thickets or close plantations being too suddenly laid open, as above mentioned. The want of a stronger system of root in such cases, is sufficiently accounted for by the reasonings already given, and by a deficient supply of the descending sap.

In order to enable trees to withstand the wind, there is nothing more important than the taproot, or root that has its determination directly downwards. Roots and branches, as has been already observed, are relative and correlative; and I am inclined to think, that a striking resemblance of character exists between the leading shoots and the taproots, insomuch that they will be found not only analogous to, but also coexistent with each other. While the tree continues in full vigour, and has not as yet attained its ultimate height or size, it has a leading shoot or shoots at top; and at that period we find, that there are, in like manner, underground, a leading taproot of corresponding vigour. When the leading shoots of the stem begin to lose their preeminence, and gradually disappear among the other branches, the top of the tree assumes a rounded form, and becomes what is called clump-headed. At this period also the taproot, in the same way, loses its preeminence, and begins to disappear among the other roots: it loses likewise its power of going downwards, and is no longer distinguished among the latter. Thus we may perceive, how remarkable a resemblance the roots and branches of trees bear to each other, not only in respect to *form*, but also in respect to *the period of their* *duration*, a fact which has not hitherto been observed by Phytologists.

As to the taproot, it appears, that a good deal of exaggeration has prevailed among late writers, respecting its importance to trees, which has been affirmed to be quite paramount. Hence the doctrine, that if it be cut off by transplantation, or other means, the tree has no longer the power either of renewing or reproducing it, or even of growing to timber of any magnitude. This opinion, however, is founded in error, and cannot be supported by experience. From the development of woody plants, we are warranted in believing, that, in infancy, the taproot is indispensable to their vigorous growth. But the fact, that in trees of mature age, when cut down, the taproot is no longer distinguishable from the other roots, sufficiently shows that the importance which it once possessed, does not continue to a late period of their age.

From my own experience, I am enabled to adduce a direct confirmation of the analogy above mentioned. In sundry instances, when I have had occasion for the second time to remove a tree, the power of renovation appeared conspicuous, in the fresh set of taproots that was generated. In the same way, respecting the top, on heading down a spiral tree, in order to communicate to it the spreading character, it was found, that numerous growths were sent out, instead of the leading-shoot, which had been displaced by the pruning-knife; and when it came to be shortened a second time, there appeared, of course, a still greater multiplicity. The truth seems to be, that no physiological observations as yet made are inconsistent with this doctrine. Art or accident may cut off or shorten either the taproot, or the preeminent shoots of the top, but the plastic powers of most trees will soon renew them;* not indeed with the same degree of strength individually in either, but in greater numbers,

* Note IV.

aggregately qualified to perform the same functions in nourishing the plant.

Further: Roots are materially determined in their form by the nature of the soil in which they grow; insomuch that, in many instances, before we can pronounce on their true form, we must be aware of the condition and texture of the soil that is most natural to them. Their development is most luxuriant in ground that is neither too loose nor too dense. In stiff and poor soils, they are spare and scraggy; whereas, in such as are at once deep and loose, the minutest fibres both expand and elongate with facility, and render the mouths, that search for food to the plant, almost innumerable.* This is remarkably exemplified in the beech and the sycamore, and still more in the ash, of which the fibrous roots sometimes amount to millions. Such soils, accordingly, furnish the best rooting ground, and are always favourites with the planter. To fit trees, however, for removal to situations of great exposure, the roots may, by artificial methods, be multiplied to a degree far beyond what can be accomplished by unassisted nature; and thus, by art discreetly employed, the business of vegetation, that is, the circulation of the sap, is prevented from standing still, during the extreme violence, which transplanting in its best form must inflict.

Fourthly: Extent, Balance, and Closeness of Branches Branches, like the roots and stem, are classed among the conservative organs. They are divisions of the trunk originating generally in the upper extremity, but often likewise along the sides. The primary divisions are again subdivided into secondary divisions, and these again into divisions still smaller, till they terminate at last in slender sprigs or spray. In point of external form and structure, branches resemble

* Du Hamel, Phys. des Arbres, T. I. p. 82.—Ellis, Veget. Anat. in Supp. to Encyclop. Britan.

the trunk from which they issue; but in point of insertion, distribution, and direction, they exhibit considerable variety, furnishing a ground of distinction, occasionally assumed by botanists, in the discriminating and characterizing of species, Like the stem and root, branches increase in width, by the accession of new layers, and in length, by the addition of new shoots; but they are not formed merely by means of an horizontal extension of the longitudinal tubes of the stem, but each branch is, as it were, a distinct individual. Hence, the stem is to the branch what the soil is to the plant, the source of nourishment and stability.*

Branches may properly be considered as among the most important parts of trees, as they certainly are the most beautiful. One of the most obvious offices they have to perform, is to support the leaves; and the leaves, by a respiration perceptible and imperceptible, and by the action of the atmosphere, as above noticed, elaborate the sap sent up by the roots, and convert it into juice fitted for nutrition. The ascent of the sap from the roots seems to be considerably assisted, by a proper number of side-branches, distributed along the stem; and the general health and vigour of the tree are in the same way increased; so that it will ultimately attain a greater size, than if deprived of such branches, or very sparingly supplied with them. During the descent of the proper juice, on the other hand, as has been seen, each branch is nourished by the sap prepared by itself; and the surplus quantity beyond what is so employed, goes to the increase, first of the stem, and, in the end, of the roots. From the experiments made by the most accurate observers, we further find, that the solid texture of the wood depends on the quantity of the descending sap, and in a great measure likewise, on the slowness of its descent; both of which objects are

* Grew, Anat. of Plants, p. 28.—Du Hamel, T. I. p. 93.—Keith, Vol. I. p. 18—51.—Vol. II. pp. 255, 256.

materially promoted by the lateral branches.* But, should they exceed the due number, requisite for those important purposes, retaining too much of the sap which they prepare, and affording too scanty a supply to the stem, they may, in ordinary cases, be considered as robbers, and should be curtailed by pruning, within proper limits.

In this view, it will be perceived that judicious pruning is a work of far greater nicety and difficulty than is generally believed, and that it should not be permitted, unless under the superintendence of some scientific person. It is true, it has been shown by the ingenious Mr. Pontey, that severe pruning will, in some cases, augment the actual *weight* of the stem, and therefore, as he speciously argues, the *value* of the tree. But great doubts may be entertained, whether this writer, meritorious as he is, may not have proceeded on erroneous principles in his theory; and that his practice in pruning has been carried to a height, sanctioned by neither science nor experience.†

Branches, besides giving to trees both beauty and nourishment, serve to balance them properly, and by throwing themselves out on every side, aid the trees in withstanding the wind, in whichever way it may blow. Most trees, if not prevented by adverse circumstances, have at first a leading shoot, which tends perpendicularly upwards, and is invested with a preeminence over the other branches. Having reached the height, which the soil and situation admit, the central shoot loses its preeminence. The sap, required to give it superior vigour, seems then to fail, and it gradually disappears among the other shoots. Meanwhile, the plastic powers of the trees soon multiply the branches of the top, which last gradually obtains a rounded form, and becomes what the

* Knight on the Sap of Trees, Philosoph. Trans. 1803, 1804. Mirbel, Anat. et Phys. Veget. Art. 6.

† Note V.

nurserymen call "clump-headed." But this sort of head, so desirable for picturesque purposes, may also be procured by judicious treatment, as will be seen in the sequel, and with sufficient room for expansion, during the youthful age of the tree, and while the central shoot yet maintains its preeminence, and the power of reaching its greatest height.

It is pleasing to observe, in this place, how beauty and utility coincide in the same object. In proportion as the tree has room to expand on every side (agreeably to the foregoing account of the action and reaction of the different parts on one another), it must be with an equal and corresponding expansion of the roots. As the exposure is increased, we uniformly perceive, that both branches and roots multiply. Towards the quarter most exposed, the branches are always more contracted in their growth, but in general more thickly set with spray; plainly for the purpose of furnishing a closer cover of leaves, for the protection of the sap-vessels, as they lie immediately under the bark. This, however, is by no means inconsistent with the established fact, that a more active vegetation is carried on, on the warmer than the colder side of trees, and a greater deposition of nutrient matter consequently made on the former: Because by far the largest and longest branches are always found on the warmer side, though more thinly disposed over it; and they prove the superior activity of vegetation there; while the shorter, but weaker and more crowded style of ramification on the colder side, shows, in like manner, its inferior activity. Nevertheless, the clothing of leaves is in this way usually thicker, for the wise purpose of defence from cold, on the side last mentioned.

This is extremely well illustrated, in the general development of the position of branches, which we see assume all the varieties of form, from the reflected, to the horizontal and the upright. In all these instances it is observable that the lowermost branches are parallel to the surface of the soil on which they grow, even although its surface should be the sloping side of a hill; owing, as is supposed by phytologists, to the evolution of a greater number of buds on the side that forms the obtuse angle with the surface, in consequence of its being exposed to the action of a greater mass of air.* From this statement, however, it will be preceived, that the most exposed tree is, generally speaking, the most picturesque and beautiful.

To the inexperienced planter it may seem paradoxical to assert, that the largest-headed tree, if well balanced, is the best calculated, on removal, to resist the winds. But the assertion is nevertheless true, if the foregoing facts be correctly given: because, as the roots are always correlative to the branches, it will be found, that the smallest-headed tree is the least able to support itself, in an open situation. It is to trees only with insignificant heads, and sparingly furnished with lateral branches, although they expose a much less surface to the wind, that props or supports are at all necessary, after being properly transplanted; and it matters little, whether these defects have been produced by ignorance and the axe, or by undue confinement. From all which facts and observations it is apparent, that branches, being organs to a certain extent necessary to the existence and health of all trees, are indispensable in a peculiar degree to such as are intended for removal. If the roots, in their capacity of absorbents, collect and send up a supply of food to the plant; the leaves, which are a constituent part of the branches, in their capacity of exhalents, perform a function at least as important, by preparing and rendering that food fit for nutrition; while the branches act as the main channels, in distributing it to every part of the plant. Other things, therefore, being equal, it may be held as an axiom in practice,

* Physiolog. Bot. Vol. II. p. 256.—La Nature Dévoilée, Dial. XIV. —See Note VI.

that the success of the planter will be nearly in proportion to the fulness of ramification of top and sides, which his subjects may possess.

It is further deserving of remark, that, although there is little more which we can do, towards either beauty or utility, where nature regulates the process, than humbly to follow her footsteps, yet experience leads us to believe, that in transplanting (which, however, is a department of art), art may improve the balance, and, of course, the beauty of trees, on a principle, to all appearance, contrary to nature, and certainly opposed to all former practice. It is well known to those best acquainted with Woods, that most trees are unequally balanced, and show what is called a "weather-side," usually to the west and south-west, in this island; from which side they seem to bend, and exhibit, in consequence, a very unseemly appearance. The same thing also takes place in close plantations, where they are mechanically injured by others. Of this propensity to bend to the gale, the beech and the larch are remarkable examples; and there is scarcely any tree, the sycamore perhaps excepted, which does not exhibit a weather-side towards the blast, and towards the opposite side throw out by far the longest and stoutest branches. In other words, all trees growing for a certain time in exposed situations, or even in close ones where they cannot equally expand, may be said to be ill-balanced. This, in parks much exposed, is found a very serious eyesore; as, in such situations, the stems describe very unequal angles with the surface, singularly acute on the one side, and as obtuse on the other. It is true, the painter sometimes makes use of such objects in his landscapes, as being agreeable to nature. Kent, the father of landscape gardening, planted dead trees in his earlier designs, the better to imitate natural variety, until he was laughed out of the practice by his friends or rivals. But most planters of the present day will regard it as safer and more judicious to copy beautiful rather than deformed nature in most instances, and leave those picturesque effects, which disfigurement occasionally supplies, to be produced by accident, rather than by intentional labour.

In order to remedy the striking deformity in question, I have in transplanting uniformly *reversed* the position of the tree in its new situation. By that means, and in consequence of greater warmth, the greater activity of vegetation is *transferred to the deficient side*, the equal balance of the tree is gradually effected, and its beauty and symmetry are unspeakably augmented. In exposed situations, there is no other possible way of procuring a full and extensive ramification, on the stormy side; for wherever the action of the air is the greatest, there the greatest evolution of buds, as above stated, and the thickest growth of spray, will take place; but those growths, for the reasons already assigned, are shorter and feebler, in proportion as they are more numerous. In so far, then, the art of transplanting on fixed principles may be said to substitute beauty for deformity, and fairly to cure one of the most prominent defects, which, in a picturesque view, park-trees in loose dispositions are apt to display, particularly on our western coasts. Probably I am the first planter, who ever thought of turning these properties of woody plants to any practical or useful purpose.*

In respect to the health and strength of the trees, I have never found it to injure them, or in anywise to impede their growth. As soon as the warmer or more sheltered side becomes the colder or more exposed, according to the law of nature, the respective parts soon accommodate themselves to the circumstances in which they are placed. The free extension of branches, which, in the former position, had been acquired by the sheltered side, loses none of its preeminence, while the contracted growths on the opposite side as freely expand. The health and progress of the tree sustain no

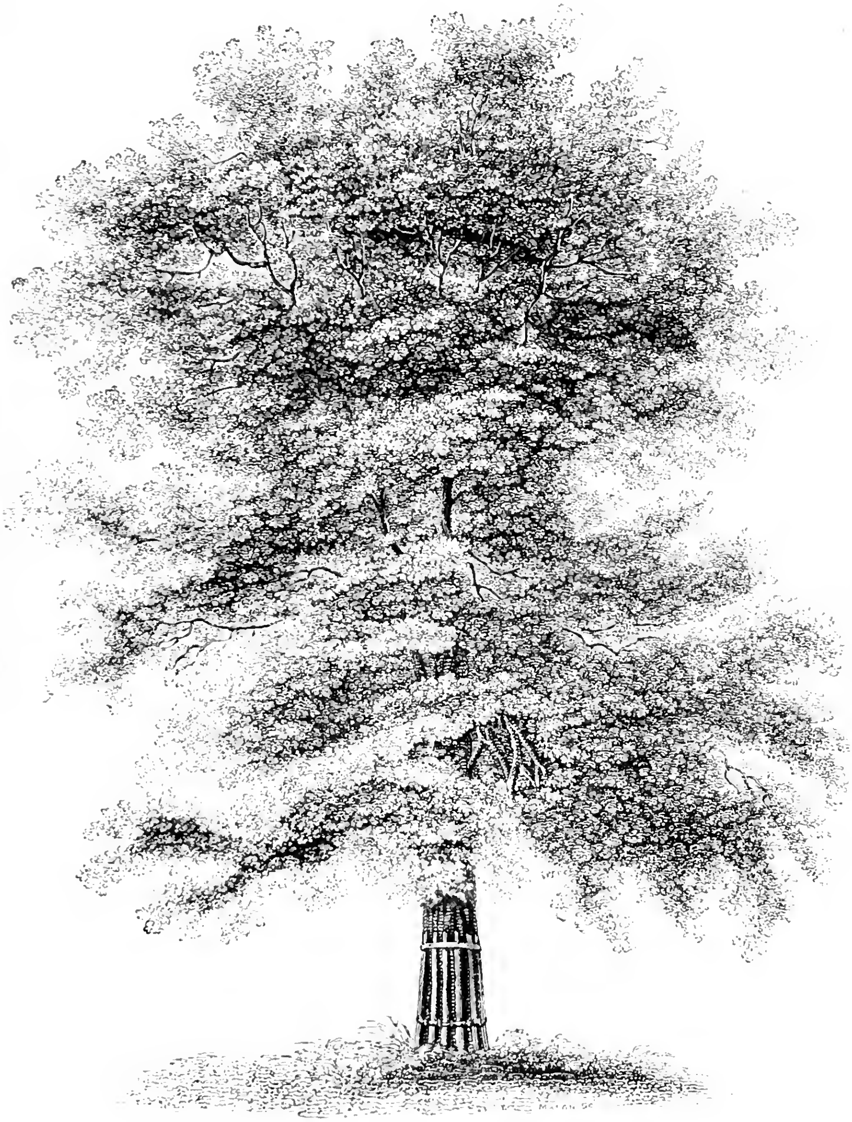
* Note VII.

check or detriment, while its equal balance and symmetry are both singularly improved. On this subject I may speak with some confidence, after long experience in the Removal of Wood of all sorts, and in a situation decidedly exposed; because the exposure of nearly the one half of the Park here is considerable, and the climate on the whole is none of the most propitious. The practice, therefore, may be deemed of some value to the planter, who will perceive, that where so great a point is gained, no visible injury is suffered, as is admitted by all, who have examined the trees at this place. That almost every naturalist and georgical writer, ancient and modern, from Theophrastus to Virgil, and from Virgil down to Evelyn and his followers, has insisted on an opposite practice, as quite indispensable to the health and well-being of woody plants, is little to the purpose. It is nothing more than a reiterated precept, handed down from one age to another, in the face of the most unquestionable experience of its fallacy.*

Upon the whole, in considering this fairest, and most beautiful of vegetable productions, it is interesting to observe the curious and complicated mechanism, if I may so speak, that is displayed by nature, in nourishing and bringing it to perfection, and the intimate connexion which subsists between the most distant parts. In fact, every part of a tree is the condition of every other part, which continually acts and re-acts. The judicious planter, therefore, will regard the treatment to be given to none of these parts with indifference; it being clear, that *the preservation of all the parts, in as entire and perfect a state as possible*, is a matter of first-rate moment to his art.† He will also see, that his success mainly depends on *the due regulation of the sap*, and a careful *protection of the sap-vessels*.

In the course of the foregoing remarks and illustrations,

* Note VIII. † Note IX.



SPECIMEN OF A TREE REMOVED ON THE PRESERVATIVE PRINCIPLE.

I have endeavoured to show the importance of the four main properties or prerequisites, which trees should possess to render them fit for removal to exposed situations. I have also given a cursory idea of the nature of the different organs of woody plants, by which those properties are designated. From what has been said, the intelligent reader will perceive that the principle adopted, for a new theory of the art, is founded on the laws of vegetation, and the researches of the most eminent phytologists. By reducing it to practice, the mutilating system, now generally prevalent, will be rendered unnecessary, and a method established, which is obviously superior in itself, and more agreeable to observation and experience. This system I shall venture to call the PRESERVATIVE. But, before concluding these remarks, it is but fair towards the existing system, to take a short view of the actual merits of both, and by giving them in a comparative way, endeavour to show how each applies to practice.

We will suppose that a planter, according to the Mutilating method, is to remove, to an exposed situation, a tree eight-and-twenty or thirty feet high, three feet and a half in girth (or fourteen inches in diameter), at a foot from the ground. We will suppose further, that it displays the most perfect symmetry of form, having an expansion of top from five-and-twenty to eight-and-twenty feet, with boughs descending to within three or four feet of the ground. Such a tree we may consider as a very handsome subject, and such as has frequently been removed at this place.

Having prepared the roots, according to Lord Fitzharding's method, three or four years before, and taken them up as well as he can, perhaps, seven feet out from the stem, (which, according to Marshall, is well rooted for its height*), we will suppose that this planter then proceeds to lighten and lop the top, in order to reduce it, as the same intelligent

* Rural Ornament, Vol. I. p. 367.

writer recommends, "to the ability of the roots." We will, moreover, take it for granted, that he deals mercifully with this beautiful tree, and cuts away only a half, or a third part of its boughs, and thus transfers it to its new situation. Under these circumstances, we may presume, that some props or fastenings, whether of wood or cordage, may be requisite, especially about the equinox, to preserve the tree in an upright position. Now, will not all the evils, ascribed by Miller to the Mutilating system, independently altogether of picturesque considerations, soon begin to assail it? Having the roots and top (which are both conservative organs), curtailed and injured at one and the same time, the supply, not less than the preparation of the sap, is completely impeded. From the obvious want of leaves sufficient to elaborate the sap, and the equally striking want of branches to communicate nourishment to the stem, and ultimately to the roots, the whole tree in most instances becomes stunted and paralyzed. Pale and yellowish tints supply the place of a deep and healthful verdure of foliage, and the larger boughs, as well as the light spray, gradually decay and drop off. Even in cases which are the most eminently successful, and where the tree fortunately escapes these mischances, fifteen years, as I conceive it, in the best English climates, and twenty and five-and-twenty at least, in the northern counties, and in Scotland, are scarcely sufficient to replace the amputations with fresh wood, and to restore the tree to its natural health and strength.

What, we may ask, have now become of its fine symmetry of form, its characteristic and ample top, "its happy surface (as Gilpin expresses it), for catching great masses of light?" What also has become of the fair promise, which before removal it held out, of enduring vigour, and of sound and healthy wood? All these are gone, as Miller truly states; all are utterly annihilated, by the rude assaults of the axe, which has left no trace remaining of their existence! The most prominent and characteristic features of the species, which mainly reside in the top, have disappeared also by the same process: For even when such trees do succeed, and acquire the formal and *bush-like* head, common to all that are removed after the Mutilating method, "It is seldom," as Pontey observes, "that they harmonize with any thing about them."* On comparing them with plants raised from the nursery, of the seed, we perceive but a small saving of time in favour of this system: Yet it is time saved with the infliction of such evils, and the sacrifice of such advantages, as to render it any thing but desirable to the planter of taste.

On the other hand, we will suppose the same planter to transfer a tree of similar description and dimensions, to a situation of similar exposure, but according to the Preservative method. This tree, being a subject of uncommon beauty, as above described, and having a head of more than five-and-twenty feet broad, strong roots of fourteen and fifteen feet of a side (instead of seven), are taken up with it, together with abundance of the minutest fibres, after a peculiar method, to be explained in the sequel. Instead of lopping and defacing the top and side-branches, the whole are left untouched, and their fine symmetry is preserved entire. Transportation of the tree to its destined site then follows: where, after being replanted according to a peculiar method also, productive of stability in an extraordinary degree, it is found capable of resisting the wind, on the simplest principles, namely, the acquired steadfastness of the stem, and the length and distribution of the roots, added to the balance of an extensive top, from whatever quarter it may blow.

During the first spring, when the sap begins to flow abundantly upwards, if no severe frosts supervene, to cut down the slender spray of the top, not a branch or a twig is

* Rural Improver, p. 87.

found to decay. The sap ascends, by means of adequate roots, in a sufficient quantity for the support of both, and for enabling the leaves to perform their elaborating functions. The leaves, therefore, though for obvious reasons of a lesser size, and sometimes a lighter colour than usual, during the first season, *universally clothe every part.* After the first, or, at all events, after the second year, under common circumstances, the deep hue of health, and the fulness of leaf, which the tree formerly displayed, again return; and, while its foliage glitters in the sunshine, or floats on the breeze, no eye can distinguish whether it has been two years or forty in its new situation. Picturesque effect or shelter, as the planter's object chances to be, is in this way *obtained from the first:* But no planter of experience will expect shoots of much consequence to appear, till the tree be established in the ground. This, of course, requires four or five years, at least in the climate of Scotland; after which, it usually shoots forth with vigour; and, the *longer it stands*, according to the Preservative system, it will shoot with the *greater vigour*, as the experience of more than thirty years has incontestably proved. By this statement, then, it appears, that the system in question has, in *this* country, the power of saving, and in some sort of anticipating *forty years of the life of man;* a large portion, in any view, of that uncertain possession: and thus, by following such a system, the Immediate and Full Effect of Wood is at once procured at a moderate expense, as shall be made apparent in the sequel.

In this view of the two methods, I am not conscious to myself of having exaggerated the evils, or concealed any of the advantages, attendant on the Mutilating system; at least, if the opinions of Miller, Marshall, Pontey, and other skilful planters and phytologists be well founded. Should any of my readers conceive, that I have too highly coloured the delineation of the Preservative, let them do me the honour to visit this place, and judge for themselves. Which of the two methods is deserving of the preference, I leave to the decision of the impartial. But I will take the liberty to add that, as I write chiefly for the practical, not for the speculative improver, probably those planters will be found to judge most candidly, in this competition between the systems, *who have themselves tried the practice of the art.*

Thus, I have endeavoured, in the course of the foregoing observations, to develop and illustrate certain principles, for the improvement of this art, and also that of general planting; which principles, though derived from science, may not attract the notice they deserve. It is only on an acquaintance with vegetable physiology and the anatomy of plants, with the habits they display, and the organs and properties they possess, that any sound foundation can be laid for practical arboriculture. The lessons suggested by this inquiry, and the conclusions to which it has led, are the fruit of long experience, and a careful induction of facts and experiments, the only safe and true method of philosophizing on any subject. From what has been said, the inexperienced planter will see, of how much importance it is for him, in this as in other things, to distrust established dogmas, to adopt some phytological inquiry as the groundwork of his practice, and to think for himself.

Yet there are those who may imagine, that, in a Treatise professing to be *practical,* I have dwelt unnecessarily long on the exposition of *principles.* But they may rest assured, that no method could have been devised more certain, than a thorough acquaintance with them, to shorten the road to knowledge. Without this, the utmost diligence of the planter is being at sea without a compass. Accurate practice and manual dexterity are soon acquired, and can succeed only when made subservient to principles, and to a careful study of those beautiful but simple methods which nature pursues in perfecting her works.

SECTION V.

FURTHER DEVELOPMENT OF THE NEW THEORY. SELECTION OF SUBJECTS FOR REMOVAL.

If it be true, as has been observed by a judicious writer,* that the removal of large trees "forms the most difficult part of planting," it is certainly not less true, that the selection of subjects forms the most difficult part of transplanting. This I have no expectation is to gain general belief with country gentlemen, or even with practical planters of superior intelligence; because both consider planting merely as a *mechanical art*, and neither will easily be brought to study it as an object of interesting science, or even liberal inquiry. When Demosthenes was asked, what he considered as the first quality in an orator, he at once replied, action; according to the very extensive acceptation of that term, which prevailed in his day. When questioned as to the second quality, he said, action; and being desired to name the third, he still gave the same answer. In this emphatic way, I must own, I should be disposed to speak of the selection of subjects, were I to be similarly questioned by the young planter, whether his curiosity were directed to planting in general, or to any particular branch or department of the art; and I should earnestly recommend this difficult subject to his patient investigation, and his most assiduous study.

* Marshall.

It is obvious, however, in the department under consideration, that to transplant at all, we must have subjects. At a place of any extent, tolerable subjects are never wanting; although they must abound or be deficient, according to the diligence of culture, especially in respect to thinning, with which the woods and plantations have been treated. Yet it must not be imagined, that, at places of small extent, subjects are not likewise to be found. At such, the current of the prevailing winds is always less broken, and the climate less improved, than under the shelter of broad and extensive masses of wood. Other things, therefore, being equal, there will probably be more and better subjects at small, or middle-sized places, than at great, that is, in proportion to the size of the masses, from which they are taken. But it should be remembered, that at both they may often be invisible to the eyes of the owners.

Woods are planted for two main purposes, utility and ornament, with both of which shelter is obviously combined. In woods planted for utility, the greatest elongation of the stems of trees is required; and close-planting, pruning, and other means are employed, to obtain what is considered as the greatest possible "weight of wood." In plantations, raised for beauty or shelter, such as in parks and pleasure-grounds, the planter's object is, to prevent an undue elongation of the stems, unless for particular purposes, and to promote an expansion of the tops of trees, so as to enable them to develop themselves, in their just and natural proportions. It is almost needless to observe, that it is from woods or plantations of the last mentioned description, that the selection of subjects is for the most part to be made. If made judiciously, it will furnish, without doubt, the best practical illustration of the principles held forth, and the theory attempted to be established, in the two foregoing sections.

Before proceeding to deliver any specific rules on this important topic, perhaps the best way will be, to attempt an indirect road to our purpose, by enumerating the most common errors committed by planters, in their choice of subjects; and then by endeavouring shortly to account, from the laws of nature, for the ill success that has attended such selection.

The most common errors, which injudicious planters commit, appear to be of three different kinds; first, they bestow no pains or care in the adaptation of trees to the particular soils in which they are calculated to thrive; secondly, they have recourse to close woods and plantations, for the supply of subjects; and thirdly, they set out plants at too early an age, and of too diminutive a size, into the open field.

First; as to the non-adaptation of trees to their proper soils. All plants, woody or herbaceous, seem to be fitted by nature to grow best in particular soils and subsoils, in which they thrive more luxuriantly than in others. This is a fact, which is, or should be familiar to all planters. In other departments, such as husbandry, it is universally understood. No farmer of intelligence ever errs in adapting his crops to the soils most proper for them, or puts his wheat or his beans, where his barley or turnip should be put, or *vice versâ*. Not so, however, the planter; for, nine times in ten, he pays no regard to adaptation, but puts the same trees indiscriminately on every soil. Even late practical writers of name and authority advocate the practice, and recommend, that mixed plantations of all trees should universally be made, with the design, as they alledge, of producing "a greater weight of wood," than by any other method. This is a system, which, to say the least, sets little value on experience. In fact, it equalizes all plants, and all soils at once, and renders all judgment in treating them superfluous.

But however such a method may succeed, in producing mixed effects in plantations, it cannot be admitted for wood in the lawn or park, in which the prominent effects are to result from small groups or individual trees, and where, on that account, every single failure tells, and appears conspicuous. No man, who knows any thing of wood, will put down the sycamore, the lime, or the wild cherry, for example, on a clayey soil; neither will he put the oak or the elm on light sand or gravel, but, on the contrary, on the deepest and loamiest land he can find, and in the case of the oak, even with a clay-bottom: for, although that tree, in particular, is the most accommodating of all plants, it is only on land of this sort that it will really thrive, and grow to timber. But to the skilful planter, the subsoil is often regarded as of more moment than the mere texture of the surface, as the degrees of moisture, most suitable to woody plants, form perhaps the most prominent features in their characteristic differences. It is, therefore, of the utmost importance to the planter care fully to study these distinctions. In certain situations, where he might be anxious for the grand effect of the oak or the chestnut, it will often be prudent for him to be content with the inferior forms of the lime, or the beech.

It is a maxim of good sense, as well as good taste, of which every man conversant with wood is not sufficiently aware, namely, that *those trees about a place will always look the handsomest, that thrive the best,* and that no peculiarity of ramification, nor delicacy of foliage can ever compensate for a deficiency of luxuriance and full health. A rage for exotics, for plants with new names, or of more delicate habits than the soil and climate will properly rear, is, I am sorry to say, the besetting sin of the present race of planters. The errors which are committed, for want of this sort of adaptation in transplanted wood, are scarcely credible, unless by those who have closely attended to the subject. A striking example has been brought forward in Note I., Section First. A number of others, that have come under my observation, might be added, were it necessary; as a great proportion of the failures, which take place in transplanting, are distinctly referable to this fruitful source.

The second error to which I shall advert, is the having recourse to close woods and plantations, for the supply of subjects for removal. Perhaps there is no planter, who in the beginning has not fallen into this mistake, before he has had sufficient time to attend to the effects of heat and cold on the growth of wood. Allured by the fine forms of trees so trained, by the tallness of their stems, the beauty of their bark, and their general appearance of health and strength, we naturally form the wish to transfer them to the lawn, or open park: but we should reflect, that how much soever they may please the eye, there are no properties so unfit as these for this degree of exposure, as they are generated solely by warmth and shelter. As well might we bring forth the native of the burning plains of Asia or Africa, and in the light attire of those tropical climates, expect him to endure a British winter. Either the facts respecting exposed and sheltered wood, as above stated, are incorrect and unfounded, or nature must be supposed to act in contradiction to herself, if she sanctioned such incongruities. Yet ninety-nine times in a hundred, the success of an art, which, if rightly understood, would be interesting to many, is fairly marred by this erroneous practice. Nor are these the errors of youth or inexperience. Two of our best informed writers, Boutcher and Marshall, as we have already seen, regard the art as mainly applicable to "the thinning of nurseries or plantations," and recommend it accordingly for that purpose.

It is not necessary to dwell long on so unhappy a system of selection. The trees, being transferred to a climate, colder by several degrees than that in which they were trained, and with the peculiar conditions and properties adapted to the latter, internally decline. The usual lightening or mutilating of the tops affords no alleviation or remedy from without. In such a situation, the mechanical effect of wind would be sufficient of itself, without any other cause, to ensure their miscarriage. Yet, as they carry leaf, and show no immediate symptoms of decay in the outset, their ultimate, though certain failure is not contemplated by the sanguine planter. With roots inadequate either to fix them in the earth, or to furnish the supply of sap, which their new circumstances demand, they are incapable of extending themselves, either above or under ground. The leaves, from the deprivation of shelter, cannot freely elaborate the sap; and the proper juice, on the other hand, is chilled in its descent, from the want of leaves, and branches, and bark sufficient to protect the sap-vessels. Meanwhile, the trees are vexed by the winds from every quarter. They want side-boughs to nourish and balance them properly. Gradually, they become stunted and hidebound. The few branches they have decay and drop off; and at last they are rooted out, as a proof of the hopelessness of the art, and the inutility of all attempts to cultivate it. A few plants perhaps, taken from the outskirts of the wood, and partly furnished with the protecting properties, struggle on for ten or fifteen years, until they acquire these properties to a certain extent; and, beginning *then* only to thrive, after half a lifetime of expectation, they show beyond controversy, to the planter and his friends, how much more speedily trees might have been got up to an equal size, from the nursery, or the seed-bed! It is, however, perfectly obvious, that nothing less than a miracle, that is, a counteraction of the course of nature for a special purpose, could have effected any other results.

The third and last error, or cause of miscarriage remaining to be noticed, is the setting out of plants of too diminutive a size into the open field. This error is not less frequent than the others, and is usually committed by those, who condemn the practice of large removals, or who are of opinion, that "large trees and small possess similar properties, and are therefore to be managed on similar principles." All thriving wood, they say, whether in masses or open groups, must be got up by means of small plants. Nature, according to these planters, to a certainty produces wood of every sort, within a given time; and experience demonstrates, that if we wait that time, we cannot miss the produce. It is through haste and impatience to anticipate the period, that we incur disappointment. It is a well known fact, as they further alledge, that, in the course of forty or fifty years, trees of considerable magnitude may be raised, on almost any land in Britain, that is of tolerable quality; hence it must follow, that a nobleman's or gentleman's park, which in general is superiorly cultivated, will in all likelihood raise them in a less time.

On such undeniable data, these operators often proceed to fill a whole park with plants, taken from the nursery-ground, of three, four, and sometimes six feet high. Great care is bestowed in planting out the trees, and still greater expense in securing them from sheep and cattle. Palings, hurdles, cordage, according to the taste and consequence of the owners, are all employed for that necessary end; and those ponderous and unsightly erections, when abundantly scattered over an extensive and open surface, serve to fill the eye, and afford a pleasing anticipation of what these stripling plants are expected to do, at a future day. As to the expense of such barricadoes (which will always last for five or six years,) they hold it as insignificant, when compared with the formidable cost of removing large trees. That cannot be accomplished, they conceive, without heavy charges for men and machinery, not to mention the contingency of a fortuitous art; whereas, with young and healthy plants, as they believe, you have only to wait for a few years with patience, when success, as in other things, must be the reward of industry.

I once knew a gentleman, not destitute of talents or intelligence in rural affairs, who in this way had planted about two-thirds of his place, which was of some extent, though for the most part exposed to the west and southwest. When I saw it, this arboricultural experiment had gone on for about five-and-thirty years, and even the owner had, by that time, begun to despair of its success. A very few of the plants, meeting with a deep soil, and with sites singularly sheltered, had got up to about twenty feet high. The generality, and especially in trying exposures, had grown to large bushes. What was once their leading shoot had lost its preeminence over the side-branches, plainly indicating, that no further elongation of the stem was to be expected. Moreover, they had begun, like old trees, to be clump-headed, and to assume the appearance of premature old age. As to the expense of the hurdles and pales, five or six times renewed, together with the loss of the ground which they occupied, it amounted, according to the candid acknowledgment of the owner himself, to *far more than the cost of removing proper subjects in the beginning!* The consequence was, that he was persuaded to replant nearly the whole of his park on better principles, and with trees of from five-and-twenty to thirty feet high; and he lived to see them vigorous plants, productive of picturesque effect in no small degree, with the promise of becoming timber for the succeeding generation. What he most regretted was, not so much the pecuniary loss, which he had actually sustained, as the loss of nearly a lifetime, in vexation and disappointment.

To the vegetable physiologist (if any such should be among my readers,) it is almost unnecessary to detail the radical and efficient causes of this species of failure. Every organic creation, whether animal or vegetable, requires, during infancy, the aid of considerable heat, to enable it to develop its powers, and to expand freely. The tenderness, and, indeed, utter helplessness of man and other animals, at this early stage of their existence, press more forcibly upon our notice, than the case of the vegetable tribe, under similar circumstances; yet both are governed by the same natural laws, and display in their development a striking analogy. The planter who, without due consideration, sets out a tender plant into the open field, would not rashly so expose a young dog or a horse, until, by a proper degree of warmth and care, its constitution were confirmed, and it had acquired strength to resist cold, and other ills and accidents. A certain portion of heat, that is, of shelter, is in the very same way indispensable to trees during infancy, in order that they may grow with freedom, so that, when their organs are matured, and their strength properly established, they may withstand the elements in open exposures. Hence, to set them out prematurely, is to a certainty to paralyze their energies, and check the development of their parts.

The intelligent reader, I have no doubt, will be pleased to find, how clear and full an illustration of this doctrine was afforded, by the close plantations of the gentleman just now mentioned. It so happened, when he planted the open and exposed parts of his park, with small trees from the nursery-ground, as already stated, that at the same time, and with a part of the same plants, he executed a considerable stretch of the adjoining plantations. When I examined the latter, the trees were, for the most part, about thirty and five-and-thirty feet high, and in a state of the most perfect health. They had been drawn up and protected, in the warm and kindly atmosphere generated by close woods. The outside rows had acquired to a certain degree the protecting properties, and were nearly fit for removal; and the whole exhibited a striking contrast to the diminutive and stunted plants in the adjoining park, many of which, instead of five-and-thirty feet, had not grown above as many inches, from the time they were set out!

It is indubitable, that one and all of these radical errors in practice, into which planters fall, originate mainly in a want of science to regulate it, and of a competent knowledge of the history and properties of woody plants. General planting, as well as every particular department of the art, as has been already noticed, must depend for its success on scientific principles. Since the first publication of this Essay, it is pleasing to perceive some symptoms of the public attention being roused to physiological inquiry, on this subject: but nothing less than an Institution for the encouragement of Arboriculture *exclusively*, will supply this desideratum in the education and intelligence of the country, and place the art on that footing of respectability, to which no one will deny it is entitled by its importance.

In what, then, it may be asked, does a proper selection of subjects consist? A proper selection of subjects consists, as I conceive it (exclusively of picturesque considerations,) in two things especially: First, in a judicious adaptation of trees to their proper soils; and secondly, in taking care, that the trees so adapted possess as great a share of the protecting or non-protecting properties, as is fairly required by the situation of exposure, or of shelter, in which the trees are to be placed. Of these two points the former has already been sufficiently illustrated, in the course of the foregoing discussion on the want of adaptation. As to the latter, it may be observed, that much will depend, in applying it to practice, on the particular objects of selection, which the planter may have in view.

If his object be single or detached trees, and such as are intended to be set out in trying exposures, the acquisition of the protecting properties must be the chief end and aim of his selection; and the trees must have made the acquisition in sites, as much exposed at least as those to which they are to be removed. He may rest assured, in this case, that his success or miscarriage will be in the precise ratio, in which his subjects may have obtained these indispensable prerequisites. If fully obtained, their progress will be visible from the beginning; but if imperfectly, their progress will be retarded, until the deficiency be made up. In other words, as planters do not always follow nature, in the choice of their subjects, they need not be surprised, if trees planted out in such exposures (supposing them to live at all,) should continue ten, fifteen years, or more, in a stationary condition, struggling, under the unpropitious circumstances of cold and exposure, to generate provisions, which they should previously have acquired; when at length, having overcome the evils of injudicious selection, they only *then* begin to make that progress, which ignorance and mismanagement have retarded.*

On the other hand, if his object be to raise close masses of wood (for hiding, for example, some prominent defect, or attaining some general ornamental purpose,) of which masses the materials are to consist of grove-wood and copse intermixed, it is evident, that, excepting perhaps, for the outside rows, the protecting properties would be altogether thrown away on such designs. If what has been said above be well founded, trees possessing those properties would, in this situation, soon have them exchanged for the non-protecting, by the heat and shelter, which a close mass of wood must always generate. Even were not that to happen, the needless extension of both their branches and roots would prove extremely injurious to a plantation, where underwood predominated. In these circumstances, an operator of judgment would select such subjects for his work, as possessed the non-protecting properties exclusively, and were far more suitable to the designs in question.

These, however, may be considered as extreme cases, while ordinary practice lies in a medium between the two. Thus, in parks or places of any extent, the climate and soil are usually as various, as the proportions of the protecting properties, which have been acquired by different trees. The tree, which would succeed in the sheltered valley, would have little chance on the exposed eminence; and to transfer a subject well adapted to the latter to the former site, would be to misapply qualities, which are so extremely

* Note I.

valuable, as well as to abridge the range of the planter's operations. As the protecting properties, therefore, must of course be more rare in all woodlands, than the non-protecting, one of the most difficult tasks, which the planter has to perform, is judiciously to husband the application of the former. He should always bear in mind, that if he put down but one tree in any given spot, in that tree the protecting properties should exist in a greater degree, than if he put down ten trees, and still more than if twenty were put down. Even by means of the loosest dispositions, and the most scattered groups of wood on an open surface, the force of the wind is sensibly broken, and hindered from exerting its entire violence on any individual tree. In creating real landscape, climate is not always to be regarded absolutely, but relatively. Absolute elevation may be considerable, but relative mildness in the climate of a place may be as great, from the number and richness of its woody accompaniments. Hence, poverty of clothing on the surface of a park, if we can command the subjects, should always be avoided; for that is as inconsistent with the richness of the picture, as with the health and success of the trees of which it is composed.

As the modifying of the effect of heat and cold on woods, and especially on parks and pleasure-grounds, is a subject not generally understood, it may be worth while, in this place, to say a few words respecting it, and also respecting the principles on which it is founded, as being connected with the subject immediately under discussion. Air, in several respects, resembles, and is governed by the same laws as another element, namely, water, although the effects of the former are less cognizable by the eye. If you erect powerful abutments on the banks of a river, you may forcibly turn the stream from its course; but it will break with tenfold violence on the opposite side. In the same way, if by close and continued plantations you endeavour altogether to exclude the wind, it will contrive to assail you in some quarter, and rushing in with fury at the first opening it can find, do incalculable mischief. The art, therefore, of controlling either element, consists in judiciously breaking it into parts, and thereby dividing, and consequently weakening its force.

It is on this simple principle, when fine landscape effect is produced on the surface of a park, by means of large open dispositions of wood, and of groups and scattered trees, creating a succession of rich and varied pictures, that the climate is best ameliorated, and the most effectual defence against the elements is procured, whether for plants or animals, or for the comfort and accommodation of man. In this instance we see, that beauty and utility entirely coincide: for wherever park-scenery is most successfully cultivated, there heat and cold are best modified on woods. It is under such circumstances, that trees uniformly develop themselves in their most natural and most perfect proportions, and display the fullest luxuriance of health. Thus the places, which are planted in the best style, are always the most effectively sheltered; and thus good sense and good taste will be found here, as in most other things, to unite in the same object, and mutually to strengthen and confirm each other.

Obvious and satisfactory as this doctrine may appear, its soundness is not universally admitted, even by men of discernment and understanding. There is a very intelligent and worthy friend of mine, who reasons in a very different way from this, on the best method of defending himself from cold. Wherever, says he, the wind enters, I immediately stop the gap; and the more gaps I stop, the less the wind will enter: hence it follows, that in time I shall be completely secured against both wind and cold.—This gentleman's place, though it stands high, is in many respects a noble one. It has picturesque features of a striking sort; and it is moreover well covered with deep masses of full grown wood, arranged in all the rectilinear dignity of a former day, in which here and there was an open and cheerful vista, from which we may suppose his ancestors delighted to look out. All these, however, from a rooted abhorrence of wind, he some years since diligently planted up; so that his mansion, when viewed from without, is rather like a bird's nest in a thicket, than the grand and central object, in an extensive and well wooded park.

It was in vain that I pressed on my friend the necessity of his freely, but gradually thinning and opening up his woods. It was in vain that I expatiated on the striking similarity of the two kindred elements of air and water, and on the extreme caution that is requisite, in the management of trees nearly at their best, so as to break and dissipate the wind, thereby not only improving the trees, but making a beneficial use of so uncertain an element. It was to no purpose that I explained to him the wise economy which nature displays, in modifying the influence of heat and cold on the vegetable kingdom, and that if heat, during the infancy of trees, is necessary to the full development of their parts, cold in a due proportion is just as necessary, at an after period. That, therefore, it must follow, in all large masses of wood, where heat is superabundant, and light insufficiently supplied, that a progressive elongation of stem, and a progressive delicacy of constitution, must be the consequence, and in time all admission of air be rendered dangerous or impossible. That, in these circumstances, were so unnatural a state of things suffered to continue, and were he to persist in an unavailing warfare with his old enemy the wind, instead of prudently conciliating that boisterous element, it was clear, that erelong it would find, or make for itself more than one entrance into his premises, however closely secured, and to a certainty blow down his woods. Yet notwithstanding, I am sorry to observe, that these dense masses and barricades are still continued, and that his woods are gradually approaching to a state utterly hopeless and irremediable.—I fear that my worthy friend is not a solitary instance of want of skill, or rather want of resolution, in conducting this important department.

Having said so much about trees, it may be proper, in this place, to add a few observations on the selection of subjects for underwood. Copse or underwood for removal is of two kinds: the one is that intended to mass up with grove-wood, and to form close and mixed plantations: the other is what is meant as subjects for bush-planting in the park. Of the properties which the former sort should possess, little need be said, as it is evident, that they may be all quite properly of the non-protecting description, and that any other sort of plants would be thrown away upon it. Of the latter kind it is equally plain, that it must have properties suited to exposures, although not in the same degree as trees; because trees, on account of their height, and other circumstances, can less easily withstand the elements.

As to bush-planting in the park or open field, it seems to be something new, both in the conception, and the execution. Mr. Pontey speaks of the thing in his late useful treatise on laying-out grounds, but he justly doubts the possibility of protecting such underwood as he recommends for the purpose, until it get to a proper size. It is extremely difficult, and in a park where deer, black cattle, or horses are kept, probably impossible, to succeed in bush-planting, whatever may be thought, by those who have never made the experiment, on the perusal of Mr. Pontey's late work.* Even with sheep as the only stock, the numerous small and dotted clumps, of only a few yards square, and fenced with wire, such as he proposes, must be ten times more offensive to the fastidiousness of modern taste, than the unfortunate clumps of brown, which were gigantic in comparison, if the

* Rural Improver, pp. 149, 253, et. seq.

latter now, in spite of the severe interdiction of Messrs. Price and Knight, were once more to lift up their heads. But with middle-sized plants, and a machine of small dimensions (as shall be described in the sequel.) the entire effect of bush-planting may be obtained, and, I am certain, at a fourth part of the expense and trouble of Mr. Pontey's clumps.

To select subjects for this purpose will be a matter of little difficulty, if the rules already explained be sufficiently apprehended; and they must, of course, have the principal protecting properties, in as far as the degree of exposure may require, especially numerous roots. As bushes also, these plants must obviously be low, from four to eight or nine feet high, with broad tops, headed down from time to time, and branches as near the ground, as the sheep will permit them to grow, that is, within about three feet and a half: For on this last mentioned circumstance their effect mainly depends. They must, moreover, have only one stem, or as few as possible for the open ground, in order to admit of their being fenced with facility, and at a small expense. In this way, many have been planted here, which are desirable as accompaniments to water. Likewise they are useful in massing up with tall trees; in the formation of low skreens, while distant objects may be seen over their heads; and occasionally in breaking a hard outline, which should always be fringed with both trees and bushes.

Before taking leave of so important a discussion, as the Selection of Subjects, it may be asked, what in point of size are to be regarded as the best subjects for removal, in accordance with the principle above enunciated? To this it may be replied, that, if ordinary judgment be exercised, and flagrant errors avoided, preference will greatly depend on the choice and circumstances of the planter. Size offers to successful removal no actual impediment further than *increased expenditure.* The same principles apply to the largest trees just as well as to the least. But it is material to notice, that size implies greater labour and contingency, and, by consequence, more powerful machinery; and both rise in a ratio far more accelerated, than might at first be conceived to correspond with the increased dimensions of the trees. My own operations as to size having been of a limited sort (the subjects seldom exceeding thirty-five or thirty-six feet high, and in the stem from fifteen to eighteen inches in diameter) I do not presume to prescribe to what height others should go, because it is altogether arbitrary: but I may with confidence recommend *below* what height they should never *descend*. No subject, in my judgment, should be selected for removal, of which the girth of stem is *less* than from eighteen inches to two feet, or, in other words, whose diameter does not extend to six or eight inches at the least, reckoning at a foot from the ground: the height of the tree being supposed from fifteen to eighteen feet. Any subject, possessing a *lesser* magnitude, and lesser proportional stoutness than this, I consider as unfit for judicious removal, in exposed situations, and destitute of proper stamina to resist the elements. To this injunction I may add, that in the above, as in every case, we should labour to acquire, by observation and study, a knowledge of that nice and adequate adaptation to circumstances of the protecting properties, which nature displays in her more or less open dispositions of Wood, and learn to follow her provident example. All that the best preceptive efforts can do, is to point out and illustrate the principle in its general bearings: it is judgment and experience only, that can give the practice.

SECTION VI.

PREPARATION OF THE SOIL FOR OPEN DISPOSITIONS OF TREES AND CLOSE PLANTATIONS.

HAVING sufficiently illustrated the New Theory suggested for Transplantation, the first branch of practice, that claims attention, is the Preparation of the Soil.

The substances which constitute Soils, as Sir H. Davy states, are certain compounds of the earths, silica, lime, alumina, magnesia, and of oxides of iron and manganesum; also animal and vegetable matters in a decomposing state; and saline, acid, or alkaline combinations.* Soils afford to plants a fixed abode, and the medium only of their nourishment. Earths, exclusively of organized matter and water, as the best phytologists admit, are of no other use to woody plants, than to fix them in the ground, and support them: they act merely as mechanical, or as chemical agents: but earth and organic matter united constitute what is properly called Soils, and furnish to plants at once support and nourishment. The true food of plants, as the same instructive writer observes, is water and decomposing organic matter. The earthy particles are useful in retaining the water, so as to supply it in due proportions to the roots of vegetables; and they likewise act, in producing a proper distribution of the animal or vegetable matter. When equally mixed with it,

* Elements of Agricultural Chemistry.

they prevent it from too rapid a decomposition; and they also supply the soluble parts in their due proportions.

Kirwan, in his Geological Essays, has shown, that the fertility of a soil in a great measure depends on its capacity to retain water. The power of the soil to absorb water by cohesive attraction, depends, in a considerable degree, on the division of its parts. The more these are divided, the greater their absorbent power. Hence the great importance of friability or looseness of texture; so that moisture may have free access to the fibres of the roots, that heat may be readily conveyed to them, and that evaporation may proceed without obstruction. These benefits are usually attained by the presence of sand. As alumina possesses, in an eminent degree, all the powers of adhesiveness, and silex those of friability, it is obvious, that a mixture of those earths in suitable proportions, would furnish every thing that could be wanted in the most perfect soil. In a soil so constituted, water would be presented to the roots by capillary attraction. It would be suspended in it, says Griesenthwaite, in the same way as in a sponge, that is, in a state not of aggregation, but of minute division, so that every part might be moist, but not wet.* Hence the best soil, whether for wood or agricultural crops, obviously is one that is at once loose and deep, containing the most alumina and carbonate of lime, so as to act with the greatest chemical energy, in the preservation of manures.†

Trees, far more than agricultural crops, require depth of soil, to raise them to perfection: the effect of climate appears much less necessary, in giving them their greatest magnitude. Accordingly, notwithstanding the insularity of our situation, which naturally tends to the equalization of climates, little park-timber is found in Scotland, or the north of England, approaching in size and grandeur to the great

* New Theory of Agriculture. † Note I

trees in the midland and southern counties, owing probably to the superior soil, which exists in the latter districts. Of these, the Swilcar, Shelton, Chandos, and Fredville oaks, the Tortworth, Burleigh, and Cobham chestnuts, the Chipstead and Tutbury elms, the Woburn ash, the Knowle beech, and the Cobham lime and sycamore are eminent examples, as may be seen in Mr. Sturt's late elegant delineations.* A more powerful delineator than Sturt says, of the King's Oak at Blenheim, that "although scathed and gnarled in its branches, the immense trunk still showed, to what gigantic size the monarch of the forest can attain in the groves of merry England."† As it appears plain, from these and other instances, both in the north and south, that the size of wood will be mainly in proportion to *the depth of the soil* on which it grows, it should be the chief study of the planter, to promote that capital object. It is a sound maxim, as old as Theophrastus, and repeated by Columella and Pliny, as familiar to the Roman husbandman, to transfer no tree to a worse soil than that in which it had previously stood :‡ and whatever in this respect holds true of young plants, must, *a fortiori*, hold more decidedly true of large subjects, such as are intended for removal. If in transplanting we must often increase the cold, and other circumstances adverse to trees, it becomes us the more diligently to study, that the soil be rendered as rich and deep as possible, in order in some sort to counterbalance those disadvantages.

There are few persons so happily situated, as to be able to command much animal or vegetable manure, for the use of trees. Such artificial modes of enrichment or improvement must therefore be resorted to, as science or experience has

* See Sturt's elegant Portraits of British Forest Trees, with respectable letterpress description. Lond. 1826.

† Sir Walter Scott, Woodstock, Vol. I. p. 68.

‡ Note II.

pointed out. By following such guides, we may often learn so to alter the constituent parts of soils, as to increase their fertility, by the addition of ingredients, in which they are deficient, and in some cases, by the subtraction of such as too copiously abound in them; or else, by effecting chemical changes of some constituent part by incineration, or by the application of mineral manures. Soils, considered as agents of vegetable culture, are subjected to operations, which effect changes on them, either mechanically or chemically. Of the former description there are none so important for the use of trees, as deepening and pulverizing. Deepening can be executed with effect, only by trenching or double-digging (for the plough can do little in such a business), and pulverizing is naturally combined with that process. The depth of pulverization, as Sir H. Davy well observes, must depend on the nature of the soil and subsoil. In rich clayey soils, it can scarcely be too deep; and even in sands, unless the subsoil contain some principle noxious to vegetables, deep comminution should be practised. When the roots are deep, they are less liable to be injured by excessive rain, or excessive drought, and the radicles are shot forth into every part of the soil.* In a word, nothing but water stagnating under the trench, in consequence of a clayey bottom, and the risk of the roots being thereby chilled, should prevent trenching from being always executed as deep as possible.

The surprising changes worked on all soils, in consequence of a minute comminution of their parts, and the various ways in which it increases fertility, have only of late years been communicated to agriculture, by chemical analysis and investigation; so that there is the less wonder that they should, in a great measure, have escaped the planter's notice. If the process be important in general to woody plants, it must be greatly more important to subjects meant for removal;

* Elements of Agricul. Chemist.

and I earnestly request the reader's attention, while I take a rapid view of it.

Pulverization, or the mechanical division of parts, is applicable to all soils, in proportion to their adhesive texture; as even the most silicious, if not duly stirred, will become too compact and dense for the admission of air, rain, and heat, and, by consequence, for the free growth of plants. Strong upland clays, not submitted to the plough, or the spade, will in a few years be found in the possession of fibrous-rooted perennial grasses, which form a clothing on their surface, or of strong taprooted trees, such as the oak, which force their way through the interior of the mass. For these reasons, the first and great object should be, to give scope to the young roots and fibres; because, without fibres in abundance, no woody plant can shoot freely, and develop its parts, whatever be the richness of the soil. The fibrous roots, as has been shown in Section IV., absorb the juices by means of introsusception; but the quantity absorbed does not depend alone on the quantity existing in the soil, but on the number of the absorbing fibres. The more we can comminuate the soil, the more those fibres will be increased, the more this nourishment will be absorbed, and the more vigorous and healthy the plant will become.

Further: Comminution of parts increases capillary attraction, or the sponge-like property of soils, by which their humidity is rendered more uniform, and more effective. It is evident, that where the particles of earth are the most minutely divided, capillary attraction must be the greatest; for gravels and sands hardly retain water, while clays, not opened by pulverization, either do not absorb water at all, or, when by long action it is absorbed in a superabundant quantity, it is not readily discharged. Water is necessary to the growth of plants: it is essential to the juices or extract of the vegetable matter which they contain; and unless the soil, by means of comminution, be fitted to retain the quantity of water requisite to produce those juices, the addition of manure will be useless. Manure is ineffectual towards vegetation, until it become soluble in water; and it would remain useless in a state of solution, if it so abounded as utterly to exclude air; for in that case, the fibres or mouths of plants would be unable to perform their functions, and they would soon drop off by decay.

The temperature of soils, which few planters take into their consideration, is singularly improved by their being pulverized. Earths, as Griesenthwaite remarks, are among the worst conductors of heat which we know; consequently, it would require a considerable time, ere the gradually increasing temperature of spring could communicate its genial warmth to the roots of plants, if their lower parts were not heated by other means. To remove this defect, which always belongs to a close or dense soil, it is essentially necessary to have the land open, so that there may be a free ingress to the genial air, and tepid rains of spring.

Water, moreover, is known to be a condenser and solvent of carbonic acid gas, which, when the ground is open, can be carried immediately to the roots of vegetables, and probably contributes to their growth. But if the land be close, and the water lie on, or near the surface, then the carbonic acid gas, which always exists in the atmosphere, and is carried down by the rains, will soon be dissipated. Let it be observed also, that an open soil, besides being favourable to the transmission of nutriment to the roots of plants, is likewise favourable to their extension, and thereby enlarges the field whence nutriment is derived. Nor are these the only benefits resulting from a friable soil: for, in addition to its being the best adapted to supply the vegetables with food, it is always most suitable for effecting those changes in the manure itself, which are equally necessary to the preparation of such food; and animal and vegetable substances, exposed to the alternate action of heat, moisture, light and air, undergo spontaneous decompositions, which, independently of it, would not take place.

Soils are surprisingly benefited by aeration, and the free admission of the weather into their interior parts. This is generally considered as the principal use of fallowing; and its importance in gardening is proved by compost heaps, and both winter and summer ridging up. The precise advantages, however, of exposure to the air, independently of the concurrent influence of water, heat, and the other effects above mentioned, as resulting from pulverization, do not seem at present to be fully ascertained. It is admitted on all hands, that carbonic acid gas is absorbed by calcareous earths; and Dr. Thomson, who is among the ablest of our chemical writers, is of opinion, that the earths alone may thus, in all likelihood, administer food to plants. Sir H. Davy seems to consider mere exposure to the atmosphere as of no benefit whatever to soils: he, therefore, condemns fallowing as useless and unprofitable. But the reasons given for such an opinion are merely speculative, and founded on nothing experimental or conclusive; accordingly, they will convince no skilful agriculturist, nor no practical planter.

To these facts and observations we may add a suggestion of Darwin's, respecting temperature, which though fanciful, is ingenious, namely, that a certain portion of atmospheric air being always taken down into the soil, at the time of pulverization, its internal heat is thereby promoted, and its fertility increased. The confinement of the air occasions decomposition, by means of the moisture in the earthy portions. Ammonia is formed, by the union of the hydrogen of the water, with the nitrogen of the atmosphere, and nitre, by the union of oxygen and nitrogen. The oxygen likewise probably unites with the carbon contained in the soil, and forms carbonic acid gas, and carburetted hydrogen. Hence the heat given out, during these processes.

Such is a short, and very imperfect view of the manifold beneficial changes, which deepening and pulverizing effect in soils, according to the ingenious researches of Davy, Thomson, Griesenthwaite, and others, who have usefully laboured to render chemical researches subservient to rural purposes. Had Tull, who flourished about a century ago, been acquainted with chemistry, as at present improved, he would not have missed that permanent fame, to which his ingenuity so well entitled him. Tull was unquestionably the first practical advocate for the powers of pulverization; but he was deceived by its astonishing and various effects, without being able to perceive its limits. Hence he was led into the erroneous belief, that pulverization could even supply the place of manures, in farm management. Modern science, however, would have enabled him to discover, that, although the comminuating of soils incredibly multiplies the fibrous roots, or mouths of plants; although it also facilitates the speedy and perfect preparation of their food, and conducts the food so prepared more regularly to the roots, yet of food itself it does not communicate the smallest supply or portion, beyond what the soil actually possesses. As we cannot, in these times, fall into the error of Tull, let us not omit, for our present purpose, to put a due value on pulverization (which in husbandry of late, as connected with deepening, seems to be rather undervalued), while we endeavour, by the methods already pointed out, to add as much as possible to the vigour and food of woody plants.

Soils, then, may be most effectually improved by the planter, by altering their constituent parts, as has been above shown, either by the addition of ingredients, in which they are deficient, or by the subtraction of others, that too much abound in them; but in ordinary cases, chiefly in the former way, by admixture with other soils, and by the application of mineral manures. The best natural soils are certainly those, of which the materials have been derived from different strata; that have been minutely divided by air and water, and are intimately blended together. On this account, in improving soils by artificial methods, the husbandman or the arboriculturist cannot steer in so safe a course, as by studying the effects of intermixture, and imitating the chemistry of nature.

In preparing soils on these principles, for the removal of trees, the materials cannot often lie at a distance. In this quarter of the island, there is no man, possessing grounds of any extent, who has not the command of more than one sort of soil, especially in the mineral districts. In the Park here, three different species are found, namely, tenacious clay, strong loam, and light sand; and fortunately also, peat-moss in abundance near at hand. My practice, therefore, has been diligently to collect and make up masses or heaps of compost, in different parts of the grounds, adjacent to where the trees might be wanted, and to have them always ready for use, of not less than six months old. These masses are compounded usually in the following manner: First, quicklime recently burnt (called in Scotland "lime shells") with clayey matter, for the light land; Secondly, mild lime with sandy soil, for the aluminous; and Thirdly, quicklime with peat-moss, for the loamy. To each of the two soils first mentioned, I usually give an addition of about a third part of the peat compost; and by procuring the peat in rather an advanced state of decomposition, its speedy preparation is more easily brought about.

In this way, I conceive, I have succeeded, with the least possible expense of manure and labour, in preparing materials for improving the different soils, for the reception of the fibrous roots of trees. The clay compost, by means of the lime, being brought into a state of decomposition, surprisingly improves the silicious soil, by giving it greater consistency, in the same way that the same soil is benefited by marl, or calcareous matter. The sand compost, in like manner, still more powerfully acts on the aluminous soil.

As all soils are meliorated by lime, that do not effervesce with acids, and sands most remarkably, so the hard and adhesive qualities of the clay are subdued, by the action of the sand and lime united, its parts are comminuated, and the inert vegetable matter is brought into operation. The peat compost, for similar reasons, and by means of the lime which it contains, is well calculated to stimulate, and add vegetable matter to the loamy soil.

But the peat compost, for general application to all soils, I have found the most extensively useful of the whole, if prepared with a third part of animal manure, or fresh farm-yard dung, according to the fermenting process, discovered by the late Lord Meadowbank, whose memory will be immortal with both the husbandman and the arboriculturist. For thin gravelly soil, where a considerable quantity of carbonaceous matter is required to supply its wants, this compost, if properly made, will be found even preferable to ordinary animal manure, as containing much more carbon, and continuing its action longer on the ground. Even when prepared with quicklime only, recently burnt and slacked, that is, hydrate of lime, one-fifth part of lime to four-fifths of peat, it is extremely valuable, from its loose and friable properties, and the fine state of comminution, to which it may be readily brought. Quicklime, when it becomes mild, operates in the same way as chalk; but, in the act of becoming mild, it has the power of preparing soluble out of insoluble matter. Hence its great effect on peat, and on all soils containing an excess of vegetable insoluble matter. But for peat compost of either species to operate fully in preparing the soil for the fibrous roots of plants, it should be mixed in the ground, for at least a twelvemonth before the trees are removed, so that, on opening the pits for the second time, it shall have *nearly disappeared*, in consequence of its complete and perfect incorporation with the soil.

This last method of decomposing peat, we owe to a very ingenious and scientific nobleman, the Earl of Dundonald, whose memory will also be long held in grateful remembrance by his countrymen. This distinguished chemist was the first writer, who, nearly half a century ago, pointed out the means of rendering agriculture a new art, by the aid of chemistry, in which he has been since followed by Kirwan, by Sir H. Davy, and other ingenious authors. The general error then and still committed, in the making up of lime compost, is the use of the lime in far too great a proportion, thereby reducing the peat to charcoal, and dissipating in a gaseous state its most useful component parts. Thus, the lime is rendered nearly effete and powerless, and brought back to the state of mere chalk, instead of forming such a combination with the peat, and the gas generated in the process, as, on being applied to the soil, should promote the growth of plants.

In the same way, a want of success not less remarkable has been experienced, in preparing dung compost, according to the fermenting process discovered by Lord Meadowbank. This, I conceive, has proceeded chiefly from two causes; first, the want of skill in providing peat of a proper quality, and in a state fitted to undergo the fermenting process with effect; and secondly, in applying the dung in too exhausted a condition; both of which tend to prevent the antiseptic qualities of the moss from being counteracted, and the peat from being rendered soluble. For the methods, which have been suggested by experience, for the improvement of both of these valuable composts, the agricultural reader, as well as the planter, is referred to the notes, which may probably be found interesting to both.*

There is one circumstance, which deserves particular attention, in preparing this valuable compost. It is observable in the southern, as well as in the northern division of the

* Note III.

island, that peat-moss is found of very different qualities, and has frequently some portion of iron combined with it, united with sulphuric acid. This is a mixture, which in excess is pernicious to vegetation and to the growth of woody plants It therefore becomes necessary to destroy or neutralize it, by admixture with other substances. The respectable judge above mentioned says, that all his peat at Meadowbank was so contaminated. Some part of the peat at this place is unfortunately of the same species, and many of my crops, as well as trees, were injured by it, before the cause was discovered. When the peat is taken from the pit, and laid out to dry in the heap, the sulphate of iron is easily distinguished, by an efflorescence of small white crystals of an astringent taste appearing on the surface, and also a strong sulphureous smell, on its being burnt, or exposed to the rays of the sun.

The remedy suggested by the learned judge I have found perfectly effectual, in attenuating or counteracting these pernicious ingredients, namely, to add to the dunghill or compost, in preparing it for fermentation, a certain proportion of coal, wood, or peat ashes; he says, a twenty-eighth part; or, in default of these, half the quantity of slacked lime. Lime is the substance, which has been used here, but in a rather larger proportion than that which Lord Meadowbank recommends.* It gives me, however, particular satisfaction to find, that I am borne out in my partiality to peat compost, as a *general and useful manure*, by the practice as well as the opinion of a writer, who was himself a skilful planter, and a chemist of considerable experience.

The transplanting of large trees and underwood is practised for two different purposes; First, for procuring Single Trees, and Open dispositions of Wood in the park; and Secondly, for raising at once Close Woods or Plantations, for

* Directions for preparing Manure from Peat, p. 33.

shelter or ornament. Hence the preparation of the soil is to be considered, in reference to those two separate purposes or heads, which shall be examined in their order. And here, as in may instances, which occur in the sequel, I entertain great doubt of being able to make myself distinctly understood. It is one thing to be acquainted with a series of daily practices and manual operations, and another to render a minute detail of them, of their causes, and consequences, and various application intelligible to the reader. Language from its nature often treats more clearly of abstract ideas, and general truths, than of sensible or material objects; and there are processes in all arts, which a single glance of the eye will more fully explain, than whole pages of description. On this account, I stand greatly in need of the indulgence of the reader; and I shall endeavour to deserve it, by studying perspicuity in the delineations which are to follow, in this and other sections, and conciseness also, in as far as the peculiarities of a new subject will admit.

First, then, as to the preparation of the soil for single trees, and open dispositions of wood. It has been said above, that no trees of magnitude can be raised, without very considerable depth of soil. No tree transplanted should have less than from eighteen inches to two feet deep of mould, prepared and enriched according to the above principles, to some distance round the plant. If park-planting be intended, the first thing to be done is, to mark out with stakes the site or position of the single and scattered trees, or groups of two, three, or more; a work of no small nicety and difficulty in any case, and which, where the prominent parts of a place are concerned, cannot be trusted to inferior hands. Here an art is in requisition of a far higher and more difficult class than the mere planting of trees, I mean the art of designing real landscape, or landscape composed of nature's own materials: for, as these open or loose dispositions of wood form often the principal features of the picture, or its accessories, to disperse them with skill and effect, implies no mean acquaintance with this superior art.

As single trees, in respect to site, are wholly unconnected with one another, the pits for them are to be made separately. For this purpose, the ground, supposing it to be tolerably rich and deep, with a porous subsoil (that is, a subsoil of sand, gravel, or rock, or combinations of them), is to be trenched to the depth of nearly two feet; which depth is six inches more than common gardeners' trenching. The latter is usually executed two spits deep, with two intermediate shovellings; but in the work in question, we should go down between three and four spits, without any shovellings. The method last mentioned tends to increase pulverization, and especially a more general intermixture of the different portions of the soil, without increasing the expense of the work.* For a pit of this description, two, or at most three cart-loads of the proper compost, are sufficient (I mean single carts, or carts drawn by one horse), if mixed according to the principles above laid down. If the soil be sandy or gravelly, the clay compost should be used; if clayey, the sand compost; with the addition of one third-part of the peat, or general compost, which, as said above, is applicable to all soils. Should the soil be deep and loamy, the last mentioned is probably the compost best suited to divide into parts the fresh mould brought up, and to excite a general chemical action throughout the mass.

In executing the trenching, if the pit be to stand for a twelvemonth or more, before transplanting, the compost is to be laid down in half-loads round the stake, which marks out the site of the pit, and at such a distance, as not to obstruct the workmen. The dimensions are then to be marked out for middle-sized trees, of from five-and-twenty to eight-and-twenty feet high, in a circular form, and at two "spades" and

* Note IV.

a half distant from the stake, or about eighteen feet diameter. This is the mode of measuring usual among our workmen; the spade being that superior and efficient implement, about three feet eight inches long, called the "Scotch spade," with an iron handle at the upper end of the shaft, and not the common garden spade, which is of little use, except for stirring loose mould.

Supposing the subsoil to be sand or gravel, and of a sufficient depth to admit of the pit prescribed, the next thing to be done is, to wheel away, from the side at which you are to begin, as much earth as will close in the last trench, and to lay it down for the purpose, on the opposite side of the pit. The compost being of two kinds, clayey and peaty, as already described, should be dashed on, or scattered like lime upon a field, as the trenching proceeds, over the entire surface of the work, so as to mix the whole in the completest manner; and when the trench is closed in at the further side, it should lie for a twelvemonth, as before stated.

Supposing, on the other hand, that the soil be deficient in the competent depth (a thing which has unfortunately too often happened at this place,) there is no remedy but to supply the want with earth brought from some other quarter. A few cart-loads are all, that in most instances are required; and a little practice will teach the planter to procure it, from the cleanings of drains or ditches, from natural hollows in woods, and such like places, where calcareous earth is sure to be collected. The best way is, to take it out in strips or lines of only one spit wide, and of the same depth; by which means, no material injury will be done to the ground by the operation.

In supplying such earth, let it be remembered that rich mould is not essentially necessary, and that soil even of a *very* inferior quality will answer the purpose. Every one must have observed the readiness with which the roots of trees find their way into a mound of earth of *any* quality whatever, that has been stirred, and consequently comminuated, by being forced up beyond the natural level of the surface; a fact, which demonstrates in a striking manner the justness of the principle, that to render any soil pervious to air and water, and to render it fertile, are almost synonymous terms. With a mass of earth so prepared, and to between eighteen inches and two feet out beyond the length of the roots, both roots and branches will soon be stimulated to greater multiplicity and more vigorous extension; and the former may be then safely trusted to seek food for themselves, over the natural surface of the ground. Should a still greater range of pabulum, or of deepened soil be requisite for particular trees, it will be easy to provide it, after the trees are transplanted; as such masses of earth, as these pits contain, can be extended at pleasure, and both the shape and the quality of the ground at the same time be improved.

Supposing the soil and subsoil to be clayey and tenacious, particular caution must be observed in trenching, to leave the substratum untouched; and the safest method in all cases is, to penetrate no deeper than the improved and friable mould extends, which is always permeable by moisture. But, should the workmen unfortunately, through ignorance or inattention, penetrate such a subsoil, a pool of water would be formed by the first rains that fell, of the size of the pit, where, being held as in a cup, the roots of the tree would be chilled on its removal, and the tree itself probably killed, in the first season.

Supposing further, that from necessity, or perhaps from choice, the planter cannot wait the prescribed space of a twelvemonth, for the most propitious time for removal, and will be content with a less perfect comminution, and a less intimate incorporation of the materials, let him proceed as follows. Having maked out the pit and its dimensions, and laid the compost, or extra earth, or both, as the case may be, round the outside, let the workmen, in the first place, spade the whole into the centre at the stake; and mixing it as much as possible by that operation, form a high and narrow heap round the stake. Let them next open the pit to the depth wanted, as before noticed; but, instead of trenching or double-digging, they must turn out the contents to the outside edges; throwing over, for every stratum of a spit deep, a corresponding stratum of the mixed mass from the centre, till the pit is thus excavated to the proper depth. As soon as the stake is driven down, the workmen begin, each at a different part of the mound thrown out, and work round the pit, so as to give a sort of half-trenching or turning over to the mound, by tossing it to and fro, throughout its whole extent. The contents being in the loosest possible state, this can be done with great rapidity; and when the workmen meet in the half-trenching, the business is completed. The pit is then ready for the immediate planting of the tree. Thus, the greatest comminution of these mingled ingredients is obtained with the least labour, and by only once throwing out; but the most *intimate* mixture is absolutely necessary. It is true, that the process, however compendious, is an imperfect succedaneum to the slower maceration or preparation by nature: but an entire year is saved by adopting this method, which at times may be of consequence to the owner of a place; while there are not perhaps many gardeners, who can boast of their hothouse mould being of a texture more perfect than that which has been produced by it.

Next, as to groups and larger masses. By a group of trees is to be understood any number from two (which is the smallest group) to ten, or more, in the lawn or park, intended for some particular effect. As the distances between the trees are generally from sixteen to twenty feet, according to the ground, it is obvious, that, after trenching as many large spaces or circles as there are trees in the group, not more than a third part of the whole space or area occupied will remain solid or untouched, between the circles. In all cases of this sort, I should much recommend, that the *entire area*, comprising all the trees of the group, be trenched at once, and reaching to at least five yards beyond the stakes, which mark the outside plants. Thus, the labour of wheeling earth, to close in the work at each particular space or circle, is saved, and a much wider range given to the roots to extend freely. In fact, the number of additional or extra poles of ground to be turned over is trifling, whilst a considerable saving is made, in the lesser depth of the trench required, particularly on stiff land, and a great additional value conferred on the ground itself.

There is no soil, of which the produce, whether in grain-crops or in pasture, will not be *increased by the one half*, in consequence of such stirring and deepening; and there are many soils, those of a thin quality in particular, on which these processes will *double the produce*, if the new earth brought up be properly pulverized, and manured with compost. Besides, from poor clays, and lands inclined to moisture it will banish rushes effectually (if rushes be produced by surface causes,) one of the most troublesome weeds which we have to eradicate. It is unnecessary to pursue the subject further in this place, although it has hitherto attracted no general notice. But, as it rises greatly in the scale of interest and consequence, from its importance to both husbandry and arboriculture, it may be worth while to give the details and explanations in a Note below, to which I refer the inquisitive reader.*

In trenching entire spaces or areas for groups, moreover, two important savings are made in the execution of the work. First, in the trenching itself; as not more than eighteen inches are necessary for the deepening a light soil, and one that is heavy, not more than twenty inches. This saving obviously results from the far greater and more uni-

* Note V.

form scope, that is given for the elongation of the roots, on a space of ground of such increased magnitude. The second saving is, that on such a space, it is very seldom that any extra earth can be wanted, in order to supply a deficiency of soil, as must sometimes happen with single trees. On clayey land, you may freely go down, and procure the depth required ; because no water can stagnate, where there is no pit to hold it, but where the entire bottom of the space, or area trenched, is worked to a uniform level, that is, a slope-level, so as to carry off the water collected from the surface ; and hence the great excellence of deep trenching in every case. The only case which can require an aid of extra earth to the soil, is where pure sand or gravel, as on small eminences, rises nearly to the surface, and where there is next to nothing to form the nourishment of plants.

During the trenching of the spaces, it is advisable to give the work a good dressing of compost of a quality directly opposite to the quality of the soil, and to be dashed on, thinly and frequently, over the face or front of the new earth thrown up. If this be abundantly done, one extra cart-load of compost (I mean a single cart) for each tree is sufficient, not omitting a third part more of the peaty or general compost, to finish the preparation. The inexperienced planter may rely upon it, that there is no improvement more certain than this of trenching at once the whole area which a group comprises, instead of the preparation of pits for individual trees. It is not always that the best style of work proves the cheapest in the *beginning*, however it may in general turn out in the *end*. But in the present instance, the most perfect economy is united with the most perfect efficiency, and the success of the trees, and the improvement of the ground are equally consulted.

It is to be noticed, that the work of preparation, in every situation where it is convenient, should be done a year at least before the removal of the trees. This is a maxim fully as important and deserving of consideration, as any one that has been delivered in the present Section. Although somewhat may be lost, in missing the carbonic acid gas, and the genial influence of the atmosphere, which are introduced during the work, in order to excite vegetation, yet a superior object is gained, by a fuller incorporation of the compost with the soil, during the renewed comminution of the whole, when the planting takes place. No doubt, an excellent soil, as has been already seen, may be obtained at the moment, and under the pressure of circumstances, by ingenuity and skill. But it will be found by experience, that there is no case, in which a little time and patience is better laid out than in the present, as may be proved by the relative progress of trees that have been planted in the one way, and in the other. I can speak from repeated experience as to the fact, during the last twenty years, when from haste, or impatience, or other motive, I have been induced to sacrifice science to convenience, and to work the pits, and remove the trees at one and the same time. On one and all of those occasions, I felt, as in many other things, that I was following the worse course, with the better all the while before my eyes.

In planting new approaches, in wooding the banks of lakes or rivers, by means of the transplanting machine; in giving additional woody features to grounds near the mansion-house; and, in a word, wherever numerous groups or scattered trees are wanted for immediate effect, I earnestly recommend this method to be followed. In an approach, for example, fifty or sixty yards broad, or more, as circumstances may require, should be trenched and prepared, as above, on each side the carriage-way; and a similar space on the bank of a lake or river. In any less space, there would not be room to group and scatter the trees with a due regard to landscape effect. As to the returning of the ground to grass, although the rest of the park be in pasture at the time, it is not a very formidable task. It may be fenced with hurdles for three months, after being properly dressed, and sown down with grass-seeds, if the space or area of the ground trenched be large; and if it be trifling, it needs not to be fenced at all, where sheep are the stock upon the ground. The superior chance, which is by this system given to trees to rise speedily to great timber, and the increased facility to the work of removal, ought to be sufficient inducements to the owner of a place, particularly in new designs, to adopt the system. But when it is considered, that the extra expense of trenching an acre, or two acres at once, for these objects, is repaid more than twofold, by the additional yearly value of the ground, there must be *gain* rather than loss, by following the culture recommended.

We now come to the second head, namely, close woods and plantations. Close plantations, raised by means of the transplanting machine, may be desirable, whether at old places or new, for various purposes, where the immediate effect of wood is wanted, for concealing objects, for example, that require concealment; for adding features to the foreground of the landscape; or for giving accompaniments to water, and the like. These plantations consist of standard or grove wood, at from eighteen to twenty feet from tree to tree, with copse or underwood at five or six feet, occupying the intervals.

When the plantation is marked out, the first thing to be done is, soon after the autumn, to trench or double-dig the ground, eighteen inches deep, in light or silicious soils, and twenty inches at least, in clayey or aluminous. During the course of the trenching, if a manuring of compost can be spared, it is an obvious improvement to dash it on, over the slope of the earth thrown up, in order to promote a comminution of, and to give an incitement to the new earth, which had never before been exposed to the air. But that is not essentially necessary in this stage of the business.

By the month of April, the winter frosts will have mellowed and made friable the new soil, especially if aluminous; which greatly assists the pulverization or comminution of its parts. The ground is next well dunged for a potatoe-crop, with ordinary animal manure, or better, peat compost, made with farm-yard dung, according to the fermenting process of Lord Meadowbank, and twice heated and turned. In default of compost during the trenching, particularly if the subsoil be clay, it is advisable, soon after the potatoes are planted, to hoe into the drills as much slacked lime, in fine powder, as is generally used to a wheat crop, that is, about a hundred and fifty or sixty bushels per acre. This treatment surprisingly tends to comminuate the subsoil turned up; it brings the hard or inert substances contained in it into a state of decomposition or solution, and renders them the proper food of plants. If the process be conducted with common judgment, the value of the potatoe-crop cannot be less than from 20*l.* to 25*l.* per Scotch acre (I have myself drawn 30*l.* under favourable circumstances;) and it fully pays the labour and manure laid out, and perhaps some rent besides. By the succeeding season, the ground will be in a good condition to be planted; after which, it should be kept with the hoe for three years.

In so far, then, the mode of preparing the ground for close plantations is superior, in point of economical arrangement, to the preparation for open dispositions of wood, as it is clear that it may be prepared *without expense to the owner.* By the directions here given, the soil in the latter is more pulverized, and approaches, if well managed, to the state of fine dark-coloured mould, such as is used for a vinery, and superior to that of most vineries. In the former, what is deficient in fineness is often compensated by variety, and by the extensive scope, which it gives to the roots to search for their food.

On considering these various methods of improving soils, for the use of woody plants, the great, and indeed paramount importance of subsoils cannot fail to strike the reader. In fact, the latter may be said, in a great measure, to command and render subordinate the actual properties of the former, rendering them favourable or unfavourable, according to their own peculiar character. The first question that is asked by a skilful planter, on surveying a place for the first time, is not respecting the soil, but the subsoil. If that be propitious, he is comparatively indifferent as to the superincumbent strata. All soils are susceptible of melioration, from the most silicious to the most argillaceous. Their pernicious ingredients can often be modified, if they cannot be altered, as we have already seen; but subsoils are the gift of nature, for evil or for good, and always lie beyond the reach of our improvement. In order that the reader may form a right judgment of both their favourable and unfavourable properties, for the growth of wood, the following short view is subjoined of the merits of both.

The most favourable subsoils are those, through which the excess of water, received in rainy seasons, is allowed slowly to percolate, and which retain moisture sufficient for the sustenance of plants. First, close-lying strata; in which a considerable proportion of sand and fine gravel is intimately mixed. Secondly, free-stone; provided a bed of hard and impermeable clay do not intervene between it and the soil, which sometimes happens. And thirdly, a kind of greenstone (Scotticè, rotten whin,) which is the most favourable of all, when there is over it a sufficient depth of mould, for the above purposes. Such, for example, are the soil and subsoil of that favourite tract of country, at the foot of the Ochill and other hills in Stirlingshire and Perthshire, so well known for the growth of its timber. Here it descends in a gradual slope, from the hills towards the river Forth, both east and west of the town of Stirling, while the river slowly winds through the rich, but alluvial plain below. In this sort of subsoil, the excess of the water collected from the sky, and the heights above, passes through the fissures, and is received and retained in its subterraneous cavities; by which means the rock, being always damp, and never exsiccated, can communicate its moisture to the soil above, in seasons of drought. It is true, this rock sends out frequent springs, from its internal reservoirs, to the surface: but they are often useful, instead of being pernicious; and they may generally be carried off, by drains of inconsiderable depth, if cut across the outcropping extremity of the rock.

The subsoils of an unfavourable quality are, First, such as are composed of dense and argillaceous substances, through which no water can pass, it being retained stagnant at the bottom of the soil. In this situation, it has the most injurious effects, not only by chilling the roots that reach it, but by disabling the soil from exerting that sort of repulsive force, which, as has been seen, is necessary to fertility. Secondly, those open beds of loose stones and sand, from the bottom of which water is readily drawn off, by subterraneous outlets. These strata are sometimes continuous, but they oftener occur in narrow lines or strips; they are named "scalds" by the Norfolk farmers, and are as injurious to crops in a wet, as in a dry season. Thirdly, there may be added those extensive ranges, or strata of dry rocks, of a hard texture, composed of slate, sometimes granite, but most commonly of gneiss, accompanied in some districts with a considerable proportion of iron, probably in the state of orange oxide. These rocks run in long ridges through the districts where they lie, sometimes narrow, and sometimes of a considerable breadth. They are dry to a great breadth, and full of fissures, through which the water quickly passes. The orange oxide always appears in thin lamina among the fissures. As they are, like the sandy bottoms, not retentive of water, all vegetation is destroyed in dry seasons, on the soils which cover them, and woods, were they planted there, would share the same fate. When these rocks are near the surface, the oxide with which they abound is generally injurious to vegetable life, and trees die, as soon as their roots come in contact with it. Of these rocky strata the greater part of the Western Highlands and islands of Scotland furnish remarkable examples, excluding, of course, in most districts, the ingredient of iron. But it is from a want of soil, and not of climate, that woods of any given extent cannot be got up in those unsheltered, but romantic regions. Nature is every where impartial in her gifts. Where wood abounds, the character of a district is often tame and uninteresting. Were the grand scenery of these "high-featured countries," their sublime mountains, and blue lakes crowned with the forests of the south, they would in point of picturesque beauty be the paradise of the earth.

Happy, then, is the planter, who has none of these dry rocks for his subsoil ; for it clearly appears that neither general planting, nor removal of trees is possible, of whatever size, where they are present. Still happier is he, who, with clay and sand intermingled beneath his surface, or even with those untoward substances separately composing his soils, can by industry and skill prepare them for his purpose. But happiest certainly of all is the man, who can boast the possession of that enviable greenstone or rotten whin, with the deep, friable, and dark-coloured mould of the Ochills superincumbent on it; for then he may plant or remove whatever trees he pleases, and without preparation either chemical or mechanical.

In conclusion, I have to observe, that there is perhaps some reason to claim the indulgence of the general reader, for the seemingly elaborate manner in which I have been obliged to point out the chemical and scientific principles, on which soils should be improved, and rendered proper for the food of plants. It has been said above, and it cannot be too often repeated, or too earnestly enforced, that it is by principles drawn from nature, and elucidated by science, that any real progress can be made in an art like the one under discussion, where nature and science must unite in regulating the process, and art must follow in the track which they prescribe.

SECTION VII.

PREPARATION OF THE TREES FOR REMOVAL.

It has been said above, that the removal of large trees is applicable to two different objects, namely, single trees, or open dispositions of wood, and to close plantations; which last consist of grove and underwood intermixed. Now, as the former much more frequently occur in practice than the latter, so transplanting may be generally said, as has been already noticed, to imply increased exposure.

By the wise economy of nature, it has been provided, that trees in open situations, in order to thrive, must possess certain external conditions, which have been designated the protecting properties. Therefore, the principle of transplanting lies, in adopting such subjects as possess those properties, wherever they can be found, and in communicating them to others, in which they may be deficient. It is obvious that trees, endued with the protecting properties or prerequisites, require no preparation at all; and that those trees, which possess them partially or inadequately, require it precisely in the ratio or degree of that inadequate possession. Further, it is apparent, as these properties must be either protecting or non-protecting, or a modification of the one or the other, so the complete presence of the one class of properties necessarily implies the absence of the other class. But both may nevertheless exist at one and the same time, in different parts of the same tree. For the purpose of removal, for example, such a plant may possess fibrous roots, and spreading branches (two of the protecting properties, which are generally concomitant,) yet it may be deficient in both bark and stem. In like manner, it may have desirable stem and bark (two properties likewise, which usually go together,) and yet fail in branches and roots.

It is a great error to imagine, with the early planters, and as is still done by many, that the business of preparation applies solely to roots. As well might it be imagined, that the roots carry up the sap to the top; that they elaborate it in the leaves; that they transmit it to the stem and branches; and, in a word, that this single organ performs all the various functions which exist in a complicated system. When the ingenious Lord Fitzharding, as we learn from Evelyn, thought of cutting round the roots of trees, in order to multiply their lateral fibres, it cannot be deemed surprising, that he should have been unaware how small a part of the work of preparation he had effected by that invention. But it is much more extraordinary, that, during the many years that my practice has been open to general inspection, it should never occur to any one, that its success did not depend merely on the roots, but must be governed by some general and fixed principles: for, to this day, when the roots of trees are cut round, as is often done, they are said to be "*fully prepared* according to *my* method;" while the planter, who so prepares them, does not suspect, that he is merely fulfilling one of *four* conditions, which are pointed out by that method. But perhaps it was not supposed that a process, seemingly so simple as transplanting appeared to be, in the hands of my workmen, required any principle at all to regulate it.

It has been stated in a foregoing Section, that the perfect and internal development of woody plants is dependent on certain external conditions; and that, when those conditions are imperfectly supplied, this development cannot take place. It has been further observed, that the most perfect development in all cases appears manifest, where the protecting properties are most fully displayed. If these things be true, it will follow, that to prepare trees for removal only means, to allow nature, if I may so speak, to do her own work: and that we shall always best accomplish, by clearing away those accidental obstacles, and mechanical impediments, which are sometimes thrown in her way; as they obstruct and misdirect the simple, but efficient methods which she employs, towards the accomplishment of one of the most beautiful, as well as complicated of her processes. The difficulty lies in administering to nature discreetly; neither officiously directing her on the one hand, nor rudely controlling her on the other.

The main obstacle or impediment to the acquisition of the protecting properties in trees, is shelter and closeness, or the want of a sufficient action of the atmosphere around them. Vegetable, like animal life, is dependent for its existence on the external conditions of food, air, water, and heat, while light is a condition more peculiar to plants. Where trees, as in unthinned plantations, press too closely on one another, the range which the roots require for their food, is circumscribed. Wind being in a great degree excluded, and evaporation prevented, heat is by consequence generated in an undue degree. In the same way, light is nearly shut out from such plantations, except from the top, and a disproportioned elongation of the stem is occasioned, by the efforts which each individual makes to gain the light. By these means, the bark becomes thinner and more delicate, the roots more scanty, and the spray and branches more open and sparing, than when there is a greater action of the atmosphere, and a freer access of light. Thus, by the law of nature, by which trees accommodate themselves to the circumstances in which they are placed, as the possession of the non-protecting properties does not constitute the most natural, or most perfect state of trees, but is superinduced by circumstances; so that state must be improved by the alteration of such circumstances, and the possession of the opposite or protecting properties be substituted in its stead. The planter therefore, in ordinary cases, if he act with judgment, has little more to do, than to bring about a gradual, a salutary, and in the end a *free exposure* of trees to the elements, and their own native energies and plastic powers will do every thing else for themselves.

Having explained as distinctly as I can the true principle, on which the preparation of trees should be made, I will now proceed to point out the practice. Subjects for removal may be prepared in two different ways, or, more properly speaking, in two different classes, namely, as single trees, each independently of the other; or as masses, especially trained and disciplined for the purpose.

And first, as to single or individual trees. It has been already noticed, that many trees stand in need of no preparation at all, but may immediately be taken up, and removed to where they are wanted. If what has been said above, on the selection of subjects, be fully apprehended by the reader, he will have little difficulty in regulating his choice, and determining what subjects really possess the four essential prerequisites, or protecting properties: because proper preparation, and the possession of those properties, may be considered as nearly convertible terms. About every place, great or small, such subjects are always to be found in pretty open dispositions, in old grass-plots or avenues, in woodlands near the flower or kitchen garden, and the like, where the ground is usually kept under the sythe. Here, if the soil be loose and deep, that is, if it afford good rooting-ground, you are sure to find tolerable subjects, which may be immediately taken up, in the manner hereafter to be described. Even subjects drawn from hedge-rows may be pressed into the service, provided their roots have not too deeply penetrated the mound, on which the hedge is planted, or provided you have a soil of suitable depth to receive them. It is not necessary, as already explained in Sect. V., that every subject fit for immediate transplantation should be endued in the *fullest* manner with the protecting properties. They need only to possess such a proportion of them, as is *sufficient for the exposure, in which the tree is to be placed.* By a sound judgment exercised in this particular, and by the help of an experienced eye, much useful work may be done with trees taken up at once, and the most surprising improvements made, at a small expense. This, I find, is a part of the business, which has not been at all understood, as *indiscriminate preparation* is generally conceived to be necessary; a supposition implying needless expense, and quite contrary to judicious practice.

To prepare single or individual trees, is often a work of difficulty, as well as time. It frequently happens, that they may be found in a free exposure, and have good bark and stems; but in such an exposure, they are frequently defective in branches or roots, or both, in consequence of mechanical injury suffered from other trees. If the branches be tolerable, but the roots deficient, by being long and scraggy, they are to be cut round, according to Lord Fitzharding's method, with some improvements, which have been made on that operation. If the deficiency lie in both branches and roots, a different method must be adopted; as it is plain that branches and roots, being relative and correlative, the former could not possibly be got to extend, were so severe a discipline to be practised on the latter.

To meet this difficulty with any counteracting effect, I have found but one method, which, although opposite to gardener's practice, is deserving of the notice of the planter. Instead of digging among, and disturbing the roots for the introduction of manure, let about a cart-load of peat-compost be taken, carefully prepared, as above, and in the most perfect state of pulverization, or coal ashes of a like quantity, for a tree five-and-twenty feet high; to which let four or five cart-loads of any tolerable soil be added, of an opposite quality if possible to that of the ground; and let the whole be laid down round the tree, and about four feet out from it. Let three workmen proceed to throw these materials close to the stem, two throwing the earth, and one throwing the compost in a regular manner, and scattering the whole in the way of lime on a field of fallow. Let the workmen next half-trench the heap, as directed above in the foregoing section, and intimately mix and toss it backwards and forwards, for the same purpose. Lastly, let them spread it in a sloping direction outwards, to the extent of the roots; keeping it at the extremities four inches thick, and at the stem about three times that thickness. Should there not be materials enough to accomplish this, an additional quantity must be procured. Into this loose and friable mould the genial rains of spring will readily enter, and, carrying with them the carbonic acid gas of the atmosphere, render the whole the most desirable food for plants. Thus excited, the fibrous roots, which always strike upwards, will, during the first year, nearly pervade the mass; by which means, both the roots and the branches will soon be improved, and the tree itself be in a proper condition for taking up, after the third or fourth season.

On the other hand, should the branches be tolerable, at least for a spiral tree, and the roots defective, in consequence of tenacity of soil, or mechanical injury done by other trees, let the following improved method of cutting round be followed.

In the first place, supposing the plant to be five-and-twenty feet high, as before, let a trench thirty inches wide be opened round it, at the distance of three feet and a half, if you mean to let it stand for four years, or more, after the operation, and at the distance of six or seven feet, if you mean to let it stand only two years. For, let it be remembered, that no tree can with propriety be taken up, on a single year's growth, after cutting round; because, in that case, the fresh shoots of the fibres being nearly as tender as the roots of an onion or a cabbage, can neither be extricated nor handled, without sensible injury.

Supposing the first case, and that the tree be to stand for four or more years, the operation is simple. Let the trench be cut fully to the depth of the subsoil, rather excavating the bank, in order to get somewhat underneath the roots; or, in the case of taprooted plants (as the oak or elm,) going down nearly a foot deeper still, and opening a drain or outlet on the lower side, to prevent a stagnation of water, if the subsoil be tenacious. After this, the earth may be returned well broken down into the trench; taking care to put in the surface-mould first, in order to afford the best pabulum or nourishment to the young fibres, which may be expected at once to strike into it. Previously to the last mentioned operation, it would certainly be an improvement, if a little compost could be spared, to mix through the mass; but that is an improvement which I have seldom had time to practise.

Supposing the second case, and that the tree be to stand only two years, the same method may be followed, but with this difference, that on the south and southwest sides, two, or perhaps three of the strongest roots should be left uncut, and allowed to pass entire through the trench; so that, when taken up at their full length, they can act as stays against the winds, which may assail it from those quarters. Something like this, as Evelyn informs us, was done in his time by Lord Fitzharding.* As to "forcing down trees upon their sides," so as to cut the taproot, which seems to have been practised by that nobleman, it may answer with subjects such as his, which were of the "bigness only of his thigh:" but, with heavy trees, besides endangering their

* Silva, Vol. I. p. 102.

stability, it would be imprudent too severely to reduce their strength, by cutting at one and the same time their downward, and their lateral roots. As to the taproot, my practice always has been to leave it untouched, until the tree be taken up. The power of renovation which it unquestionably possesses, and the erroneous opinions of some respecting it, are points that have been sufficiently illustrated, in Section IV. and the Notes, so as to satisfy any phytologist of the striking analogy, which subsists between the branches and the roots, and that if shortening may be safely practised on the one, it cannot be injurious to the other.

Before we quit the subject of preparing individual trees, it may be proper to repeat what has been already stated, that it is an error to imagine, as is done by many, that cutting round is an operation which should *always* be resorted to. When advisable, however, two good consequences result from it. In the first place, it gives superior facility both in the taking up, and the replanting of the tree; and in the second place, it furnishes a vast multiplicity of fibrous roots, far more numerous than could be furnished by unassisted nature; and these act as so many superadded mouths, to take up, by means of introsusception, the food proper for the nourishment of the plant. This, we should reflect, is the more peculiarly needful in a process so violent as transplanting, however carefully performed and scientifically directed, must imply.

Next, as to the preparation of trees in large masses. In executing designs of any extent, where many subjects are wanted, this comes to be a work of necessity as well as importance, because materials for such designs could not be furnished by individual trees. It is therefore proper, that it should be done with the least possible expense and labour. For any design great or small, a separate spot, which I have called a transplanting nursery, is extremely desirable, as contributing in an eminent degree to the facility, not less than to the accuracy of the work. Here subjects of all denominations may be most conveniently trained and disciplined. From a nursery like this, as from a great repository of materials, high and low, light and massive, spreading and spiral trees may be brought forth at pleasure, as may best suit the planter's design; and without throwing away or misapplying the prerequisites for success, he may have the power of wooding the highest, as well as the lowest parts of his grounds. The fact is, that all grove-wood from about twenty to forty years' growth, if properly thinned and pruned, after the first ten or twelve years, so as that the tops are never after allowed to touch one another, may be esteemed the best transplanting nurseries of any, provided that the soil be loose and friable; but there is no necessity for its being extremely deep. On the contrary, a thin clay, or peaty loam is a desirable soil for training various trees, such as the oak, the beech, and the birch, as it gives great facilities, both in the preparing and taking up. Woody glades, or small forest lawns, left open in the original planting of a place, are likewise most commodious as sites for nursery-ground. But to find woods or plantations so trained, for a series of years, to wide distances, is extremely rare, although valuable when they are found. I know but one example, in this part of the country, to the extent of from fifteen to twenty acres. But there may easily be others that have escaped my notice. A department, however, of the woodland of a place, of the age just now mentioned, retired from the view, but little sheltered by surrounding objects, is the most favourable situation, both for the convenience, and the efficiency of the nursery.

I once more entreat the forgiveness of the reader, for here obtruding some further account of my own practice. But should he have any extent of grounds to be planted for immediate effect, and fortunately possess, as I do, a remnant of the old belt of Brown and his followers, or what would be still more valuable, any of the circular or oval clumps of that celebrated artist, which have suffered so much obloquy, he may rely upon it, that he is possessed of a treasure, which cannot be too highly prized, for the purpose in question. With his permission, then, I will beg leave to give a cursory idea of my own transplanting nurseries, and of the superior materials, out of which they were formed.

About forty years since, when the style of Brown was in high fashion and repute, this place was modernized and laid out by an eminent landscape gardener, well known in Scotland, namely, Mr. Thomas White, one of the most ingenious of his pupils. With a better education than his master could boast, with a more correct taste, and a more vivid fancy, White had a juster discernment of the true style, in which the principles of artificial should be applied to the improvement of real landscape. He was a superior draughtsman, and possessed a thorough knowledge of the principles of design; and had it not been for the professional trammels, by which he was confined, he probably would have anticipated, as well as illustrated in his own designs, those more correct notions of park-scenery which Sir Uvedale Price and Mr. Knight afterwards had the merit of bringing into notice.* As it was, White rather yielded to, than approved of the fashion of the day: accordingly, he gave a belt and clumps to all the new places he laid out, and sometimes to the old ones, which he so ingeniously improved.

Although my little Park was not deficient in these necessary appendages, it must not be imagined, that such formal plantations, and especially the clumps, were ever intended to be *permanent*, by this able artist. On the contrary, they were meant to act as kindly and sheltering masses to a very open subject, and as the only means of protecting and getting up good single trees, and loose dispositions of wood. I therefore trenched the ground by his advice, and took from

* Note I.

it a potatoe crop (after the manner directed in the foregoing Section), before being planted. About the twelfth or fifteenth year after the clumps were planted, I began to cut away the larch and spruce-firs. These had been introduced merely as nurses to the deciduous trees; and from the warmth and shelter they had afforded, and the previous double-digging, the whole had rushed up with singular rapidity. The next thing I did was, to thin out the trees to single distance, so as that the tops could not touch one another, and to cut away the side branches, within about three, or three-and-a-half feet of the surface. By this treatment it will be perceived, that a considerable deal of air was admitted into the plantations. The light, which before had had access only at the top, was now equally diffused on all sides; and the trees, although for a few years they advanced but little in height, made surprising efforts towards a full development of their most important properties. They acquired greater strength of stem, greater thickness of bark, and extension of roots, together with a corresponding amplitude of top and branches.

But at this time it was apparent, that the clumps had a remarkable advantage over the belt, or continuous plantation. While in no part so deep as to impede the salutary action of the atmosphere, the circular or oval figure of the clumps, and their free exposure to the elements, furnished them with a far greater proportion of good outside trees; and these, having acquired from the beginning a considerable share of the protecting properties, were in a situation to shelter the rest, and also to prevent the violence of the wind from injuriously acting on the interior of the mass. It therefore became necessary to thin the belt for the second time, which was now done to double distance; that is to say, to such a distance, as would have admitted of a similar number of trees to stand between the existing plants. Thus, within four or five years after the first thinning, I began to have tolerable subjects for removal, to situations of moderate exposure; while every succeeding season added fresh beauty and vigour to these thriving nurseries, and made a visible accession to all the desirable prerequisites.

It is deserving of remark in this place, that no second thinning of these clumps was necessary, although on ordinary occasions it would have been indispensable, for the free admission of air among the plants. At this period, I happened to have a good deal of transplanting work upon my hands; by which means, the original trenching, and the successive removals that were made from the clumps, not only served this salutary purpose, but operated as a complete preparation of the roots, as well as of every other part of the trees, which were left behind: for I found, that, how severely soever they might be cut, I could always return to them after two years, with renewed advantage. The clumps, as it fortunately happened, were pretty numerous. They had been planted in various soils, from the most tenacious clay, to the lightest sand; therefore, no better opportunity could be figured, for raising forest trees of almost every description with success. The clumps for the most part, by the above operations, were soon reduced to open dispositions of wood, and in some instances, to mere groups of six and seven plants. But some still remained as nurseries for subjects, which, at this moment, are of great size and beauty, and endued in the most eminent degree with all the protecting properties.

Although few planters may be so fortunate, as to possess such valuable remains of the former school of design, yet no one, I trust, will find much difficulty, from the statement just now made, in forming, out of the ordinary plantations of a place, a transplanting nursery for himself. The main object, in such a view, is to select a plantation, which has friable mould for the development of the roots, and, if possible, a dry subsoil; and such a plantation likewise, as has been the least neglected in proper thinning. The first point towards obtaining a good nursery, is to cut away the spruce firs and larches, which have been planted as nurses. But if any Scotch firs appear, with tolerable heads (a rare thing to be seen under such circumstances), they are well deserving of preservation. Such fine picturesque pines are sometimes susceptible of removal on the principles already laid down; and they always form noble park-wood, particularly when of that species which throws out its branches horizontally from the stem. The next object is, to clear away the most drawn-up and unsightly plants, by at once grubbing them up, so that their roots may not continue to exhaust the soil unprofitably, and that the best plants may be left free, and at single distance from one another. Last of all, the ground is to be trenched over, eighteen inches deep at the least, that is, supposing it never to have been trenched before; leaving open drains deeper than the trench, for the surface water to run off properly.

During this operation, a few of the handsomest plants, and such as possess the desirable prerequisites in the greatest degree, must have about five feet broad of solid ground left round them, and two or three roots also entire and untouched on the stormy side. The rest of the trees may have three feet and a half of solid ground left entire during the trenching; also two or three roots, in the same way, towards the west and southwest, and so passing through the trench. During the execution of this work, some tolerable mould, to the depth of a foot or better near the stem, and not less than six or eight inches at the extremity of the solid ground, should be thrown up, in order that the roots may send out new fibres into that friable superaddition to the soil. Moreover, in respect to injury from wind, should the nursery be formed at, or near the outskirts of a plantation (which is rather an advantage), care must be taken for the three first years, to leave the two outside rows unthinned, and as close as may be, both in respect to underwood and standard plants, the better to break the force of any sudden tempest. All these measures are to be taken at some convenient time between November and April; but in situations of particular exposure, it would be prudent, on account of the winds at the vernal equinox, to postpone the trenching until that trying season be past.

In the month of April the whole surface must be well dunged for a potatoe crop, if possible with fermented peat compost, which is the best; or, if that cannot be commanded, with good farm-yard manure; and this, with a crop of flax, or barley, or early oats, and with one of hay immediately following, will more than cover the entire expense of grubbing up, trenching, and otherwise preparing the nursery. By the end of the fourth year, the trees that were considered as the handsomest, and were left with the largest solid spaces round them, and the longest roots, may now be removed, and others in succession, as they are found to acquire the necessary prerequisites. Should there be then regular transplanting-work going forward, it will supersede the necessity of the second thinning.

But in any transplanting nursery judiciously formed, it is not to the spade only that trees are to be indebted for complete preparation. The axe and the hedge-bill must likewise do their office; and both are advantageously to be employed in fashioning the tops to whatever shape or character may be desirable. Most trees growing freely are disposed to assume the conical form. To render them tall and spiral, so as that distant objects may be shown between, or under their boughs, it will be proper to cut away all the lowermost branches, or such others as seem from their luxuriance to rival the leading stem, leaving one stout or main leader preeminent above the rest. It will be advisable also, to displace the branches of the sides in general, and suffer no more to remain than are judged necessary to contain proper vessels in sufficient number, in order to convey down the descending sap. In the same manner, if low and spreading subjects be required to crown, for example, some bold eminence, or clothe its sloping sides, the leader or leaders of the top may be headed down, for that or similar objects; and by skilfully repeating the operation from time to time, we shall produce or continue what has been called the clump-headed character. Let it not, however, be imagined that the *mutilating*, or what is usually called the "lightening" of the tops of trees is by any means intended. The system here recommended is radically and characteristically PRESERVATIVE; and one of its striking merits consists in carefully seconding, not counteracting the laws of nature. Her exuberant efforts, indeed, may be sometimes discreetly restrained, or specially directed, without producing those unhappy consequences, which never fail to flow from undue violence, under whatever name it may be allowed to operate. It is by the former method alone, that the scientific planter will communicate to his trees that particular character, which best suits his purpose, and thus be enabled to confer both intricacy and variety on his landscapes.

In ordering the useful nurseries here attempted to be described, the size will, of course, depend on the scale of the place, and the wants of the owner. Two acres, or three at most, would probably suffice as a repository of transplanting materials for pretty large places, with the addition of such single trees, as may always be found in plantations of extent. But it is not necessary, nor would it at all times be practicable, to set apart such a space of woodland in one spot. More divisions, however, of this sort of training-ground are just as good as fewer, if the requisite quantity be obtained on the whole, and be the extent what it may, provided a competent degree of healthful exposure, but likewise relative shelter, can be commanded at pleasure. The great point of judgment and difficulty lies in the opening up. A slow and gradual, yet ultimately a *full exposure* should be given to the plantation; but we should neither chill the trees, by too sudden a transition to cold, from the former temperature of the wood, nor yet by too timid a style of thinning, continue the existence of the non-protecting properties.

Perhaps it may appear a recommendation to some, should they be persuaded to undertake this novel cultivation of woodland, that the benefits resulting from it are not wholly confined to the removal of trees. If the extent of the tree-nursery thus formed be two or three acres, and the trees themselves of from twenty to thirty years' growth, then there will stand on the ground probably more than three hundred plants per acre, after the first thinning. Now, supposing that the land-owner, who had formed the nursery, should change his mind as to transplanting, and wish to dedicate the space to ordinary woodland purposes, it is to be observed that he has as yet put himself to little or no expense, by this arboricultural improvement. The culture, which he has bestowed upon the plantation, has already made its return by ample remunerating crops; and to whatever purpose he may think proper to turn it, the ground will still give him tolerable crops of hay, for some years to come. But after all, on comparing it with his plantations of a corresponding age, it will be found, that he has strikingly benefited, not deteriorated the trees; for they will yield him more vigorous and valuable wood, than he could have obtained by any other given method.

SECTION VIII.

TAKING-UP, AND TRANSPORTATION OF THE TREES.

If there be any one thing more than another in the removal of trees, that places the superiority of the preservative system in a striking point of view, it is the management of the roots. Few planters, in the taking-up of trees, make much account of roots, provided that a large mass or ball of earth only adhere to them. Marshall, one of the most judicious writers who has treated the subject, in giving directions on this point, says, that the length of the roots, properly speaking, should not be less than the fourth part of the whole height of the tree; although probably, from a want of the means of extricating them from the soil, he did not contemplate the possibility of applying the rule to trees of any magnitude. Had he been better acquainted with vegetable physiology, he would have seen, that by the law of nature, roots and branches must, in every case, be relative and correlative, and that the standard of judging with respect to roots is not the height of the plant, but the actual length of the side-branches. If we mean that our subjects should fully possess the protecting properties, in respect to those two important conservative organs, they must possess them relatively in such proportions, as nature confers on all trees, which are found to thrive in open exposures.

Roots spread themselves in the ground, in a way nearly

* See Rural Ornament, Vol. I. p. 367.

analogous to that, in which branches spread themselves in the air, but with a far greater multiplicity of ramification. From the principal root proceed the buds, that give rise to the primary rootlets; and these again give off finer ramifications, which are the true absorbents of the root. To take up such minute and diminutive shoots on the preservative principle, in any thing like an entire state, is obviously impossible, with the arboricultural implements now generally in use. Hence it became necessary to have something more effective; and the tree-picker was some years since invented for this purpose, and is now used in Scotland by many persons, who have witnessed its extraordinary utility in my practice. This implement is of very simple structure, resembling the pick used by miners, but with only one point or prong, which forms an angle somewhat more acute with the handle, than in the miner's pick. See Plate, Fig. 4. The head, which is of iron, and fifteen inches long in the prong, is made extremely light, as also the wooden handle. The length of the latter is two feet and a half, the entire implement weighing no more than about four-and-a-half pounds. In fact, it can scarcely be made too light, for the purpose in question.

From what has been said in the foregoing Section respecting the preparation of trees, it is apparent, that those which have been cut round are more easily taken up than those that have never been so prepared. The trench, made during this operation, serves as a sure guide to show the point, to which the fibrous elongation has extended; whereas, in subjects which have undergone no such preparation, the roots must be judged of from other, and sometimes more uncertain circumstances. Every experienced workman is aware, in examining a tree, that has never been prepared for the purpose of taking it up, that in any tolerable rooting-ground, he will find the points of the roots, if not mechanically prevented, running out to the full extent of the branches, and sometimes still farther out. Hence, he should begin cautiously to try with the spade and picker, in order to discover the extreme points of the rootlets. Whether the roots he may lay bare belong to the plant, or to some other tree of the same species, he will at a glance perceive, from what the workmen call "the feathering," that is, the position of the capillary rootlets upon the primary rootlets or branches, which are always found pointing outwards from the body of the tree.

Having ascertained where the extremities lie, the next step to be taken is, to open a trench two, or two-and-a-half feet wide, and cut down to the subsoil or deeper, should the roots have penetrated so far. The bank is then to be undermined, in which the roots seem to lie, to the extent of eight or ten inches, in order to facilitate the operation of the picker. Two workmen are next to extricate or scratch up the roots, while one is sufficient to throw out the mould, which in consequence falls down into the trench; and thus the workmen are distributed three and three together, according to the number employed, over the whole extent of the excavation. As every effort must be made to preserve the minutest fibres and capillary rootlets entire, the difference between an experienced and an inexperienced workman is very striking, in an operation of so much nicety; and the surprising dexterity which some men of ingenuity and attention acquire in this department, is as valuable to the employer, as it is beautiful and interesting to the spectator who examines it. The main thing, which the pickman has here to study, is never to strike *across* the roots, but as much as possible in the line of their elongation, always standing in the right line of divergence from the tree as a centre; that is, in such a line or lines, as the rays of the sun are represented to describe, in emanating from that luminous body. In striking the picker into the ground, which must sometimes be done pretty deeply, there is a certain dexterous shake, more easily understood than described, which a superior workman knows how to give with the implement; and that, when properly applied, will more efficaciously and speedily discover and disengage the various bearings and ramifications of the root, than any other method.

By thus continuing to extricate the roots, and to shovel away the mould that falls into the trench, at one and the same time, an immense body, amounting to thousands, and sometimes to millions of roots great and small, will ere long be disengaged, and which must be carefully laid aside, or bundled up, so as to make room for the workmen, and also to avoid the strokes of their implements, as well as injury from their feet. In like manner, the stiffer roots must be cautiously put aside and disposed of, and any that are broken or lacerated cut off. Ere long the pickmen from all sides nearly meet in the centre, by approaching to within three, four, or five feet of the stem, in proportion to its size; and at this point the process of extrication ceases, as it would be imprudent to advance too near the collar of the tree. A ball of earth round the stem, as large as can be got according to the nature of the soil, with two or three feet broad of the original sward adhering to it, should now, if possible, be left undisturbed at that place.

The above, as the reader will perceive, is a very complicated and delicate process, although probably more complicated in the description than in the execution. It is no easy matter, even in the freest soils, so to disengage the fibrous and capillary roots of trees, as not to lacerate or disbark a considerable number of them, and yet perform the work with any tolerable dispatch. But it is the process of all others which will the least bear to be *hurried*. There are some departments of rural labour, in which dispatch and economy are nearly allied, and almost convertible terms, and where every one, of course, will study to promote the former as far as lies in his power. But in the one in question, the greatest deliberation, or at least the greatest caution, is the truest saving that can be made: for here the well-known adage, *Festina lente*, is the golden rule which should regulate the process. It is well known to the vegetable anatomist, who can discern with his microscope the flattened extremities of the capillary rootlets (*Capillamenta*), how well fitted they are to perform the office of absorption, and that it is to those effective organs chiefly, that plants are indebted for the introsusception of their food. Hence, when disbarked or lacerated, or what is worse, cut away, the severe, and often ineffectual efforts made by plants, to restore or replace them. The planter cannot too earnestly reflect, that the greater roots do little more than serve as canals or channels, to transmit the sap to the trunk, where it ascends by the tubes of the wood to the branches, and ultimately to the leaves; on which account it is evident, that the failure and decay of the top (the great opprobrium of transplanters) is primarily to be ascribed to the entire want of skill in the preservation of these fibrous roots, on which the tree mainly depends, for a suitable supply of sap during the first season. He, therefore, who can most successfully vanquish this difficulty, is the greatest master of his art.

But to return to the business of the field. As soon as the workmen have completed the task of extrication, within three or four feet of the stem, as already explained, it becomes necessary to take measures for pulling down the tree. According to circumstances, its roots are now either to be covered up, in order to be planted out with others at a future period, or it is immediately to be raised from the pit and removed by itself. On the supposition that the roots are to be covered up, it is of some importance, that that work be done properly and carefully, so as not to injure the tender fibres. After trying various substances for this purpose, I have found nothing to answer so well as the smaller branches of the spruce or silver fir, which unite closeness with elasticity: for straw, or turf, or moss (*Scotticè* fog), are all apt to intermingle with the fibres, and cannot be separated from them, without much mischief ensuing. The roots, for obvious reasons (as their time of lying covered must always be uncertain), are not now to be put up in bundles or masses, but stretched out at their full length in the pit. The branches and twigs of spruce or silver fir are then laid over them, in at least two rows or strata in thickness; next, eight or nine inches of fine mould follow; and last of all, sods of common turf are here and there added, to increase the pressure. If the subsoil be retentive of moisture, a deep cut is at the same time made, at the lower edge of the excavation, in order that the water may not stagnate in any part.

In this way, I have often found the roots of the soft-wooded trees, such as the lime and the horse-chestnut, lie safely in the ground for a month or six weeks, or more, when severe frost happened to supervene, and stop the work of planting. But as the hard-wooded kinds, especially the oak and the beech, are extremely sensitive of cold or drought, it is always desirable to plant them, within a week or ten days after the roots have been loosened in the ground. If this be not done, the latter often become discoloured by the action of the air, and when blackness appears, it is a symptom oftentimes fatal to the success of the plants.

On the supposition that the tree is to be immediately removed, it must be raised at once from the pit. It cannot have escaped the intelligent reader, that if it be a subject of any magnitude, say eight-and-twenty feet high, what with the actual thickness of its mass of roots and earth, which cannot be less than two feet, and what with the contents of the trench, that have been thrown out round the bank, the pit so formed must in any case be from three to four feet deep. In order to bring up from the pit so heavy a load, I used, some years since, to employ five and six horses, and even a greater number. At present, it is done usually with one horse, and never more than two, by the following simple contrivance; which certainly nothing but the most extraordinary want of reflection could have prevented from being seen in the beginning. This sufficiently proves, if any proof were wanting, how strikingly men will often pursue a more circuitous route to their object, when a nearer and more direct one lies open before their eyes.

With the view, then, of effecting the two purposes in question, namely, the pulling down of the tree, and the getting it out of the pit, a strong but soft rope, of perhaps four inches in girth, is fixed as near to the top of the tree as a man can safely climb, so as to furnish the longest possible lever to bear upon the roots; taking care, at the same time, to interpose two or three folds of mat, in order to prevent the chafing of the bark. Eight or nine workmen (the greatest number I usually employ in the department in question,) are then set to draw the tree down on one side. Or it is a good way, if you have an old and steady pulling horse, to employ him in this business: for it is plain, that one stout horse, acting forcibly on the rope, will do more than twenty men, even if so great a number could get about it; and moreover, he will save some manual labour in excavating, by giving an effectual pull, at a much earlier period of the work. The tree being drawn down, it is next forcibly held in that position, until earth be raised to the height of a foot or more, on the opposite side of the pit, so that, as soon as it is liberated, it springs up, and stops against the bank thus formed. On this, the workmen proceed to lighten the mass of earth with the picker, laying bare the roots as little as possible, but still necessarily reducing the mass to manageable dimensions. The tree is then pulled down on the opposite side, and a foot of earth forced up, in a similar manner; and the same thing being repeated once or twice, it is gradually raised to even a higher level than that of the adjoining surface. In this manner, by a method extremely simple, and not less expeditious, however it may appear in the narrative, it becomes quite an easy, instead of a formidable undertaking, to draw the tree from the pit.

Before the tree is pulled down, as just now described, there is one thing more, which must not be omitted. Almost all trees, as stated in Section IV., are ill balanced in point of ramification, and towards the stormy quarter, usually the southwest, they exhibit a "weather side;" which side, accordingly, is on removal to be reversed, as shall be directed in the sequel. Therefore, while the tree retains its upright position, is the only certain time to ascertain the side where the longest branches have been thrown out. This is now accurately done by the director of the work, and the side in question marked on the stem with chalk, or very slightly with a knife, care being taken not to penetrate beyond the epidermis. After which, the tree is ready to be put upon the machine, and drawn out of the pit.

In giving the history of the progress of the art during the last century, it was stated above, that Brown, the celebrated landscape gardener, was the inventor of the best and simplest transplanting machine now known. It consists of a strong pole and two wheels, with a smaller wheel occasionally used, which is fixed at the extremity of the pole, and turns on a pivot. The pole operates both as a powerful lever, to bring down the trees to the horizontal position, and in conjunction with the wheels, as a still more powerful conveyance, to remove them to their new situation. Various, however, are the machines, which the caprice of fashion, the love of novelty, and in some instances the ambition of attempting a stupendous scale of work, have introduced into both France and England, within the last century and a half. Among these are the great machine of Versailles, constructed by order of Louis XIV., with its broad and powerful wheels and platforms; the high three-wheeled machine of England during the last century, of ponderous make, with its platform also, for transferring trees of vast size and weight in an upright position; the oblong machine of the same period, with four, and sometimes six low wheels, for the same gigantic purpose: these, and such like costly implements, more fitted for show than daily use, it were needless to enumerate, and still more needless to describe. My sole object being a park-practice, to which dispatch and success are the chief recommendations, I prefer the simple machine of Brown, with some improvements which I have made upon it, to all other contrivances. It is to that machine, therefore, that the directions for the transportation about to be given, are understood to refer.

The tree being in readiness, as above described, for removal to its new site, the machining of it (if I may be permitted the expression,) is a work deserving of the particular attention of the planter.* On the skill of the person, who conducts this department, and whom I have ventured to denominate the machiner, much depends, in providing against the various accidents, to which branches, not less than roots are exposed in an operation, always implying much violence, and sometimes unforeseen contingency. The first step to be taken is, to bring the wheels of the machine close up to the body of the tree; and should the protuberance of the nucleus, or mass of roots under the collar stand in the way, as sometimes happens, the wheels must be forcibly approximated, until they be quite close. While this is about to be performed, the machiner darts an experienced eye over the stem, and whole style of the ramification, and at once ascertains the side, upon which the tree can be best laid along the pole, and also the particular opening among the boughs, into which the pole can be most safely introduced. If there be the smallest bend in the stem, as almost always happens, the convex side must lie uppermost on the machine; other-

* Note I.

wise, were the concave side to be so placed, the great weight of both the root and top, acting at once on so narrow and unstable a surface as the stem presents, would cause the fastenings to slip, on the first movement of the wheels, and in consequence of the tree turning suddenly round, the most shocking havoc might be committed, among both branches and roots.

However easy all this may appear to the looker-on, who views the work, there is much judgment and nicety in ascertaining such adaptations, and there is a considerable saving of time, and consequently of expense, in *at once* ascertaining them, without those tedious consultations, and vexatious delays, in which the best workmen are apt to indulge, in this stage of the business. For such an evil there is no remedy, but in the useful principle of the subdivision of labour, or, in other words, in making the machiner's a distinct office, of which the duty is committed to the sagacity and dispatch of a single individual. Besides these arrangements, it is a material consideration so to machine the tree, as that its lee-side branches, which are always the stoutest and longest, should, if possible, be uppermost on the pole, when the tree is laid horizontally; because no branch or root of considerable length should be suffered to sweep the ground, during the time of transportation. But other circumstances may occur to render this desirable position of the roots and branches impracticable, such as a decided and untoward bend in the stem, in an adverse direction: in which case, the machiner must adopt the next best arrangement, and that which will do the least injury.

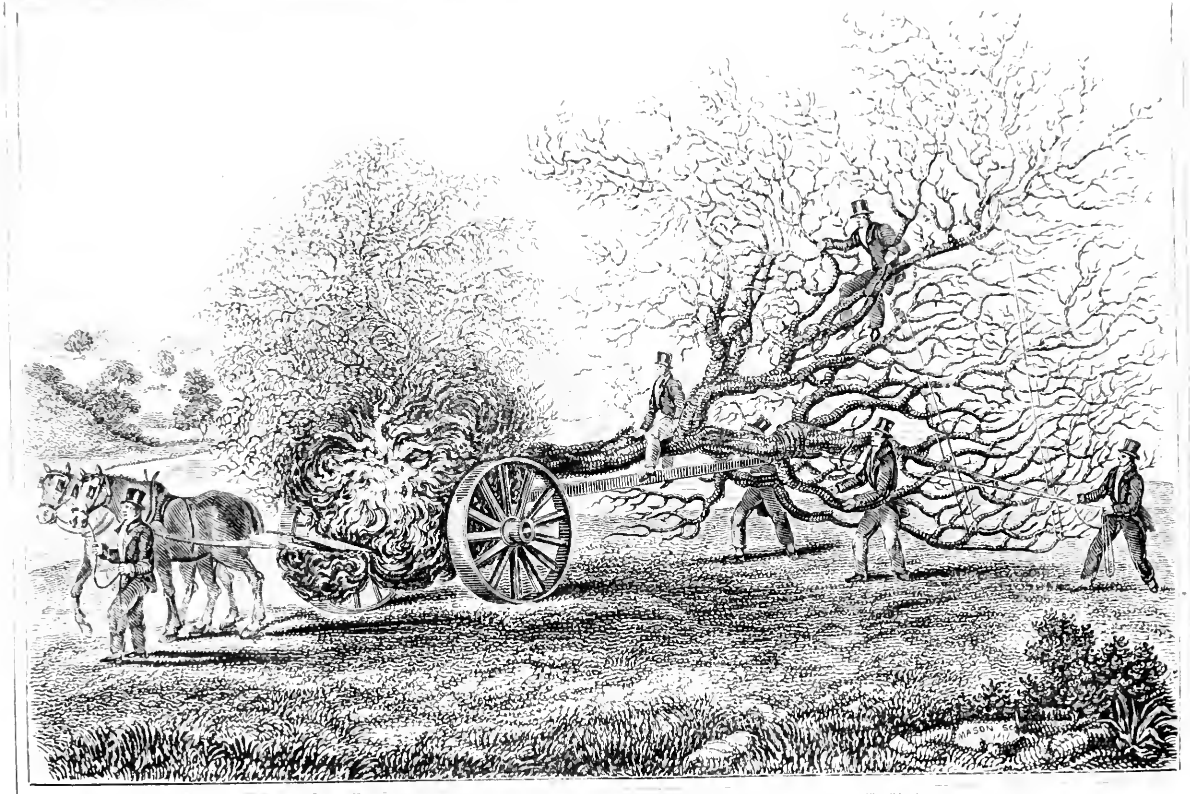
As soon as the machiner has adjusted these things, and directed the proper introduction of the pole among the boughs, an active workman is sent up, to lash the stem and the pole as firmly together as possible, taking care, by redoubled folds of mat, to secure the bark against the damage it might suffer, from the iron ring at the point of the pole. A double rope of the stoutest kind (which is greatly preferable to the chain used by some planters,) is then passed under the root, so as to seize it firmly, and balance it on the upper stage of the crossbar between the wheels; which rope is then drawn tight, by means of bracing or rackpins, such as waggoners generally use, and secured in the ordinary manner. Last of all, the tree is drawn down, by the united strength of the workmen, or by a steady horse, if at hand, bearing on the pole-rope; and the tree, being in this way left suspended horizontally on the crossbar, is ready to be drawn away, root foremost, to its intended destination.

Before the horse or horses are put to, a simple but very material matter requires attention, and that is, to secure the boughs and roots from all friction with the wheels, or with the ground, which would greatly chafe and injure both: for all the boughs, which appear under the pole, unless very slender and pliant, must be bound up by means of cords cautiously passed under them, so as to compress this part of the top, but without fracturing the parts, into the narrowest compass. And the same care must be taken to bundle up all the flexible parts of the roots, so as to prevent their coming in contact with the ground, or with the wheels. If the forced-up surface also of the pit be too soft and sinky, it will be expedient to form a path for the wheels, by a close line of hedge stakes laid transversely to the path, so that they may easily pass upon it to the firmer ground. These things being done, the horses are put to, in the same manner as to a plough, but with much stronger draughtbars, at least the main one. An iron chain of great strength attaches them to the machine; and stout ropes are employed instead of plough-chains, which are ill calculated to withstand the sudden pulls and jerks, incident to this species of work. As to the horses, it is of the utmost importance that none but quiet and steady-pulling animals be admitted to this service, such as are not hot and fiery, however true to the draught, otherwise the most fatal accidents may ensue, to both branches and roots.

As soon as the horses are put to, the machiner seizes the end of the pole-rope, in order to act as steersman, the most important functionary in this part of the business, and the person, on whom the safety of the transmission entirely depends. For this purpose, he takes post two or three yards in the rear, with a stout assistant, or two if necessary, in order to manage the top of the tree; it being understood that the root, as already mentioned, is in front, or is drawn foremost. One or two able-bodied workmen are then stationed under the pole, to bear up the top, at first starting, on their shoulders, at the same time that all the others, who are unoccupied, apply their strength to the wheels; when, on a signal given by the steersman, or other person directing the work, the men and horses acting simultaneously, the tree is drawn at once beyond the limits of the pit.

When advanced a few yards upon firm and level ground, it is prudent to halt the horses, in order to examine, if every thing be well ordered and secure; especially if the equilibrium between root and top have been accurately obtained. If the root be found too light, it is proper to make it heavier, by loosening the cords of the bracers or rack-pins, and allowing it to drop down. If it be found too heavy (which is the lesser evil of the two,) the easiest method of counteracting it is, by sending up a couple of balancemen to the top; who, by shifting their position as circumstances may require, serve as *movable* makeweights, and maintain the equipoise. If these things be truly adjusted, the tree will proceed in the transportation, with perfect safety to all its parts, the pole beautifully playing on the axle and crossbar, like the beam of a well-constructed weighing machine, which many times vibrates, before settling in the equilibrium.

In order that the reader may form a competent idea of the machine itself, as used here, and of the transportation of



VIEW OF THE MACHINE IN MOTION, AND OF A TREE DURING TRANSPORTATION.

the tree, on the balancing principle, a "view of the machine in motion" will be found in the engraving, as taken on the spot by an ingenious artist. The tree delineated is a beech of about eight-and-twenty feet high, with a stout stem, a beautiful top, and with roots more than twelve feet long; so that the whole is calculated to form a load of considerable weight. The mode of maintaining the balance, of bundling up the roots, of compressing and preserving the branches; as also the various functions of the steersman, the balancemen, and their assistants, may all probably be better apprehended in this view of their united efforts, than by any verbal description. The reader, however, may compare the two, as they will be found greatly to aid each other.

It is easy to apprehend, that, with a machine so constructed, the person stationed at the end of the pole, possesses the same complete power over the direction of it, as the steersman over that of a boat; but with this disadvantage on the side of the former, that the machine is far more difficult to manage than the boat in the water, owing to the greater unevenness of the surface of ground, and the extraordinary length of the pole, as compared with the rudder, thereby causing a much more sudden impulse to be communicated to the machine than to the boat. The steersman of the machine has, for that reason, a far more difficult part to perform, in which much judgment as well as strength is called forth, and where one assistant, and sometimes two or three, are requisite to aid him in so laborious a task.

The above mode of balancing the tree between the axle, which is the centre of gravity, and the extremity of the pole, I greatly prefer, on every occasion where it can be adopted, to that of having recourse to the third wheel. This addition to the machine could seldom be made, with such extensive tops as the park-trees removed here usually have, without severe injury to the branches. But it will be found useful with long-stemmed, or very heavy subjects of any sort, especially when they are to be brought from the distance of half a mile or more, as must often happen. I have, however, by bringing the third wheel closer to the two others, endeavoured to render this less objectionable.

In a system of transportation, regulated by the above principles, it will be perceived, that the driver of the horses cannot proceed too slowly. The rate of between two and three miles an hour on level ground, implies the quickest pace that should ever be attempted. By heights and hollows, and narrow passes, by roughness or unevenness of ground, accidents enow will happen, without aggravating them by carelessness, or needless haste. In going up an acclivity, how gradual soever it may be, it is obvious, that with a load so nicely balanced, a proportional depression of the top must take place, and in descending, a like depression of the root. But by the attention of the steersman, and particularly of the two balancemen above, or the efforts of both united, much undue pressure on either roots or branches may be avoided. If the declivity be steep, approaching to a fall of one foot in twenty, foresight will suggest the expediency of taking off the horses, so as to prevent the possibility of their being overrun by the machine; for, in such a case, it will be found to descend with sufficient velocity, and little aid from the men, in consequence of the impetus given to it by its own weight.

There is, however, one species of accident, against which it may be proper to caution the inexperienced planter, as it has happened at this place. As it *did* happen, it was productive only of merriment, instead of the loss of life or limb; although such an issue was far more "owing to good luck than to good guiding" (as the national proverb has it,) or to any claim to vigilance, or prudent management. In proceeding with the machine down a gentle slope of some length, at an accelerated pace, on which occasion both the balancemen had gained the top with their usual agility, it so fell out, that the cords, which secured the rack-pins of the root, unfortunately gave way. This happened so suddenly, that the root at once struck the ground, with a force equal to the united weight of the mass, and the momentum of the movement, and pitched the balancemen (now suddenly lifted to an elevation of nearly thirty feet,) like two shuttle-cocks, to many yards distance, over the heads of the horses and the driver, who stood in amazement at their sudden and aerial flight! Luckily for the men, there was no frost upon the ground, so that, instead of breaking their bones, they fell only on the soft turf of the park; from which soon getting up and shaking themselves, they heartily joined in the laughter of their companions, at the extraordinary length of the *leap* which they had taken. Fortunately also, the driver and the horses escaped a worse fate, which had impended them: for the steersman and his assistants, with great presence of mind, never quitted their hold; and their weight, added to the weight of a ponderous mass of roots and earth, kept the tree upright, and prevented it from overwhelming both the team and the driver. This accident, which was at once dangerous and ludicrous, made us extremely cautious afterwards, in securing the bracers; but the imagination of the balancemen was forcibly impressed by it; and it proved impossible to persuade them to resume their elevated functions for many months after.

It now only remains to say something of the nature and dimensions of the transplanting machines which have been employed, in order that those, who set a value on lightness and efficiency in such implements, may not be without a guide, whereby to provide similar machines for themselves. Planters, however, residing within a moderate distance, would do well to procure them from Thomas Nesbit, Carpenter near this place, a very ingenious man, who has been much in the habit of making them for some years.

It appears hitherto to have been the opinion of the constructors of transplanting machines, that their value in a great measure lies, in the weight of wood and iron they contain. My conception of it, on the other hand, is precisely the reverse; as I believe, that the *smaller* the quantity of those materials, the greater the utility of the implement. If it be true, that the greatest success, and the greatest despatch united, form the character of the most perfect transplanting-work, it follows, that heavy implements of this sort, unless for work of uncommon magnitude, are doubly inexpedient; first, on account of the expense which they cost in the beginning; and secondly, on account of the still greater expense, which it erelong costs to use them; for time needlessly lost is money improvidently thrown away. Better that a machine should break down twice in your life, from being somewhat too light for its work, than that it should cost you three times its price in labour, in dragging a superfluous load of wood and iron about your park; for thus there would be a loss of both time and money. This, however, is a style of estimate, which only practical persons will understand, and only economists of time will duly appreciate. If a man remove only three trees in a twelvemonth, it signifies little what sort of machine he happens to use. But if he remove sixty or a hundred trees, twenty or thirty times the cost makes a great figure in the calculation. Now, supposing that he executed but a third part of the work last mentioned, I am satisfied that there would be economy in having two machines, calculated to the scale of his work; the machine for the lesser trees being light, and possessing small power, the other for the greater trees being weighty, and possessing much greater power. In this way, power (which, as the best philosophers have agreed, is nearly the synonyme of money) would never be idly employed, but judiciously suited to, though never suffered to transcend the immediate object of the planter.

As this reasoning appears to be conclusive, I shall now proceed to give a delineation of the larger and smaller machines, used at this place; to which shall be added one of an intermediate size, chiefly intended for the use of such planters, as do not choose to put themselves to the expense of more than one such implement, and who do not mean to remove trees beyond thirty feet high, and from twelve to fourteen inches in diameter, at a foot from the ground; which trees this machine should be capable of managing. See engraving. The diagram here given relates to the pole, axle, and framework of the machine, that is, to every part of it excepting the wheels. The latter it was considered as unnecessary to delineate in the diagram, as the entire "machine in motion" is given in the view; and any good carpenter can make the wheels, on the dimensions being furnished to him. The main difficulty in constructing an effective machine, lies in proportioning the different parts to one another, and so adapting the whole to the style of work to be executed, that despatch shall be promoted in the highest degree, and that the *heaviest* work shall be executed, by means of the *smallest* possible weight of wood and iron.

These machines, as already said, are of the simplest structure, and evidently borrowed from the Janker of the wood-merchant.* The pole is made of the best oak, the axle of iron, the wheels of oak, elm, and ash, as also the subordinate parts. To the original implement I have added, among the other improvements, three stages strongly bolted to the crossbar, or axle-bed, (as our workmen term it,) and to one another, of which the upper stage is movable at pleasure, as the extent of roots or branches may require elevation from the ground. The third wheel, which according to Brown's plan was diminutive, is enlarged, and adapted to a different part of the pole. The specification is as follows: See engraving.

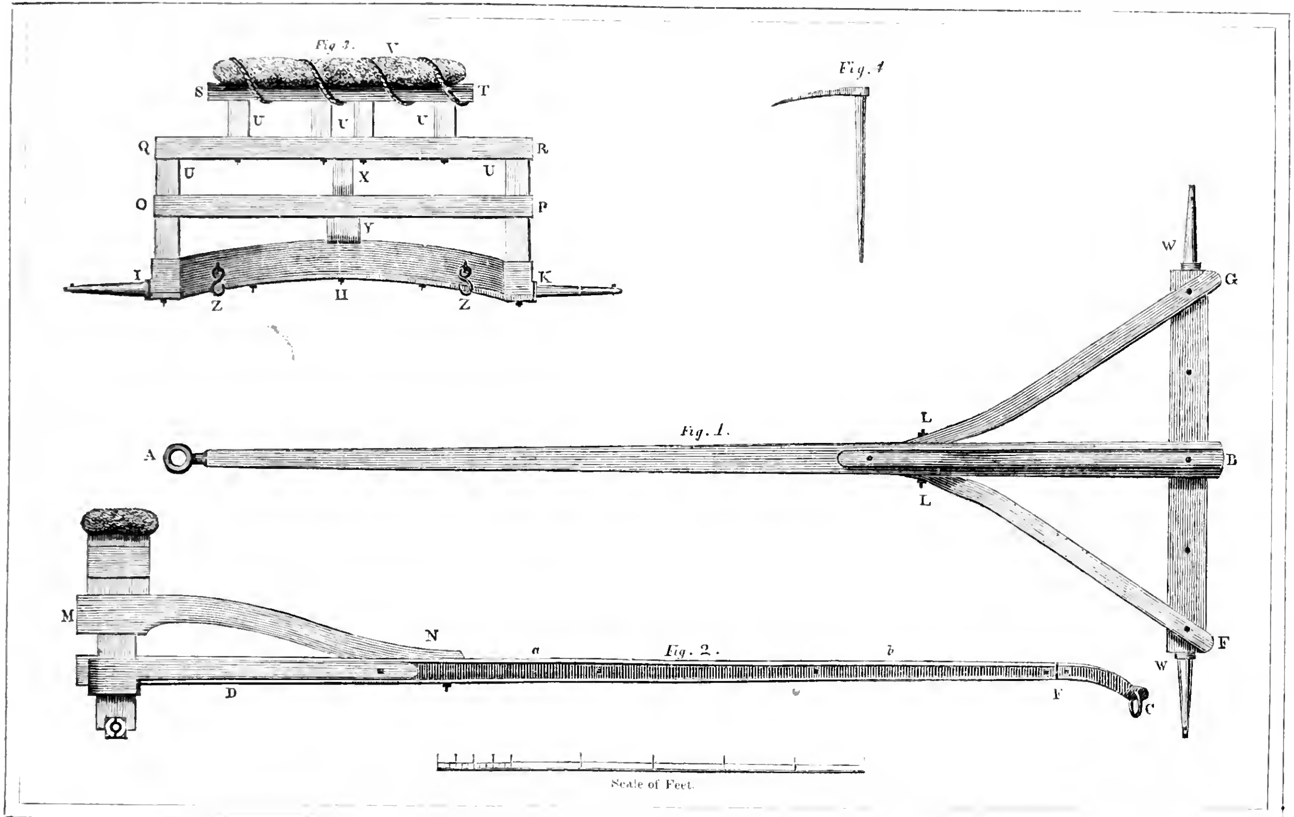
* Note II.

LARGE-SIZED MACHINE.

The pole AB (Fig. 1.) is 15 feet long, including the iron ring at the point; 6 inches broad, tapering to $3\frac{1}{2}$ at top; and 5 inches thick. The iron ring at A is 4 In. in diameter. At the top there is a small bend EC (Fig. 2.,) 3 In. off the straight, in order to prevent the bark from being chafed by the ring. Immediately at the point, but clear of the ring, is fixed a small block of iron at C. with rounded edges, 4 In. long, by $1\frac{1}{2}$ In. thick, well steeled, so as to trail along the ground, and to prevent the point of the pole, when the machine is not loaded, from cutting up the surface.

There is likewise, on one side of the pole, a plate of iron DC, extending from D, within 18 In. of the axle, to nearly the top at E, for the purpose of strengthening the pole. It is $2\frac{1}{2}$ In. broad, $\frac{3}{8}$ In. thick, and sunk into the wood. This plate for the sake of greater power, should be in one piece. Its entire length is not visible in the diagram, owing to the intervening delineation of one of the side-stays.

The iron axle FG (Fig. 1.,) and also IK (Fig. 3.,) is $5\frac{1}{2}$ F. long between the washers (but is nearly covered by the case,) and 3 In. square; with a curve of 3 In. at H, for the purpose of giving greater strength. It would not be convenient, however it might suit large roots or branches, to make the axle longer than the above dimension, on account of gates, and other narrow passes, through which the machine might be taken, and that seldom exceed 9 or 10 F. wide. The heads of the axle WW are 14 In. long, and fitted to the bushes of the wheels. The dust-hoops are 1 In. broad each. The wooden case IK (or, as it is called, the axle-bed) is 6 In. square, covering the iron 2 In., and consequently showing only 1 In. of it. To the axle-bed are fixed two strong hooks of iron ZZ, $6\frac{1}{2}$ In. long, and strongly bolted to it, to which the horses are attached, for drawing the machine.



TRANSPLANTING MACHINE AS USED AT ALLANTON HOUSE.

The two side-stays FLGL (Fig. 1.) are made as short as possible, in order to prevent interference with the branches, being 5 F. long, $3\frac{1}{2}$ In. broad, and 4 In. deep or thick, and strongly bolted to the axle-bed and pole. The upper stay MN (Fig. 2.,) which rests upon the first stage at M, is $5\frac{1}{2}$ F. long, $3\frac{1}{2}$ In. broad, and $4\frac{1}{2}$ In. thick, and is in like manner bolted to the pole.

The first stage OP (Fig. 3.) rises 4 In. in the centre above the axle-bed, and is bolted to it. This stage is 5 F. 5 In. long, 6 In. broad, and 4 In. thick. The second stage QR rises 6 In. above the first, and is in the same way bolted to the latter. It is also 5 F. 5 In. long, 10 In. broad, and 3 In. thick. The third stage ST rises 6 In. above the second. It is only 3 F. 10 In. long, 10 In. broad, and 3 In. thick, and is similarly bolted to the stage last mentioned. The third stage is movable, as occasion may require; and the machine can be used either with or without it, according to the extent of the roots and branches of the trees to be removed. On the stage which happens to be uppermost, there is fixed a firm bolstering of double mat SVT, filled with hay or straw, of at least 6 In. in thickness, so that the bark of the stem can sustain no injury.

The blocks UUUUU between these two stages, are 10 In. long, 4 In. broad, and 6 In. high. The end of the upper stay at X (or at M. Fig. 2.,) resting on the first stage, represents, in the end view of the machine, another block in that position; and the end of the pole at Y is seen in the same way, and for the same object. Wherever it can be done, the bolts, for the various purposes above mentioned, are shown in the diagram.

LARGE-SIZED WHEELS.

These wheels are made of the very best materials, $5\frac{1}{2}$ feet high, and nearly upright; the dishing (as the workmen term it) being only $1\frac{1}{2}$ inches.

The naves are $11\frac{1}{2}$ In. long, exclusively of the nave-bands, and 13 In. thick. The spokes are $3\frac{1}{2}$ In. broad, and $1\frac{1}{8}$ In. thick; the Fellies 5 In. broad, and 3 In. thick; the iron rims $\frac{1}{2}$ In. thick, and usually made in two pieces, $2\frac{1}{2}$ In. broad each.

The third wheel, having no great weight to bear, is made light. It is $3\frac{1}{2}$ F. high, and entirely upright, without any dishing. The naves are 9 In. long, exclusively of the bands, and 9 In. thick. The spokes are $2\frac{1}{2}$ In. broad, and $1\frac{1}{8}$ In. thick; the Fellies 4 In. broad, and 2 In. thick; the iron rim $\frac{1}{4}$ In. thick. The wheel is fixed to the pole by a strong pivot, on which it turns as the steersman may direct, in the same way as the wheel of a plough.

This wheel, when used, is generally from 2 to 3 F. high, and placed about 3 F. from the point of the pole, at *b* (Fig. 2.) But I should much recommend a different position (in order to elevate the point of the pole, and, by consequence, the branches from the ground,) namely, at *a*, 5 F. nearer the axle, and within 18 In. or 2 F. of the end of the upper stay; from which it can be removed at pleasure, as may suit the magnitude of the tree.

The entire weight of the machine, when mounted on its two wheels, is nearly 11 cwt. avoirdupois.

This, it will be perceived, is a powerful though rather a ponderous implement, and cannot be worked with fewer than two, and sometimes three horses. It is meant for trees not less than from five-and-thirty to five-and-forty feet high, or more, and from fourteen to eighteen inches in diameter, that is, from three-and-a-half to four feet in girth.

From the above statement it is apparent, that considerable improvements have been made on the machine, since the time of Brown, and from the rude delineation of it as introduced into Ireland, about threescore years since, by his ingenious pupil Robertson.* Some persons approve of the uniform use of the third wheel, within 2½ or 3 F. of the point of the pole: but that cannot be necessary, as already mentioned, but with subjects of extraordinary length or weight; and it is quite inadmissible in any case, in this position, unless where the tops have been severely lightened or mutilated. Others, in some of the northern districts of this kingdom, where both the soil and climate are extremely propitious, have added what they denominate a "heel-beam," 18 In. out from the axle or crossbar. But, as it appears, this should much rather have been called a fore-beam, as it is placed immediately in front of the axle, and next to the draughtbar, to which the horses are put. In other words, the side-stays are lengthened out, making them between 7 and 8 F. long, by which means they must often interfere with low-spreading branches; and the position of the axle being altered, it causes the frame to project about 18 In. beyond it. A machine so constructed they call an "Alleviator;" but on what principle or analogy, does not appear very evident. Of this sort of machine I have no experience: but I cannot perceive any good reason for making such a change so near the centre of gravity, which must always be in the axle; as it seems apparent, that in practice it must make the tree more difficult to be drawn down, and more troublesome to be balanced during the transportation, thus multiplying, instead of "alleviating" the planter's difficulties.

* See Hayes's Treatise on Planting, and the Management of Woods, p. 42—47. Also Sect. II. *anteh.*

SMALL-SIZED MACHINE.

In conveying to the reader an idea of this and the following machine, it appears unnecessary to repeat the diagram, with reduced dimensions, as he will be able, without the assistance of the capital letters, readily to apply the sizes about to be given to the parts just now minutely described, so that he may construct all, or any one of the three machines, according to his fancy. The description and uses of the different parts of the two lesser machines, however, shall be repeated nearly in the same terms as above, in order to prevent any intricacy of reference from one to another.

The specification and dimensions of the small-sized machine are the following. The pole is only 12 feet long (including the iron ring at the point,) 3½ inches broad, and 4 In. thick, tapering to 2½ at top. The ring is for the purpose of receiving the pole-rope, and is 3 In. in diameter. At the top of the pole there is a small bend, 3 In. off the straight, in order to prevent the bark from being chafed, or stripped off by the ring. Under the point of the pole there is a block of iron, with rounded edges, 3 In. long, by 1 In. thick, and well steeled; so that, whenever the point of the pole happens to be trailed along the ground, it may withstand the friction, without injuring the surface. There is likewise, on one side of the pole, a plate of iron, extending from within 18 In. of the axle nearly to the top, for strengthening the pole. It is 1½ In. broad, ¼ In. thick, and sunk into the wood. This plate, in order to render it more powerful, should be in one piece.

The iron axle is 4½ F. long between the washers (exclusively of a head at each end, 11½ In. long, which is fitted to the bushes of the wheels,) and 2¼ In. square, with a curve in the centre of 2 In., for the sake of greater strength. The dust-hoops are 1 In. broad. The wooden case, or axle-bed, is 4 In. broad, and 3 In. deep, covering the iron $1\frac{1}{4}$ In., and showing, of course, only 1 In. of it. To the axle-bed are fixed two strong hooks, 4 In. long, to which the horse is attached, for drawing the machine.

The two side-stays are each 3 F. 10 In. long, $2\frac{1}{2}$ In. square, and strongly bolted to the pole. The upper stay rests on the first stage, and is 4 F. 4 In. long, $2\frac{1}{2}$ broad, and 3 In. thick, tapering to $2\frac{1}{4}$ In., and bolted to the pole in like manner.

The first stage rises in the centre $2\frac{1}{2}$ In. above the axle-bed, and is firmly bolted to it. It is 4 F. 5 In. long, 4 In. broad, and 3 In thick. The second stage rises $4\frac{1}{2}$ In. above the first, and is bolted to the latter. It is also 4 F. 5 In. long, 9 In. broad, and 2 In. thick. The third stage rises $4\frac{1}{2}$ In. above the second, and is in the same manner bolted to it. It is 3 F. 4 In. long, 9 In. broad, and 2 In. thick. The third stage is movable at pleasure, and the machine is used either with or without it, according to the style of the subjects, and of the work. On whichever stage happens to be uppermost there is fixed a bolstering of double mat, filled with hay or straw, 6 In. thick, so that no injury can be sustained by the bark of the stem.

The blocks between the stages are 9 In. long, $2\frac{1}{2}$ In. broad, and $4\frac{1}{2}$ In. deep. The end of the upper stay, as it rests on the first stage, shows itself, in the end view (Fig. 3.,) like a block in that situation; and the end of the pole has the same appearance from the same point, as resting on the axle-bed. —Wherever it can be done, the bolts, used for all of the above purposes, are shown in the diagram.

SMALL-SIZED WHEELS.

These wheels are 5 feet high, made of the best materials, nearly upright, and the dishing only 1 inch.

The naves are 10 In. long, exclusively of the nave bands, and $10\frac{1}{2}$ In. thick. The spokes are $2\frac{1}{2}$ In. broad, and $1\frac{1}{8}$ In. thick; the fellies 4 In. broad, and $1\frac{1}{2}$ In. thick; the iron rims $\frac{1}{4}$ In. thick. As to a third wheel, it cannot be necessary for a machine of the small size, nor for such trees as are removed by it.

The weight of this machine, with its wheels, is about $5\frac{1}{4}$ cwt. avoirdupois.

The above machine, it will be perceived, is far less weighty than the foregoing. It is capable of removing subjects of from eighteen to about eight-and-twenty feet high, and of proportional girth; and in fact, a good part of my transplanted trees have been removed by means of this light and efficient implement.

MACHINE OF THE INTERMEDIATE SIZE.

The pole of this machine is $13\frac{1}{2}$ feet long, including the iron ring at the point, $3\frac{1}{2}$ inches broad, and 5 In. thick, tapering to 3 In. at top. This ring is for receiving the pole-rope, and is 4 In. in diameter. At the top there is a bend 3 In. off the straight, in order to prevent any chafing of the bark by the ring. Under the point of the pole, close to the ring, there is a small iron block $3\frac{1}{2}$ In. square. It is rounded at the edges, and well steeled for defending the point of the pole, when trailing along the ground, and so formed as to withstand the friction, and cause little or no injury to the surface. There is also on one side of the pole a plate of iron, extending from within 18 In. of the axle nearly to the top for the purpose of strengthening the pole. It is 2 In. broad, and $\frac{1}{4}$ In. thick, and is sunk into the wood. This, in order to give greater power, should be in one piece.

The iron axle is 4 F. 9 In. long between the washers, and $2\frac{1}{2}$ In. square, with a curve in the centre of 2 In., for the sake of greater strength. The wooden cover, or axle-bed, is 4 F. 8 In. long, and 5 In. square, covering the iron

1½ In., and showing only 1 In. of it. The heads of the axle, to which the bushes of the wheels are fitted, are 12 In. long; and the sand-washers are 1 In. broad each. To the axle-bed are fixed two strong iron hooks 3 In. long, to which the horse or horses are attached, for drawing the machine.

The two side-stays are 4 F. 2 In. long, 3 In. square, and strongly bolted to the pole. The upper stay rests on the first stage, and is 4 F. 4 In. long, 3 In. broad, 3½ In. thick, and tapering to 2½ In. at the pole, to which it is in like manner bolted.

The first stage rises in the centre 2½ In., and at the sides 6 In. above the axle-bed, and is bolted to it. The stage is 4 F. 8 In. long, 5 In. broad, and 3½ In. thick. The second stage rises 4½ In. above the first, and is bolted to the latter. It is 4 F. 8 In. long, 9 In. broad, and 2½ In. thick. The third stage rises 4½ In. above the second, and is in the same way bolted to it. It is 3 F. 6 In. long, 9 In. broad, and 2 In. thick. The third stage is movable at pleasure, and the machine is used either with or without it, according to the magnitude of the subjects to be removed. On the stage, which is uppermost, there is always a strong bolstering of double mat, filled with hay or straw, 6 In. thick, so that the bark of the stem may not be injured by the pressure.

The blocks between the two uppermost stages are 9 In. long, 3 In. broad, and 4½ In. thick, that is, deep. The end, of the upper stay, by resting on the first stage, shows itself like a block, in the end view of the machine (Fig. 3.); and the end of the pole presents a similar appearance, when seen in the same manner, as it rests upon the axle-bed.—Wherever it is possible, the bolts used for all of the above purposes, are shown in the diagram.

WHEELS OF THE INTERMEDIATE SIZE.

These wheels are 5 F. 2 In. high, made of the best materials, nearly upright, and the dishing only about 1 In.

The naves are $10\frac{1}{2}$ In. long, and $11\frac{1}{2}$ In. thick. The spokes are 3 In. broad, and $1\frac{1}{4}$ In. thick; the fellies 4 In. broad, and 2 In. thick; the iron rims $\frac{3}{8}$ In. thick, and in one piece.

In using a machine like this, it may, on extraordinary occasions, be proper to add a third wheel; in which case, the one above described might answer the purpose. But, were a third wheel to be made for this particular machine, it would be in better proportion at 6 In. lower.

The weight of the Intermediate Machine is considerably greater than that of the Small-sized one, being about $6\frac{3}{4}$ cwt. avoirdupois; and it is calculated for trees of from eighteen to more than five-and-thirty feet high.

For underwood, large shrubs, or the like, of which the roots and branches are not extensive, I have sometimes made use of a machine still lighter, and more manageable than any of the three above delineated. It consists of the pole of the Small-sized Machine, as already described, mounted on a pair of old coach wheels, from 4 to $4\frac{1}{2}$ F. high, with one stage only upon the crossbar. To these have been added fellies 4 In. broad, with an iron rim $\frac{1}{4}$ In. thick. Such a machine may be drawn by a small pony and is admirably adapted to light work. Whether with or without a horse, it can be conveniently introduced into woods and plantations, where a larger implement would not be productive of the same dispatch, and where the latter could not by any means be brought to operate.

As to the taking-up of underwood, little needs to be said on that head. He who attends to the directions above given for the removal of large trees, will find no difficulty with bushes or underwood. Excepting in very particular cases, I have not been in the habit of preparing them, by cutting round their roots. The chief preparation I have given, is to allow them to stand free and open in plantations or woods, for a certain period, in order that they may acquire that expansion of roots, and that share of the other protecting properties, which, according to the law of nature, may fit them for the situation which they are intended to occupy. As to transplantation, the branches of most bushes being tougher and more elastic than those of large trees, three or four, or even a greater number of plants can be carried away at one time by the smallest machine. It is only for the open park, that much nicety is required in any part of these processes.

On considering these different machines, the planter will find that they possess advantages, not at first sight apparent, but which will fully develop themselves in practice. The breadth of the stages, which are movable at pleasure; the shortness of the stays; the curvature of the axle; the iron sunk into the pole, &c; the position of the third wheel; the relative proportions and adaptations of the different parts to one another; all these tend in the most eminent degree to combine lightness with strength, and accuracy and dispatch with a due preservation of the roots and branches, during the transportation.

It is particularly to be noticed, that these implements, as well as the trees recommended to be removed by them, are of very moderate dimensions, and intended solely for the meridian of Scotland. In England, I am aware, that far larger operations are carried on, and it is possible that far greater success may be attained, than any we can here boast of. But the scale in question is perhaps highly enough estimated for a country, whose *power*, according to the philosophical notion of it above mentioned, is of such inconsiderable extent. In England, where that power is vast, I had almost said unlimited, a much larger scale may very properly be adopted. Size of subjects, as has been already observed, offers no material impediment to successful removal, except increased expenditure. If the true principles of the art be once fully established, and clearly understood, it will be easy to apply them to any scale of operations, from the least to the greatest.

SECTION IX.

PLANTING OF THE TREES, IN THEIR NEW SITUATION.

In the foregoing Section, we have seen the method, by which the tree is taken up, and transported on the machine. Let us now follow it to its destination in the open park.

It has been above observed, that for the safety and success of the operation, the rate of moving along the ground cannot be too slow. At that already pointed out of two miles and a half an hour, the difference between travelling a mile, and half a mile, does not very materially increase the labour of transportation. If the pit have been prepared a twelvemonth beforehand, the opening of it now is an easy business; and for that purpose, should it not have been done previously to the taking-up, two or three workmen should be sent forward, to throw out the earth regularly on all sides, to the depth of fourteen or fifteen inches at first, leaving, next to the inside edge, a space of eighteen inches, or two feet clear; so that the excavation can be enlarged, if requisite, without the necessity of removing the mound thrown up.

When the machine has got within forty or fifty yards of the place, it is proper to halt the horses, in order to make two necessary arrangements, the one in which the root, and the other in which the top is concerned. The director of the work first rapidly measures with his eye the depth of the root (that is, the thickness of the mass of roots and earth together, from the upper part of the collar, to the underbed of the roots,) in order to ascertain, if the excavation be of the proper depth? Supposing the depth of the root to be fourteen or fifteen inches (which in a beech is very supposable,) and the whole depth of the prepared soil of the pit to be two feet; then he directs the workmen to prepare a bed in the centre somewhat deeper, say three or four inches, to receive the taproots, should they be prominent, which with the beech seldom happens; sloping the pit upwards in the cup-fashion, but leaving it at the sides as high as before.

It is a matter of first-rate importance to get the tree set in the pit as *shallow* as possible, and to allow sufficient pabulum for the downright roots, on the one hand, and a sufficient cover at top, upon the other. If the subsoil be dry, the director may give and take a little in making his estimate; but, if it be tenacious of moisture, better that you should have a cart-load or two of earth to add to the mound afterwards, than that the roots should be deprived of the full influence of the sun and air, by being insufficiently raised up. No stagnation of water can ever occur in the prepared soil of the pit, if the directions given in the last Section as to judicious excavation, be properly apprehended and followed out.

The second thing he has to advert to is, to ascertain the position of the mark previously made upon the stem, while the tree stood upright, for designating the side where the longest boughs are thrown out, so that, in moving towards the pit, such a course may be steered, as to bring those boughs to the stormy quarter, which generally is the west or southwest. Almost all trees, as already stated in Section IV., are unequally balanced, and show in their tops more or less of what is called "a weather-side." This in many cases is a striking deformity, especially in situations on the western coasts, and is often seen to mar the effect of trees otherwise beautiful. It proceeds from the tendency, which they generally have, to throw out longer and stouter branches on the lee-side, and shorter and closer branches and spray on that, from which the blast assails them.

By the law of nature we find, that wherever the action of the air is the greatest, there the greatest evolution of buds appears, and the thickest, but weakest growth of boughs and spray takes place. And this difference is so remarkable, that any one conversant with wood, can at once point out an old tree (especially a sycamore,) that has been more, and one that has been less exposed, at the distance of two or three hundred yards; and in winter, when there is no foliage to conceal the difference in the ramification, the thing is the most striking. Hence the effect produced on trees, by bringing this decided tendency to elongation of the boughs on the lee-side, *to act on the windward or deficient side.* In fact, it is almost the only way, in which art can bring about any remarkable improvement on the symmetry and beauty of the tops of woody plants. It is true, the practice might at first sight appear rather a misdirection of the protecting properties: but experience has shown, that nature in this, as in the case of judicious pruning, or retrenchment of superfluous branches, bears with extraordinary patience such discreet control exerted over her exuberant powers, and in their subsequent development displays a vigour, even superior to what is observed in subjects which have not been so disciplined.—I believe, as already noticed, that I am the first planter, who, more than five-and-thirty years since, thought of turning this natural deformity to purposes of beauty or utility, in the face of prejudices both ancient and modern.*

The director having thus ascertained, that the mark made on the stem is uppermost (which it will always be, when not prevented by other circumstances,) he directs the driver to make such a circuit, as to go right in towards the southeast side of the pit; by which means, as the intelligent reader

* See Sect. IV., and Note.

will perceive, the tree being drawn root foremost, the marked side will directly face the opposite quarter.

While this arrangement is proceeding, which does not occupy above a few moments, two workmen rapidly ascertain, or fix the exact site of the tree, in its new situation, which till now has been marked out, only by a single stake driven into the ground. This is a still speedier process than the foregoing, and is called "setting off the tree." The two workmen, each with a stake in his hand, place themselves in different quarters, about five or six yards from the pit, the one, we shall say, on the north, and the other on the west side, so as to be able to describe two lines at right angles with each other, and to keep clear of the path or direction of the machine. Then, according to the military way of taking objects to move upon in the field, they assume the stake in the pit as a mutual centre, and some tree, or other object at no great distance, as a second object; and putting down their own stakes as a third, they describe a right line with each of the three. Thus, the two lines, marked out by these offsets, will intersect each other at right angles, or nearly so, in the pit, and the point of intersection will be the position of the tree. The stake in the pit may then be removed, for the admission of the machine, and a small piece of greensward put down in its stead, so that the tree may be dropped, with mathematical precision, on the spot intended.

With single trees in the park, this sort of accuracy may sometimes be of small moment: but, where a particular effect is to be produced by one tree, or by the combination of several trees as a group, it may be of considerable consequence; and, as it takes up only a moment, the workmen should always be made to practise it. It tends to give them habits of accuracy in their work, and teaches them the value and importance of juxtaposition, when it becomes necessary to study it.

Meanwhile the driver, as directed, makes the proper circuit with the horses (See Plate), and brings up the machine, as nearly as possible to the northeast side of the pit, running the wheels up against the bank, or mound of earth thrown out. Here it is prudent to take off the horses ; as it is always safer and better to wheel in the machine, for the two or three last yards, by manual exertion ; an object, which is readily accomplished, by cutting down the mound of earth in front of each wheel, and thereby forming an inclined plane, for the descent of the tree into the pit.

On this occasion, it is indispensably necessary that the machine should advance right upon the centre, or piece of greensward deposited in the pit, but without overrunning that point. Two persons, the director and another, then station themselves on the outside of the pit, transversely to each other, the one, we shall say, on the southwest side, opposite the machine, and the other on the northwest, or southeast side, whichever may be most convenient; because the line of sight, at both of the last mentioned points, is equally at right angles with the machine's direction. The workman who is placed immediately opposite the machine, now directs the advance of each wheel, or of both, as he sees necessary ; by which means he is enabled to bring the root of the tree right upon the centre; while, at the same time, the director, occupying the transverse station, which is the more important of the two, orders a halt to be made at the proper moment (for both cannot see the same objects); and in this manner the stem is brought directly to the centre, without being permitted to overshoot the mark. Two stakes, or stones, or other stays are now put to the wheels, in order to prevent their further advancement, and to get every thing in readiness for dropping the tree on the spot intended.—These arrangements, how complex soever they may appear in the narrative, are simple in reality, and, barring accidents, do not occupy above a few minutes.

Preparation is now made for dropping the tree into the pit.

The bundles of roots are every where loosened, and the roots freed from the wheels. The cords which confine the top, are removed, and the branches suffered to gain their natural position. Meanwhile, an active workman is sent to the top, to fix two ropes transversely to each other, in order to steady it, when set up; while another gets under the axle of the machine, and bringing out the roots of the under side, pulls them right towards the rear, in order to save them from being broken by the great weight of the descending mass; when, on a signal being given, the steersman and his assistants, together with the balancemen, as the case may be, quit their stations and their hold of the pole-rope and branches, and the tree suddenly rises to the upright position. All this may be readily apprehended, by considering its actual situation on the machine, as represented in the engraving.

If the longest branches have not been accurately brought to the stormy quarter, it is now the time to correct that error. The tree, if it be requisite, is again pulled down, and the machine wheeled round to the proper point; taking care, at the same time, if the root be heavy, to ascertain, by means of the offsets, that it is accurately deposited in the centre of the pit. It is then allowed to gain the erect position, as before. Instead of this, should the root be of no great weight, it may be turned round on its bottom or underbed in the pit, by manual strength, the workmen being careful to lay hold of great handfuls of roots and fibres, so that as little breakage as possible may take place. When these things are accomplished, the bracers of the root, and the pole-rope, are detached from the machine, and it is wheeled out of the pit. By common management, however, and attention to the directions already given, the whole of the above extra labour, which creates considerable delay, may be avoided, and the proper aspect for the heavy side of the tree obtained at once. All that is necessary in ordinary cases is, an inspection of the offsets, if great accuracy in the position of the tree be wanted.

We have now arrived at that part of the process of planting, which, as it is the most difficult to execute, so it is also the most difficult to render intelligible to the reader. It comprises the whole of the setting up, balancing, and supporting the plant; the distributing of the roots in a proper manner in the ground; and, in a word, every other precaution, on which its stability and success mainly depend. These operations, therefore, should never be performed, except under the eye of the director of the work, who should be every way competent to superintend them.—And here I cannot refrain from earnestly recommending it to gentlemen to make themselves fully masters of the practice, as well as the principles of these various processes, so that they may be enabled to take upon themselves the useful office in question, as often as it may be convenient. I need scarcely add, that, in all rural work, the superintending eye of the owner furnishes the surest earnest of success, especially where any thing like science is united with accuracy of execution.

As soon as the tree is properly placed, in respect to the position of the branches, and the machine wheeled off, the two transverse ropes (which should be ten or twelve yards long at least,) are instantly stretched out to their utmost extent, by putting one or two stout hands to each, as the balancing of the tree, and setting it straight may require. The director has then to settle the interesting point of depth, and to determine, whether it have been rightly judged, by the first cursory estimate. From what has been said above, it is evident, that if the tree be set too shallow in the ground, it has this advantage, that it is tantamount to deepening the soil, to the extent of the error committed: hence, it is possible to remedy the error, by bringing earth from some other quarter, to make up the deficiency. If the tree be set too deep, it is without a remedy, unless by planting it over again; which, were the business finished, besides the extra labour required, would considerably injure the tree. The director, if he have an accurate eye, *now* determines the matter, ere it be too late, at a single glance. Should the tree be too deep, he orders it to be pulled half way down, first on the one side, and then on the other, the transverse rope supporting it in the opposite direction. While in the heeling position, earth is then mounded on either side, as directed above for raising the tree in the pit, and it is soon got up to the height wanted. Should it be two shallow, it is in like manner pulled down, and lowered by alternate excavation on either side, to the proper depth ; but whether in the one case or the other, without altering the aspect of the tree, or the position of the branches.

The next point, and the most important of the whole, is to steady and set straight the tree, in order that it may please the eye of taste, on the one hand, and be firmly secured against wind, on the other. For this purpose, the first thing to be done is, to separate the workmen into divisions of three and three together, as before. Of these one workman seizes with both his hands as many as he can of the lateral roots, that are long and flexible, and holding them carefully aside, opens a view into the underbed of the roots. The passage being cleared, the second workman throws in mould of the finest sort he can find, in such a way as to form a bank sloping outwards against the roots so held up, and treads it firmly with his feet. He then carefully fills in and equalizes all the chasms or vacancies that appear; while the third, with a small blunt-pointed stake or rammer, about three feet long, pushes in the mould, and makes it firm in the cavities, which the foot cannot reach. But it is to be observed, that the workman, who throws in the earth, must by no means spade it at random. He must patiently wait for the co-operation of his two companions, neither hurrying the first, until every visible root is gathered up; nor the second, until the earth thrown in has, by decalcation, or by the rammer, obtained the utmost compactness and consistency.

In thus diligently and firmly bolstering up round the nucleus, but yet underneath, and quite clear of the great body of the roots and fibres, the different divisions of the workmen continue going round the tree, until they meet one another, forming a sort of circular retaining-bank, of the shape of a china saucer, of which the sides are of the depth of one half at least of the whole nucleus, or mass of roots and earth under the collar, whatever that may be, so as to compose a bank sufficient to support it. Hence the bank raised, if properly executed, will furnish such resistance to the action of the top, that a stout man, on applying himself to the transverse ropes, will find some difficulty in displacing the root, even with such a lever as the stem must afford him, and sometimes he will be altogether unable to displace it. When the resistance is found uniform on all sides (which should be often and carefully tried,) and particularly on the northeast or lee quarter, little more can be done for the stability of the plant. If roots of such stiffness and strength interfere, as cannot be put aside during the above process, the best way is, to bolster and ram them separately underneath, and especially at that part, where they issue from the nucleus of the mass.

It has been directed in the foregoing Section, that a ball of earth, as large as can be procured round the stem, shall always be left undisturbed, in the taking up. Should the weight not be excessive, and that it can be got to extend, so as nearly to meet the retaining-bank, the work may be considered as very perfectly executed; because then no interstitial vacuities will exist, in a region of the root of all the most liable to suffer from drought, during the first season. Should that prove impossible, from the lightness of the soil, or the want of adhesiveness in the greensward, mould finely pulverized, and in as dry a state as possible, should, in large subjects, be let fall into such vacuities as appear, until, by a repeated supply of the mould and water alternately, the interstices be filled up. By this mode of management, while the completest solidity is given to the whole, the finer ramifications of the root round the nucleus are little injured or cramped up, notwithstanding the retaining-bank.

While this business is going forward, the director accurately examines the position of the tree, first on the one side, and then on the other, from the two offsets (which is tantamount to his making the entire circuit of the tree,) and takes care that it be perfectly upright; making a due allowance for any bends, or natural sweeps in the outline of the stem or top. For accomplishing this, the transverse ropes, with five or six stout hands put to them, will still be able to command the tree; and it is necessary that its adjustment be at this time effected, in order to obviate the possibility of injuring the roots by dragging, and consequently displacing them, at a later period. By the above method of giving stability to the tree, *before any cover whatever is laid upon the roots* (which, I believe, is new, and peculiar to my practice,) the discerning reader will see, that a complete safeguard against wind is provided, without injury to the growth of the plant. This is truly the *planting* of the tree: all else belongs to the distribution, and the covering of the roots.

The distribution, though secondary in point of consequence to the securing of them, is a process involving much nicety and difficulty, and it is the business of the director, in the next place, to attend to its execution. The roots having been indiscriminately bundled up in the transportation, and merely untied during the fixing of the tree, are now, as may be imagined, in a state of great disorder, which the process of bolstering up rather tends to aggravate than improve. Accordingly, all the workmen are employed to disentangle them, and to stretch them out in the most regular manner from the centre. The tree, as already supposed, being a beech of more than eight-and-twenty feet high, with a spreading top, the roots must be from twelve to fourteen feet long, at least on the side placed to windward, and the minute fibres, and capillary rootlets not fewer than some thousands in number. (See engraving.) As soon as they are carefully extricated, separated, and as it were combed out with the fingers, so as to cover the ground with regularity, and as nearly as may be, in the same order in which they were taken up, it is nature that must teach us how to arrange them in their new bed. For this purpose, the director disposes the workmen, in divisions of three and three, as before. Of these one workman immediately divides or separates the roots, and prepares to distribute them: another assists in the laying and distribution; and the third throws in the mould in such quantities, as the two others stand in need of.

Whoever examines the beauty and regularity, with which the boughs and spray of trees, not mechanically prevented, are spread out in the air, and reflects, that it is an accurate transcript of the ramification (if I may so speak) of the roots under ground, will admire the remarkable analogy, that subsists between both of these organs, and the uncommon beauty and symmetry of both. The former is a matter of daily observation: the latter falls in the way only of gardeners and arboriculturists; but it is fully known to every one, who has seen, and can witness the extraordinary effects of the tree picker at this place. To give, in the replanting, any thing like an accurate imitation of such regular, but intricate network, requires no ordinary skill and attention in the operators: and yet we are aware, as nature orders nothing in vain, that in proportion as we fail or succeed in this object, we shall attain, or fall short of the purposes of vegetation, and of giving due vigour to the plant. An ingenious friend of mine, who, some years since, was struck with the dexterity of the process, in the hands of the workmen here, very appropriately called it "the handling" of the roots, and by that name it has since been distinguished.

The two handlers, then, of each division proceed to arrange and distribute the roots in their order, higher or lower, as they proceed from the mass or nucleus; stretching them out over the bolstering of the nucleus, to their full length, for which the pit must, if necessary, be enlarged. The great principle in this business being to follow nature, the roots must, like the branches of trees, be equally spread out. Nothing like crowding or confining must take place, but all must have competent spaces in which to extend, and ample scope to search for the food of the plant. For this purpose the minutest fibres, as well as the strongest roots, must be evenly embedded in the fine mould of the pit, neither kneading nor pounding it too firmly (as recommended by some), nor leaving what is technically called false filling, or interstitial vacuities. But the whole must gently consolidate into a mass sufficiently compact, yet porous, through which heat as well as moisture, as has been already observed, may have free access to the fibres, and where evaporation may proceed without obstruction.

To effect such a distribution and ordering of the roots, the first thing that the principal handler has to do is, to seize with one hand a parcel of the roots, and to divide them with the other hand into as many tiers as can conveniently be laid in the depth of the pit, allowing the strata of earth between the tiers to be an inch and a half or more in thickness. He then, in conjunction with his assistant, extends the larger roots of the first tier to wide distances, stretching out all the minor ramifications and rootlets intermediately, in the position in which they should lie, so that no one shall, if possible, touch another. The handlers having extended these, with their various inflections, to the breadth of six or seven inches, or as far as their fingers can reach, the coverer, immediately fixes them down, and secures that space with a little fine mould thrown upon it the reverse way, that is, in the direction of the points of the fibres; which mould is immediately spread and worked in, by the hands of the workmen or handlers, in such a manner, as that neither the mould can displace the minutest fibres, nor exceed the thickness of a proper stratum. After which, they go through the same process with the next tier, and so on with the others, till they exhaust the parcel of roots, with which they began.

It sometimes happens, that masses of roots occur, not far from the collar, branching out into small and numerous stems of no great length, which it is much more troublesome to deal with. With these the only way is, to divide them into tiers, and work them in the vertical, instead of the horizontal position. A quantity of the finest and most friable mould must be shaken in among the shortest, and least extricable fibres of these masses, so that the whole may have an opportunity of absorbing nourishment from the soil. If the pit be upon uneven ground, and still more, if on a steep bank, as sometimes happens, it presents considerable difficulty to inexperienced planters. In this case, especial care must be had to lay the roots in a direction corresponding to the slope, level in no part, but rising from the centre on the one side, and falling from it on the other. Hence, when the last tier on each side is finished, it has from six to eight inches of cover over it, at the general level of the ground. This, on the side of a hill of any steepness, it requires considerable skill to accomplish, so that the main body of the roots be brought within an equal distance from the surface, and receive proper benefit from the sun and air. In the manner just now attempted to be described, the workmen, three and three together, in divisions or parties, proceed round the tree, treating one parcel of roots after another in the same style in succession, and as soon as they meet, the work of distribution is completed.

At this stage of the process, it cannot have escaped the discerning reader, that contrary to the general practice, no decalcation or consolidating of the earth has as yet been directed, except in the execution of the retaining-bank round the nucleus of the root; and yet the entire ordering of the roots and fibres is supposed to be finished. But I have found by long experience, that an anxiety for immediate consolidation, which most planters possess, is not favourable to the fibrous roots of woody plants, small or great. That equability of pressure of the soil, which *gradual subsidence* alone can give, is not to be attained by any artificial means yet known, and least of all, by treading and pounding, by the feet of workmen. It is one thing to fill in mould firmly round the nucleus, and to compact it with the rammer, as above mentioned, where there is free room to operate; and another, to tread down with the feet layer after layer of the tenderest fibres, and finest capillary rootlets, as recommended by Marshall and others; a mode of treatment which cannot fail, after the critical period of removal, to be extremely prejudicial to what must be considered as the true absorbents of the plant. As to the final consolidation of the surface, it shall be treated of in the sequel.

After the covering of the roots, the only thing that remains to be performed is, to fill in the rest of the earth into the pit, so that at the stem it shall be from twelve to fourteen inches deep. If it be winter-time, that is, between November and February (in this climate including the latter month), a slight treading over the whole, by the workmen, is sufficient to bring about gradually, but effectually, the work of consolidation for the time, and that gentle and equable pressure, which excludes drought, and yet admits of the roots striking freely. If it be spring, that is, between February and May, Pontey's useful method of pouring on water is adopted,* namely, to do it (as he says), with "a watering-pan with the rose taken off," or with common pails, from the height of five or six feet, as soon as the covering of mould is half finished; dashing it down, with as much force as possible, in

* Rural Improver, pp. 88, 89.

order to wash in the mould among the roots of the plant. On this, the remaining earth is filled in, as above, taking care to begin with the green sward, if there be any, and hand-laying it in regular strata, so as in the greatest degree to retain moisture, while it promotes solidity. Another plentiful watering is next given, in the same way; the whole is left for a day to subside; and then, when it will bear the workmen's feet, it is ultimately finished, by a complete decalcation of the surface. I have been the more particular in dwelling on this part of the planting, as it is a subject not understood by the generality of either overseers or workmen.

It is wonderful what dexterity the workmen will acquire in these various processes, by attention and practice, under an able and active director, particularly in that of distributing and ordering the roots. Yet probably the greatest difficulty, that such a person will experience, is to get them to perform the handling, and to fill in the mould *leisurely enough*, without haste or confusion, or the slurring over of any part. He will also find it a difficult matter so to arrange the different departments of work round the pit, as that the whole of the workmen are constantly carrying forward the business in hand, and that the whole never have to wait for what must be done, and perhaps oftener than once, by only one or two individuals; such as adjusting the position of the tree, ascertaining the depth of the root, disengaging the pole of the machine, fixing or loosening the bracing-ropes, and the like, by which means much time is often lost, and, of course, unnecessary expense incurred.

In respect to those difficult and important processes, the securing of the tree against wind, and the ordering of the roots, I sensibly feel the inadequacy of the foregoing account of both. In order to be fully apprehended, they should be *seen* in the hands of dexterous workmen, when the efficiency of the one, and the beauty and nicety of the other would be fully appreciated. The description, as attempted above, is necessarily long, and for that reason, it may seem to many both complicated and tedious; but the processes themselves are as simple as they are effective, as has been acknowledged by all who have examined them at this place.

Some of the chief advantages attendant on the preservative sytem, obviously result from this useful method of securing, by a kind of cup-like embankment underground, the central mass or nucleus of the root, and rendering the tree steadfast and immovable, in spite of the utmost violence of the wind, from whatever quarter it may blow. The consequence is, that the roots being of great length, and consisting of innumerable and minute ramifications, instead of being *crowded and cramped up* in the ordinary manner, have as good and ample a range of pasturage, on the fine mould which has been prepared for them, as they had in their original situations, and in many cases a great deal better. What is of most moment of all is, that, from the singular steadfastness of the stem, they soon naturalize themselves to the spot, and go in search of their food; without suffering agitation at a period, when an *undisturbed state of the fibres* affords the best hope of continued stability, and therefore the best earnest of success. Thus, what is planted now on this principle, gives the Immediate Effect of Wood in the present day, together with the best prospect of becoming timber of as great magnitude as the soil and climate will admit, for the succeeding generation.

That the success of park-wood, planted here on the system in question, has been extraordinary, will be admitted from this fact alone, that although I never prop or support a tree after removal, yet *not one has been blown down in this park in the course of thirty years:* and as to deaths, *one in from forty to forty-five being the average number*, contingency may in some sort be said to be excluded from an art, which has, in all ages, been proverbially unsuccessful and fortuitous.

As to the taking-up, and transporting of trees and underwood for close plantations, the very same directions may be given for them as for park-wood, only that far less care and nicety are necessary in the management of the former, far fewer and shorter roots and branches, and in a word, the possession of the non-protecting, instead of the protecting properties. In respect to underwood for such plantations, as they are wholly out of the reach of sheep and cattle, perhaps something may be done towards giving a greater variety of effect to it, than has usually been attempted, for ornamental purposes, especially on the sides of walks, approaches, and the like.

Underwood or bushes being thick shrubby plants of low growth, from four to ten feet high, are procured in various ways, but chiefly by selecting such plants as grow in this style in woods and plantations; or by heading down, or cutting over trees of any sort that stole, or shoot out again, after being cut. In the way last mentioned, bushes may be formed of any species, as of oak, elm, chestnut, and the like, and of which the growth or foliage best suits the views of the planter. But in default of these, and for the purpose of procuring Immediate Effect, I have practised a new method, which it may be worth while to lay before the reader. This method I have called "the Composing of Copse-wood," by which, we certainly have it in our power to command, as well as to compose it.

By the Composing of Copse-wood, I mean the making up into one set or stool separate plants of the same species, from three to four or five in number, and in that process combining the high and the low, the spreading and the spiral, the straight and the crooked, in one pleasing group or assemblage. With a little practice, guided by anything like taste and judgment, bushes and stools of copse-wood may be thus composed, not only naturally and beautifully, but sometimes they may turn out more beautiful than what are found in nature. This is on the same principle of selection, that is adopted by the painter, when he assembles many separate beauties in one design, and thereby excels the beauty of any existing individual of the same species.

The materials of these compounds generally occur in young plantations of seven or eight years' growth, or more, in which the plants have not been overshadowed or unduly drawn up, but have had some room to expand. The art lies in properly working up these, so as to produce various effects; and chiefly in studying good contrasts; in letting the principal members of your group be tall and stemmy, while the accessories are low and spreading; and in a word, in so blending the whole, as to attain at once gracefulness and variety.

The two plants first put into the ground should be set somewhat deeper than the others, and nearly upright. The two or three next should have their roots crossed over to the opposite sides of the pit in which they are planted, so as to give them such an inclination outwards, as if they naturally sprang in opposite directions, from one centre or stem which had been headed down. This, if skilfully executed, will in a surprising degree promote verisimilitude. And in order to give the last finish to the group, small plants may here and there be set in, or redundant branches pruned away, that unnaturally cross or destroy the leading character of the ramification. But as the business of composing copse is to make a practical use of nature's own colours, it is as impossible minutely to direct the work, as to direct the painter who copies her, in giving the minutest touches of his pencil. One rule more I may in a general way suggest, and that is, never to overload the groups; never copying nature in her richer masses, but rather in her more simple combinations of foliage. In this, as in all other departments in which art is called in to the aid of nature, those efforts will always seem the happiest, and please the longest, where ornament is kept down, and where it is made subservient to the severer graces of composition.

In this, and the foregoing two Sections, I have now given as clear an account as I could of the Preparing, Taking-up, Transporting and Planting of Large Trees and Underwood. From the novelty of the subject, and the difficulty of making manual operations intelligible by words, the whole account has unavoidably been drawn more into length than might have been expected. Some apology, therefore, on the score of tediousness and circumstantial detail, is due to those who may open the book from mere curiosity. To those, on the other hand, who read for information, and whose object is real practice, the case is considerably different, as they perhaps may be of opinion that the detail, long as it is, has not been given circumstantially enough.

SECTION X.

TREATMENT OF THE TREES SUBSEQUENTLY TO REMOVAL.

It is with the removal of large trees, as with the execution of ordinary plantations. As soon as the plants are fairly put into the ground, the planter usually conceives his labour to be at an end, and that all after-cultivation is supererogatory or superfluous. This, although a common, is a very pernicious error, and is not less injurious in its effects, in the one case than in the other. Perhaps there is nothing in the course of this Treatise, that is calculated to be more interesting, or more practically useful to the young planter, than what is to be stated respecting Afterwork, in the few following pages.

In the foregoing three Sections, the Preparing and Taking-up, the Transportation and Planting have been treated as applicable, first, to Single Trees, and Open Dispositions of Wood; and secondly, to Close Plantations; therefore, in pointing out the Afterwork, the same order shall be followed, beginning, as before, with the former department.

First, as to Open Dispositions of Wood. In the end of April, or beginning of May, as soon as the removal of the last trees of the year (usually the lime, the horse chestnut, and the oak) is over, is then the time to examine the whole, and see how they stand as to covering for the roots. For that purpose, after trying various substances, I have found nothing so completely efficacious as the refuse of a flaxmill, called, in this part of the country, "shows," which, when they accumulate in the mill-yard, are generally thrown into the river, and carried away by the next flood.* During the scutching season, which commences in autumn, and extends frequently to the following spring, it is prudent to lay in a stock of shows, sufficient for the extent of your work; and, by stacking them up in a dry state, they will not heat, but keep well for nearly a twelvemonth. In parts of the country where there are no flax-mills, and where shows consequently cannot be procured, I should recommend moss (*Scotticè* Fog), which is every where to be had, and is the best succedaneum.

But before this valuable covering is applied, it is expedient, with late planted trees, to go over the entire surface of the pit with a wooden beater, made in the fashion of the beater used by pavers, but greatly larger, ten or twelve inches broad at bottom, and furnished with a double handle, in order that two men may work it. In working the beater, it must be raised as high as three feet or more from the ground, so as to descend with the utmost force on the loose mould of the surface; which surprisingly promotes consolidation, and, by consequence, the retention of moisture. For all trees, however, this mode of consolidating is not essentially necessary; neither is it indispensable for such as are planted early; but with the beech, the oak, the birch, and such others as are most sensitive of drought, it acts as a powerful preservative during the first season: and as it is at the nucleus of the root, immediately under the collar, that the fatal effects of drought are most to be apprehended, so it becomes the more important to provide the best mode of protection, in that quarter.

It was directed in the last section, that, on the planting being finished, the cover of earth at the stem should be from

* Note I.

a foot to fourteen inches deep, and at the extremity of the roots from six to eight inches. If by subsidence or the beater, somewhat should be lost of those dimensions, it is now proper to supply them. The next thing to be done is to level and dress the surface, and prepare it for grass seeds. Supposing the tree to stand, as often happens, upon a mound or hillock forced up by the earth or compost, which has been added to the original soil, the handsomest way of uniting it with the ground is, first to flatten it a little at top, and then to shape the mound in the fashion of the ogee in architecture, a well-known figure, consisting of a round and a hollow : for it is according to that pleasing figure, or some modification of it, that the most beautiful and elegant forms in nature, whether animate or inanimate, (for example in the female figure,) are always found to be fashioned : In fact, they are the forms, on which every eye delights to dwell, and every artist is studious to introduce into his works.

In wooding a new, or improving an old place, by means of the transplanting machine, it is to be observed, that on the sides of approaches, or other principal parts of the grounds, where foreground trees are scattered with profusion, it is of some importance, that these hillocks should always appear easy and natural swells, which *belong* to the ground, on which they have been superinduced. Above all things, they should be well "tailed out," as the workmen call it, beyond the dimensions of the pit, letting their hard outline imperceptibly disappear, and, as it were, die away in the outline of the adjoining surface. This is a business, which good taste suggests, and a good eye will readily direct. These hillocks, if handsomely shaped, give dignity to the trees that crown their summits, instead of seeming artificial and unsightly protuberances.

For this purpose, the director of the work should take a view of the surface on every side, at ten or fifteen paces off, as the work proceeds, and *there* give his orders for the execution, which will also strikingly expedite the labour of finishing. As soon as the figure pleases the eye from every side, the shows are put on round the stem, and nearly two yards out from it (that is, for trees of five-and-twenty and thirty feet high,) to the thickness of six inches at the centre, and four at the extremities; beating down the shows with the spade, to prevent the wind from taking hold of them; after which, they will soon consolidate, and completely exclude drought. The grass-seeds are then sown and raked in, over the remainder of the prepared surface, and of more than ordinary thickness; and these, on the roller being passed over them, will rapidly spring up, and greatly assist in retaining moisture. To turf such considerable spaces, as is done by some, would be an intolerable labour, without being either so effective, or so handsome in the execution.

By the above directions it is not meant that the shows shall remain longer on the surface, than during the first season. No tree, treated according to the preservative system, is known to die after the first year, if during that year it carry a healthy though small leaf, the oak and the beech perhaps excepted; which two species (from causes not yet fully ascertained, but probably owing to a peculiar sensitiveness of drought) sometimes fail in the second year. In the course of the second year, then, the circular spaces round the stem, which have been covered with shows, are to be lightly pointed over with the spade, and kept with the hoe for four or five years, until the trees shoot freely. It would be extremely injudicious to allow the spade to be used at all, after the first season; as the minute and capillary absorbents of the root immediately rise to the surface, and must suffer more or less even from the hoe, whatever caution may be employed. In respect to the oak and the beech, it would be prudent to allow the shows to remain upon those trees for two years complete, and delay all stirring of the earth round them, until the third summer.

The shows used for this sort of work are generally the short kind, the longer sort being reserved for the roofs of houses, in this district of the country. The former kind after one year, and still more after two years, greatly decays. By the second summer, when dug down, as directed above, they will serve to open and meliorate a clayey or loamy soil. Should the land be very light, they may be thrown off, previously to the pointing with the spade.

As the stirring of the mould round newly planted trees is more or less injurious, as just now stated, to the minute and capillary rootlets, there is another way, in which I have sometimes treated trees, and which it may be worth while to mention in this place. By those planters, who have large designs to execute, it may be considered as less laborious, than hoeing round the plants for several years ; and to others, whose taste has been formed on the works of the great masters of landscape, and who, for that reason, would reject whatever seems frittered into detail, or what they might term spotty in the picture, the appearance of circular hoed spaces round trees, might at all events be displeasing. To such planters I would recommend, when the shows are no longer necessary, instead of pointing over these spaces with the spade, immediately to sow them down with grass seeds, that is, after the first or second season, according to the species of the trees planted. As soon as they are properly established in the ground, which, situation and circumstances considered, may be by the fourth, or fifth, or sixth year, a topdressing should be applied, consisting of earth and coal-ashes, such as has been described at p. 189., of which the ingredients are thoroughly mixed, and the surface should then be ultimately laid down with grass seeds. Thus, a general chemical action being excited throughout the compost, the most propitious period will be seized, for giving an extraordinary stimulus to plants just recovering from the process of removal; and there are few trees so treated, that from thenceforward will not begin to shoot forth with a vigour, which the most sanguine planter could scarcely have anticipated.

The next object, after attending to their cover, is to secure the trees against injury from sheep and cattle. That rubbing, by either the one or the other, can affect the stability of trees, or in any wise displace them, after being planted in the manner described above, is out of the question. But there is in the coats of those animals an oily substance, which by continual friction is apt to stop up the minute pores of the bark, and prevent the admission of the sun and air, before the epidermis has had time to be fortified, by age and exposure, against its influence. Without entering into the ingenious speculations of Marsham, who found, that repeated washings surprisingly forwarded the growth of all woody plants, we are warranted in believing, that those owners of parks, who continue to defend their trees after sixty and seventy years' growth (and there are some persons who incur that labour,) perform a work of supererogation: at all events, it is a work of considerable expense, and of very little utility.

The best, the most pleasing, and in many situations the most profitable stock for a park, consisting of forty or fifty acres, and upwards, is unquestionably sheep. Sheep love a wide range of pasturage, and are not found fully to thrive, or to be kept with facility, within a less extensive circuit than the one just now specified. Unless your wood be of considerable age, deer, independently of the great difficulty of restraining them, prove extremely troublesome; and black cattle and horses, from their height, and uncommon fondness for the tender shoots of most woody plants, would shockingly disfigure the generality of removed trees, of which the effect chiefly results from the beauty of their spreading boughs, at from about four to seven and eight feet from the ground. The browsing-line of the blackfaced sheep seldom reaches to more than three, or three feet and a half above the surface; a height, which gives lightness rather than otherwise to park scenery, while the formality, which the browsing-line is thought to occasion, is very easily done away, by any one acquainted with the commonest arrangements in real landscape. To protect trees effectually, however, from the rubbing of sheep is a work which we seldom see well executed; because to do it well, both neatness and utility should be combined in the execution.

The guards generally in use for protecting trees, are well known; hurdles and cordage of different kinds; three-cornered, four-cornered, and circular palings, and the like; black or whitethorn branches; wrappings of straw or mat, and even of painted sailcloth, have been all employed on various occasions. Of these contrivances, the thorns are injurious to the wool of the sheep, and the different wrappings to the trees; and both act in excluding the sun and air from the stem. In respect to the hurdles and palings, they appear always cumbersome, and, if numerous, form too prominent a feature in a park. When a man, however, has planted his lawn with trees like his thumb, or at most like his wrist in thickness, he is apt to fancy, that he has covered the surface with fine wood, when he has only disfigured it with hedgestakes and railings, which are at least as unsightly to behold, as they are expensive to keep up, and show a complete absence of both taste and skill. The example which has been quoted in Section V., of the effect of this sort of wooding, by no means presents an overcharged picture of the system.

Perhaps the most perfect of all guards would be an iron collar, of about an inch and a half broad, with a hinge in the middle of it; together with sharp-pointed uprights of the same material, three feet three inches high, and three quarters of an inch in thickness, for running into the ground. The uprights might be placed about two inches asunder; and to the whole might be added a hasp, with notches in the collar, in order to accommodate it to the progressive enlargement of the stem. But the expense of such an apparatus, for trees of moderate size, including painting of the colour of the bark, could not be less than from twelve to fifteen shillings each, which would completely preclude its general adoption. A guard, therefore, which should be at once neat, cheap, and durable, seems still to be a desideratum in park economy.

There being between seven and eight hundred transplanted trees and bushes in loose dispositions in the Park here, it was necessary to construct something less hideous, and less costly, than seven or eight hundred hurdles or palings of four feet square; as no features of landscape nor richness of foliage could have redeemed so overwhelming a deformity. In Engraving II. the reader will find the delineation of such a guard for a park tree, as has been for several years adopted at this place, and it is recommended not less by its neatness, than by its unobtrusiveness and efficiency. The trifling expense likewise, which attends it, is of no small importance in situations, where any considerable number of trees stand in need of protection.

This guard is composed of stakes of larch-wood, made like hedgestakes, but somewhat lighter and neater. They are about three feet three inches long, and six or seven inches in girth, at the larger end. They are flattened at the smaller end, to the thickness of about three quarters of an inch, for applying closely to the tree, and pointed at the larger, for driving into the ground. The workmen, in setting them up, drive them into the ground, four or five inches out from the stem, and three asunder. The tops being flat, and about two inches broad, they unite in a neat manner round the stem, when pressed to it, and firmly bound round with marline, half twisted and pitched, such as is used on board a ship, to secure the ends of the cables. A small piece of doubled mat, four inches broad, is previously put between the tops of the stakes and the stem, in order to prevent chafing. As soon as this ring or hempen collar is put on, the workman, who fixes it, proceeds to connect it with the bracer at the centre, drawing the end of the marline half way down between the top of the stakes and the ground, and making it fast to one of the stakes. From thence he passes it loosely round the whole, taking a turn round each stake, until he arrives at the point where he began. He then pulls it tight, and fixes it firmly at that point; adding another line of connexion, on the opposite side between the collar and the centre-bracer last finished. For this work, it has been found more economical to use double, than single marline of the common size; as also, to employ two workmen, if expert at the business, rather than one; as two will do it better and more speedily, in proportion to the time they are employed.

Thus it will be perceived, that a guard for trees of the firmest sort is procured, and such as will last for nine or ten years, with occasional repairs of the marline; which last, as it suffers by contraction and expansion, and the continual rubbing of the sheep, should, after the first year, be gone over two or three times during the summer, and kept in good order. If the larger ends of the stakes (at which place they always fail) be dipped in coal-tar, brought to the state of half pitch, they will last from twelve to fifteen years. By driving the stakes a little way out from the tree, as above directed, the tallest blackfaced sheep (and no epicure in mutton will ever keep any other stock) are forced to rub near the centre of the stake, where the fence is the stoutest. The bark likewise, being covered in no part, excepting at the top of the fence, by the small bit of mat, receives sufficient benefit from the sun and air.

The entire cost of this guard, materials and workmanship, does not exceed sixpence per tree, reckoning ten stakes as the average number required for each. Hence it is an effective, as well as an economical mode of defence, and I may add, a neat one also. To the most fastidious eye, the effect produced by it is neither heavy nor displeasing, as the hue of the stakes, in a few days, sufficiently harmonizes with that of the bark; and so far from appearing a deformity, it is, as has been observed above, quite unobtrusive, and is nearly invisible, at fifty yards' distance.

As the season advances, and the drought of summer sets in, the watering of the trees planted in the spring, and the preceding winter, next claims attention. About the end of May, or beginning of June, when no refreshing showers have fallen for a fortnight, is the time to put in requisition the water-cart, and to endeavour to supply by artificial means that degree of moisture, which, after the first year is over, a more advanced state of consolidation enables the soil to retain. There is scarcely an instance of a tree, if properly removed, requiring water in the second year, excepting perhaps the oak, when it fails to come out freely in June; but even in that case, it is quite unnecessary to repeat the operation, beyond the month in question.

The water-cart is a very simple implement, being merely an open cart, with broad wheels, having a large barrel or hogshead mounted on it (an old wine pipe answers the purpose admirably;) and there are superadded a spreading mouth at the bunghole, for filling the cask, and a large brass cock below, for drawing off the water. The best time for dispensing this refreshing element, is unquestionably the evening, as little or no evaporation takes place during the night; but in works of any extent, it is not possible always to time it with accuracy. A single workman, with a couple of stable-pails, attends the driver of the cart, and both assist in drawing off, and distributing the water. In executing this, they cannot pour it on too leisurely, equally dribbling it out over the surface of the pit, and to the full extent of the roots, but most copiously near the stem, and on the nucleus of the root. Four or five pails, which contain sixteen or eighteen quarts each, are sufficient, at a time, for a tree from five-and-twenty to thirty feet high; and the operation is repeated every fourth day, while drought continues. It is an easy matter to overwater plants, for example the beech: an error, by which removed trees sometimes suffer, when they might otherwise have succeeded, and of which I have seen more than one instance, in the present year, 1827.

On some occasions, I have attempted the watering of entire plants, branches as well as roots, with a good garden-engine; by which means, it was easy to throw the water, in copious showers, to the tops of our highest trees. But no benefit adequate to the labour was found to result from it. The absorption of dew by the leaves, even in the driest season, added to an absorption by the roots in consequence of abundant waterings, appears quite adequate to continue vegetation, during the critical period of the first summer. If the introsusception of their food by the roots is not prevented from going forward, there seems little danger in the other parts of the process.

Gardeners usually recommend, that all artificial waterings should be performed with the watering-pan, as more accurately imitating the genial rains, as they descend from the clouds. That this is a superior method, cannot be doubted, and for the nicer business of horticulture, it may in many cases be indispensable. But in field practice, which is often less delicate, and far more extensive, *despatch* is so vast an object, that such implements as the watering-pan are quite inadmissible. As a proof in how far our field practice has been successful, it may be stated, that, during last summer (1826,) when the severity as well as the continuance of the drought was, it is believed, beyond all example, *only one removed tree in more than a hundred died at this place*, although several bushes failed, and particularly of the evergreen species; and to this it may be added, as a very striking circumstance, that more than three-fourths of the number were beeches and oaks! For such extraordinary success, in restoring and continuing vegetation after removal, I chiefly account, from the care and regularity, with which the water was distributed, and the valuable discovery, that so cheap and common a substance as shows has the property of excluding air, and retaining moisture, and is, by consequence, the best safeguard against the effects of drought.

The next branch of afterwork, that requires consideration, is a very important one, and that is the maintenance of the trees in a state of progressive vigour, after being planted: and, as there are few subjects in arboricultural economy, that appear to be less understood, I shall the more particularly enlarge upon it.

It has been already observed, that no experienced planter expects his removed trees to shoot freely, until they have been fairly established in the ground; and that is a circumstance, which must be regulated by soil and climate, by scientific planting, and previous selection. It is true, according to the system now attempted to be established, they will carry a full leaf after the first, or, at all events, after the second season; and, as they are preserved entire in all their parts, they will produce the full effect of trees, which have never been removed; still it is not until the fourth or fifth year, or more, that shoots of any consequence can be expected. With particular trees, however, this expectation is not always fulfilled; and it sometimes happens, when the process of removal has been conducted in the best manner, and on the best soil, when the sun has shone, and the rains have descended most favorably on the plants, that six, and seven, and a greater number of years will elapse, without any decided proofs of advancement. Not but that they seem sufficiently healthy, and continue to *grow;* but we want something more; we expect them to *thrive* in their new situations. This backwardness in trees, as it appears, is confined for the most part to suoh as are planted in exposed situations: heat and shelter being its cure or preventive, it is seldom seen in close plantations.

For such exceptions to general success, it is not easy to account, especially in cases, where our subjects are in the full possession of the protecting properties, particularly that of competent and healthy roots: but it is certain, that such exceptions occasionally occur, with almost every sort of tree, even the hardiest, and those the least sensitive of drought. It is, moreover, a remarkable fact, that I have sometimes found those plants of the late or aboriginal oak (the hardiest of all that genus) thrive the *best*, which had the *worst roots*, that is, the fewest in proportion to the top! The truth is, that vegetable physiology is in itself an obscure subject; and although many important facts respecting it are known and ascertained, by microscopical observation, and careful study, yet probably so many still remain to be discovered, that it is impossible to suggest a satisfactory theory for every anomaly that occurs in practice. But in the particular instance above mentioned, namely, occasional backwardness in the growth of trees, when least expected, if no theory should be found to account for it, there seems yet a certain remedy for the evil, which experience has pointed out.

If a tree appearing backward, be from five-and-twenty to thirty feet high, and of girth in proportion, let four cartloads of tolerable earth be taken, of a quality rather opposite than similar to that, on which it has been planted, that is, for light soil, of the aluminous, and for heavy, of the silicious character; to which let a cartload of coal-ashes be added, with the rough cinders carefully riddled out. Let the whole be laid round the tree, and very intimately mixed in the manner above pointed out for extra earth and compost, and particularly when made up of manure of this species.* Then, let the composition be spread on the surface, from the

* See pages 217, 218. *anteh.*

centre outwards, nine inches thick at least, at the stem or centre, and five or six at the extremities; by which means, probably a space of six or eight feet out will be richly coated. Or, if you can easily supply the materials, it would be better to coat it ten or twelve feet out. Lastly, let the composition be carefully pointed with the spade, between two and three inches deep (which is the depth of ordinary hoeing, *into* the *former* soil, round the plant. The sooner after the fall that this work can be executed, the more confidently you may rely on its effects during the following season.

Into materials so compounded the minutest fibres, or absorbents of the root, will enter with avidity, on the first approach of the genial heat of spring; or possibly the fine and friable nature of the composition may occasion an anticipation of the period. The season of vernation erelong will come on, the leaves will be enlarged, and assume a far deeper and more lively green. By midsummer, the tree will have shot some inches; and, by the following season, probably more than a foot; and it will continue to exhibit both established health and progressive vigour.

About every house in the country, there is a place appropriated for collecting the ashes; I mean of course, coal-ashes. To that deposit are usually added soot, sweepings of houses, and other miscellaneous manures from the kitchen-court, all well adapted to the purpose in question; and the whole should be exclusively reserved for trees by the judicious planter. Great attention likewise should be bestowed, in separating the cinders from the ashes, when the latter are first thrown out, and in a dry state, as the cinders are of little value, and injurious to the roots of plants.

No one, who has not seen it, will easily believe the surprising effect, which this compound produces on park-wood some time removed, and to the most exposed situations, if it chance to be in a backward condition, and by thus merely adding to the surface, and thereby enlarging the pabulum of the trees. I rather imagine, that the process is peculiar to my own practice: but, be that as it may, I have repeatedly tried it on all sorts of subjects, young and old, removed and unremoved, that seemed to be backward or stationary in their progress, and its vivifying powers have proved extraordinary in every instance. It is, however, to be observed, that in the case of old trees, as there is a complete exhaustion of the original soil around them, so a much larger mass of fresh matter must be superinduced upon it. A tree of three or four feet in diameter would require twenty cart-loads at least, in order that any material renovation of its strength might be effected; and few men, I think, would grudge so small an expense and labour, to save or improve a favourite tree.

The practice of gardeners, I am aware, is considerably different from this. If they find their trees in any wise unprosperous, their usual resource is, to *stir the earth among the roots*, instead of leaving them undisturbed, and to dig in well-rotted dung, or other manure; and it is to be presumed, that, in their management of park-wood, they would pursue a similar system. In favour of such a practice, in the horticultural department, something may be said; because the great depth of soil in garden-ground admits of the roots of fruit-trees descending far deeper, than can be expected in the park; not to mention the advantage of cultivating leguminous crops on the surface. But I am satisfied, were the fruit borders in gardens, and especially in orchards, to be left undisturbed, unless by the hoe, and were the extension or improvement of pabulum for the roots to be *made upon the surface*, as just now directed, that the effects would be not less surprising than those which I myself have experienced.*

There is another remedy, which I have sometimes tried,

* Note II.

for backwardness in the growth of trees, and which, although I cannot recommend it with the same confidence as the above Panacean Compound (if I may so call it), is yet deserving of the reader's notice. It consits of the juice or moisture proceeding from the dunghill, which, being collected in a well or pit, is pumped up into the water-cart: and it is frequently used for decomposing-peat, or manuring grass-grounds in the spring. When intended for trees, damp weather, or immediately after rain, is the time for applying it, on account of the quantity of ammonia in different forms, and the various salts which it contains. It is poured on, in the same slow and gradual way as directed for the water, but in not more than half the quantity at a time.

As this liquid may be considered as the extract of the most useful vegetable and animal manures, with a strong infusion of urine in a putrid state, so it has probably in its composition too much animal matter, to form a proper nourishment, by absorption, for the roots of woody plants. All urine, contains the essential elements of vegetables in a state of solution. During putrefaction, a great part of the soluble animal matter is destroyed; therefore, it is proper always to use it in as fresh a state as possible; or otherwise, to dilute it copiously with water, to which a moist state of the ground, or the water which falls into the pit, as above, will contribute. When managed, however, in the most careful manner, this liquid rather disappointed me in its effects on trees, and I should far rather prefer the excellent compound already described.*

In regard to backwardness in trees, as the subject is not only curious in itself, but of great moment to the general planter, as well as to him who removes larger trees, perhaps a few remarks, on the causes in which it originates, may

* Note III.

not be inappropriate in this place, and prove interesting to both.

From what has been observed of this evil, it appears, that it exists in a remarkable manner, only among exposed plants, and that heat resulting from shelter, in most cases, furnishes a complete preventive. In consideringt he nature and habits of woody plants, we find, that the warmer the atmosphere in which they grow, the more active the vegetation that is carried on in them, and consequently the greater the deposition of nutrient matter, that is made in the bodies of the plants. Our object, therefore, should be, after their removal to colder or more exposed situations, so to increase by artificial methods the action of their vegetable powers, as to compensate to the required extent for the absence of heat ; and should that not be done sufficiently in the beginning, to augment it afterwards. This important principle was stated above, in the instructions given for the preparation of the soil, but not sufficiently illustrated under that head.*

It is on this principle, that the application of the rich and friable compound above mentioned is made with such extraordinary effect. If we administer it to two park trees of the same species, and of equal size and strength, but placed in different degrees of exposure, in equal quantities, the shoots which the trees send forth, will not be in the ratio of the compound applied, but in the ratio of the exposure. In the same way, if we apply the one half of the compound to a park tree comparatively sheltered, and double the quantity, or more, to a similar tree severely exposed, the shoots which are sent forth by the former, will be fully equal to those sent forth by the latter. Thus, the uniform, but relative success attending this practice demonstrates the justness of the principle.

* See Sect. VI. p. 193—195.

But what shall we say to the case, which frequently occurs, of two trees to all appearance equally formed and circumstanced, and yet unequal in their progress; or, more properly speaking, of which the one is progressive, and the other visibly stationary? As there can be no effect without an adequate cause, so we are compelled to believe, that such plants are either different from what they appear in their internal development, or that their development is differently acted on by its external conditions, otherwise, we should unquestionably perceive the same results. From what we know of the uncertain and anomalous practices of planters, there are various circumstances respecting removed trees, that may possibly be regarded either as proximate, or efficient causes of their ill success, or at least of their appearing stationary, when, as we imagine, we have done every thing in our power to render them progressive. These circumstances or causes are probably the following:

First, An unsuitable or inappropriate Soil or Subsoil. There are certain soils, on which all trees will thrive; and there are certain other soils, on which particular trees will not thrive, according to their particular properties, and the law of nature that regulates their species. As nine planters in ten are unable to discriminate regarding plants and soils, and make the proper selection, so it must happen, that trees often fail of success, wholly from this circumstance.

The second cause seems to be, Defective Roots. Roots, when taken up and replanted, may sufficiently please even an experienced eye, and look both abundant and healthy; but they may, and often do receive such treatment between the two processes, as incapacitates them for performing their functions as absorbents. If the roots, and especially the minute fibres, are to be kept up as much as possible *entire* (which is a fundamental rule in the preservative system,) it is evident, that the utmost care and attention are indispensable, to prevent an unnecessary exposure to the atmosphere.

Should that unfortunately be permitted, the fibres will become discoloured, or altogether black, and by immediately decaying, after being replanted, soon occasion a corresponding decay in the spray and twigs of the branches. As the sap, therefore, is scantily absorbed and sent upwards, an equally scanty supply of the proper juice is sent down, in order to give expansion to the roots; and although the tree carry a tolerable leaf, and produce the general effect contemplated in its removal, still the efforts which it makes to supply the parts that have been lost, retard its progress, and a year or two may elapse, ere the due complement be made up, and the tree consequently shoot forth with vigour. It is to be feared, that this cause of backwardness oftener occurs than the best planters are aware of; but it never appears so fully displayed to the view, as in some singular case, when the tree happens *again* to be taken up, after the first or second season.

The third cause that may be assigned, is late frost, in the spring of the first year, or, it may be, early frost, in the autumn of the foregoing season. Supposing that trees have the best roots and branches, and that they have been transferred without accident or injury, premature frost is nevertheless an enemy to their success, which no foresight can prevent. In these northern latitudes we have, properly speaking, but three divisions of the year, summer, winter, and autumn. The fourth division, namely spring, although it figures in the calendar, does not always favour us with its actual presence. Sharp frosts in May, and sometimes in October, are not altogether unknown in the best English climates; but they are mild visitants there, to what they sometimes prove in Scotland.

If the reader have fully apprehended the detail, which has been given above (especially in Section IV.,) respecting roots and branches, he will perceive, that those two main conservative organs being (as the schoolmen say) " relative and correlative," continually act and react; hence, they reciprocally flourish and decay, and are reciprocally stationary or progressive. Therefore it must happen, that if, during April and May, a keen frost supervene, when the sap first rises (and the flow must always be more or less imperfect, in the season of removal,) the topshoots of the former year will inevitably be cut down, and the roots must suffer proportionally in consequence. In the same way, if they be cut down in October, they will not revive in May or April. In either case, *the activity of vegetation being checked in the outset*, and in both branches and roots, it will require more than a single year, ere the tree can regain its healthful action.

The fourth cause, which may be stated, is late planting in the spring, which always operates as a great discouragement to trees, and kills many. By planting early, that is, soon after the autumn, or at least not later than February and March, all trees (oaks and evergreens excepted) are surprisingly benefited. By means of the moisture, with which the earth is constantly saturated at this season, a *gradual consolidation* of the mould round the roots and fibres takes place, far superior to any that can be brought about by artificial pressure. But the state of the atmosphere after March being comparatively dry, no equal consolidation is attainable, and the roots, *if once injured by drought*, suffer so severely, as not to recover the injury for some years, and often they never recover it.

The fifth cause is akin to this, and acts prejudicially in the same manner, during the first year, namely, the neglect of duly covering and watering the roots, before the summer drought sets in. In situations where "shows," or the refuse of a Flaxmill cannot be obtained, moss (*Scotticè* fog,) which is frequently employed by florists, is the best substitute, as already mentioned.

It is remarkable, that these five probable causes of backwardness in the growth of trees, the first only excepted, uniformly operate during the *first season after their removal*, which points out the vast influence which their health, during that critical period, seems to possess over their after-progress. As the evils specified are all, excepting one, in our own power, and such as by attention and industry may be prevented, so it likewise points out of how much importance it is, both to the general planter, and the planter for immediate effect, by every effort to endeavour to prevent them, by attention to the selection, condition, treatment, and growth of their plants, in the early stages of their progress.

It is highly probable, that one or other of these causes of backwardness exist in all removed subjects which become stationary, although we are not always aware of its existence. How successfully soever a tree may be transferred, we do not expect any considerable shoots from it, till after the third or fourth year; and we do not decidedly pronounce as to its backwardness, till the fifth or sixth, when, if it be a fine subject, we begin to look round for a remedy. At this juncture, the evil or evils in question are in a very great degree alleviated, by the efforts made by the plants themselves to regain their lost strength. Hence, the stimulus of the compost above recommended, must now come at a very opportune period. Coal or wood-ashes, or peat-compost, as already said, soot, the sweepings of houses, and other miscellaneous compounds, intimately mixed with soil in a completely friable state, are peculiarly fitted for this purpose; and in fact, nothing less than such a stimulus is sufficient to compensate for the want of heat, and to render vegetation once more active, counteracted as it must be, by the severity of the process of removal itself, and by the effects of the exposure, in which the tree has been placed. The great object, in the application of all manure, is, to furnish as much soluble matter as possible to the roots of plants, and that in *a slow* *and gradual manner*, in order that it may be entirely consumed in forming their sap, and various organized parts.

This short statement may perhaps in some measure account for the backward condition of trees standing in the open park, and likewise for the success of the remedy that has been applied to them. In regard to the superior advantage of the method of laying the compost *on the surface*, compared with that of digging in any manure among the roots, it is too obvious to require further illustration.

There is only one other point, in the department of after-work, which it may be worth while to touch upon, in as far as open dispositions of wood are concerned, and that is, the setting straight after a certain period. There is nothing that contributes more to the beauty of park-wood, and particularly of removed trees, than their maintaining the upright position, and their appearing unaffected by the western and south-western blasts. Those, who possess grounds on the western coast, will more especially feel the importance of this remark. It is true, that in the compositions of the best masters of landscape, we find trees sometimes represented in a heeling position; and such objects are often extremely picturesque, and so found in nature. Kent, as has been already noticed, planted dead trees in his designs, the better to imitate natural variety: but that is not a taste which can be safely recommended to the young planter to adopt. Whatever be the pains and care which we bestow on making our trees steadfast in the planting, it will sometimes happen, on a large scale of work, and in bleak situations, that a few may have discernibly yielded to the blast, after being a twelvemonth in the ground. It is proper, therefore, in the spring of the second year, to go over the whole, and by means of a long rope, fixed as near as possible to the top, to bring such as require it to the windward side. The longer the lever, the greater, of course, will be the effect produced.

The speediest way is to turn out a number of hands, sufficient to command the tree at once, eight or nine persons at the least, taking care to secure the bark of the stem, by various folds of mat, interposed between it and the turns of the rope. When the tree has been sufficiently bent down towards the proper quarter, let the director of the work minutely examine where the ground rents on the lee side, and order an opening to be made at the place, with as little injury as possible to the roots, of a foot or eighteen inches long, and of half the width. While the tree is held in the heeling position, heavy masses of green-sward are then procured, as large as can be lifted with the spade, and rammed into the opening, firmly treading them in with the foot, or securing them, if needful, with the beater. If this be done in April, before the sap flows abundantly, no damage will be suffered by the bark, and little by the roots. As the position of the tree is reversed in the planting, and the longest branches, and consequently the longest roots, are turned to the stormy quarter, you will probably have no further trouble with it; although a second revision of its position is always advisable, in the spring of the following year.

Upon the whole, this is a work, which, according to the preservative system, is so seldom necessary, that the mention of it in this place might seem superfluous. But, in a body of instructions, intended for general use, it is advisable to guard against every contingency. In respect to the propping or supporting of trees with wood, or ropes, or other materials, which, with many planters, forms a principal and important branch of their afterwork, it is wholly unknown at this place. Indeed, whoever considers the method of securing the roots above delineated, will perceive, that such adventitious and unsightly contrivances are altogether superseded by that method. During the course of thirty years, as already mentioned, we have never had a tree blown down, and rarely one displaced from its original position; and it is probably to the *undisturbed* state of the roots, owing to that circumstance, during the two first years after removal, that our success may in a great measure be attributed.

I will now proceed, in the second place, to speak of close woods and plantations. The afterwork applicable to these will not require a long discussion. Much of the afterwork, that is proper for single trees, equally applies to enclosed masses of wood: besides, the same minuteness of attention, and diversity of labour, are not demanded by the latter, as by the former style of plantation.

In the foregoing three sections, the method has been pointed out of preparing and planting close woods, which, in their handsomest form consist of standard or grove trees with underwood intermixed. Such plantations, having been previously trenched, and manured to a potatoe-crop, are in a state of preparation, far exceeding any that can be obtained for open groups, and still more for detached or single trees. One advantage above all others they possess, and that is, that the plants, which compose them, form a complete shelter to one another, and thereby *create a climate* for the plantation, many times milder than that of the surrounding grounds. Here also a far greater stagnation of air prevails, and consequently, a retention of moisture, proportionally greater than in the open park.

The first thing to be done with these plantations is the same as with single trees, namely, to go over them carefully, and examine what cover they have upon the roots, and to supply it, if wanting, with earth taken from the intervals. To make up the cover to about ten inches in depth, is at least equal to a foot or fourteen inches, in the open field. It seldom happens, unless the outside plants be very deficient in length of root, that any consolidation by the beater can be wanted; neither is any uncommon accuracy material, in levelling or dressing the surface, unless what is required to preserve the general character of the ground, and to prevent the stagnation of water in any part. In respect to fencing the trees, nothing need to be said on that subject; as the plantations being close, that is, composed of grove and underwood, necessarily implies an enclosure completely secured against sheep or cattle.

As it is equally important, though not nearly so difficult, to preserve close or enclosed plantations from suffering by drought, as open dispositions of wood, shows must be laid upon the roots in the former, by the middle of May at the latest, and before the summer droughts set in. For this work, the same method is to be followed, as that prescribed for single trees; only, should your stock of shows be not abundant, the allowance may be decreased, by a third part for the trees, and by the one half for the underwood. In respect to watering, it is to be done in a similar manner, every fourth day, as pointed out for detached trees, but not so copiously, as in the case of the latter, for the reasons already assigned, and because those trees are much more exposed to the action of the atmosphere.

During the first season, the cultivation of the ground is of small moment; but without displacing the shows, it may be hoed in the intervals. In the second year, the entire surface is to be lightly pointed over with the spade, and carefully kept with the hoe, until the plants shoot freely. From the superiority of this factitious climate, and other propitious circumstances, the plants very readily become established in the ground; and in point of growth, they will soon outstrip all your other plantations. In this situation, we find no backwardness of growth, no stationary symptoms in these plants, but all advance with nearly equal vigour.

From what has been said, the reader will perceive the great importance of a judicious system of management, for a few years subsequent to the removal of trees, and, above all things, the perfect preservation of their health and strength, during the critical period of the first season. The great design of afterwork, independently of that of securing the plants from external injury, is to bring about their speedy and full establishment in the ground. No plants, as I conceive, can be said to be fully established in the ground, unless they shoot forth with freedom, according to the soil in which they are placed, and that appears to depend, in open exposures, *on their complete possession of all the* PROTECTING PROPERTIES; or, in other words, that nearly as active a vegetation shall be carried on, and nearly as great a deposition of nutrient matter made in them, as in subjects of similar magnitude in close plantations, in the same soil and climate. That shoots of equal, or nearly equal length should in any case be sent forth, by exposed as by sheltered trees (as is the case at this place,) is a fact probably unexampled in itself, and, in order to gain belief, the thing requires to be seen, or at least supported by very unexceptionable evidence.

It has been calculated by some arboriculturists, and probably with correctness, that a young plantation judiciously prepared, and afterwards kept clean with the hoe, for seven or eight years, will grow more within that space of time, than it would do in twenty years, by the ordinary method of planting, without such preparation and keeping. If this be true, I believe, it may be said, with at least equal justice, that close plantations of removed wood, if properly executed, and kept with the hoe for three years, are equal to ordinary plantations of at least forty, or five-and-forty years' standing, in this climate. At the end of four or five years, they will branch out on every side with such luxuriance, as to require the utmost industry of the pruner to restrain them within due limits: and yet it is indispensably necessary that they should be so restrained, in order that the standard or grove trees should be kept spiral, and the underwood subordinate in its character.

Upon the whole, I may assert with truth, after the experience of more than forty years, that there are no plantations at this place, which exhibit the same general health, and progressive vigour, as the Removed Woods, whether it be in open groups, or close plantations, as the committee of the Highland Society has amply attested. And, should they continue by the one half only as rapidly progressive, for the time to come, the axe must interpose, in order to prevent them from obscuring the glades, or blotting out the distances of the landscape.

SECTION XI.

EXPENSE ATTENDING THE FOREGOING OPERATIONS.

On more than one occasion, in the course of this Essay, I have ventured to state, that the art under discussion laid claim to be one of "practical utility." But it would ill support that pretension, if the principles it unfolds, and the practice it recommends, for giving Immediate Effect to Wood, involved an extravagant expenditure. For an art to be generally useful, it must produce something better than the gigantic feats, and the costly wonders of former ages. If the art in question possess any one merit above another, it is that of *lessening* the expense of both present and former practice, and bringing it within the reach of any person of moderate fortune.

Of all the rural luxuries which the landowner may enjoy, there is certainly no one more exquisite, than that of obtaining at pleasure the command of wood; and every one, we should think, would rejoice at the endeavour to render it a *cheap* luxury. The efforts, therefore, of those must appear the more surprising, who, for some years past, have laboured to mislead the public, by exaggerating the expense attending the preservative system;* and as their opportunities of information *might be supposed the best*, so it places in a

* See the Report of the Committee of the Highland Society, which is given in the Appendix.

striking point of view either their gratuitous malevolence, or their extraordinary ignorance.

The most distinct method, which, I apprehend, can be adopted, to show the true amount of the expense attending the various processes above described, in the preparation and removal of woods, is, in the first place, to state the particulars, in as far as they regard my own practice, which any one may examine and verify at pleasure: and, in the second place, to give a report of the operations of a few well-known persons of the first respectability, who, on a conviction of its correctness, have adopted my system, not gratuitously and ignorantly, but with some knowledge of scientific principle. For I will venture to assert, that *no one ever yet adopted this system, with a knowledge of the principles on which it is founded, whose practice was not attended with success.* The general error committed by planters, is to consider it too much as a *mechanical* art, and not to allow to principles the just rank and consequence they deserve.

In the first place, as to my own practice. It is obvious, that there are two ways, in which rural labour is performed. The one is by contract, according to specific rates, and stipulated dimensions, which gives the cost in money, on ascertaining the extent of the work. The other is by day-labour, which gives it as certainly, by the rate of wages paid to the workman, and an estimation of time. But wherever much accuracy or nicety of execution is in question, experience will advise to follow the latter, rather than the former method. In the preparation of the soil, however, and likewise the preparation of subjects, the work may be done sufficiently well by contract; which, on a large scale, and with expert workmen, I have sometimes found it advisable to adopt, both as most speedy, and most economical.

As to work executed by contract; the mode of preparing the pits for single trees, and open dispositions of wood, is delineated at page 171, &c. If the soil be of tolerable quality, which in a nobleman's or gentleman's park, is a fair supposition, then two, or at most, three single-horse cartloads of compost will suffice, and the pit is to be worked, to the depth of from eighteen inches to two feet. In that case, I have done the work at the rate of from 8d. to 10d. per pit; and the compost (supposing it to be made with animal manure) may be prepared for 9d. per cartload; which last is the price usually paid by persons in this part of the country, who prepare it solely for agricultural purposes.

Should the soil be very thin, or, in an extreme case, should there be no soil at all, but merely barren sand or rock on the spot, and should the owner still resolve to cover it with wood, he must necessarily bring earth for the subsistence of his trees. In such a case, every one will admit, that, although a striking improvement of property is thus made, by the superinduction of a new soil, both for grain and grass-crops, yet so entire an alteration of the nature of the ground cannot be fairly chargeable to the *planting* of it, whether with old trees or young. As may be seen at pp. 173, 174, such improvements are extremely practicable, and have been often made at this place, at no very extravagant cost: but still they are agricultural, and make an adequate return in pasture for the money laid out.

The above may serve to convey a fair idea of the expense of preparation, when the pits are to be made a twelvemonth beforehand, and the trees and underwood removed after that interval. Should the planter be in haste to obtain the effect required, and be resolved both to prepare and to plant during the same season, then the expense of the compost would be the same as that already stated, but the preparation of the pits would amount to from 1s., to 1s. 3d. each.

In trenching the entire ground for groups and larger masses of park-wood, which is strongly recommended to be done, at pp. 177—179, for reasons both agricultural and arboricultural, the trenching or double-digging may be executed, at the rate of 9d. or 10d. per Scotch fall (which is about one fifth part larger than the English pole or rod,) or *L*. 8 per acre. This calculation can be made only on the supposition, that spadable soil is in question: but should the pick be called in, somewhat extra must be charged by the workman, as above stated, and the amount will depend, of course, on the nature of the obstacles of stone, for example, gravel, or obdurate clay, that present themselves during the work. From the passages, however, just now referred to, and the notes, it clearly appears, that trenching or double-digging for groups and open dispositions, if executed on proper principles, will, besides other advantages, raise the value of the land, by the one half at least; and moreover, in most cases, it will save the labour of mounding, or bringing extra earth from a distance. In these circumstances, no reasonable person will say, that it would be equitable to charge the cost entirely to the account of transferring wood.

At pp. 179—181, the preparation of the ground for close-woods and plantations is next described. This being a work, usually executed on a more extensive scale than groups and single trees, should, generally speaking, be done by contract. The trenching should in no case exceed the rate already mentioned, for open dispositions of wood. But, as it distinctly appears, by many years' experience, that the abundance of the potatoe-crop, which follows trenching, never fails to pay both for the execution of that work, and the manure, and sometimes rent besides, the land is thus ready for the operations of the planter, without the burthen of preparatory cost of any sort.

All the above works I can say that I have, at different times, executed by contract, at the prices here stated, or nearly, according to the nature of the soil, and the rate of labour at the time. I have likewise, on other occasions, done it by day-labour; and I am obliged to add, that the difference of the expense between the two is so insignificant, while the difference in point of accuracy is material, that I greatly prefer the latter method, unless for the trenching of close plantations, where the same minute attention is not required, and where a far greater space of ground is to be turned up. In the nicer parts of the preparation of the soil, as has been shown in Section VI., it is surprising what may be done for the fine and capillary absorbents of the root, by a minute attention to the comminution of the parts.

Of the other processes connected with the removal of trees, namely, the taking-up, the transporting, and the planting itself, no part of them can be made the subject of work by contract, and they are to be estimated only by time. This is evident from the very nature of those processes; and hence, there is no other way, in which the cost can be ascertained, excepting by the dimensions of the trees transplanted, the distance from which they are brought, and the particular labour that has attended them.

If a tree, removed to the open park, be from fifteen to eighteen feet high, and from eighteen inches to two feet in girth, or, in other words, from six to eight inches in diameter, which, as has been already said, is the smallest tree that has strength to resist the elements; and that the distance it is brought be about half a mile, which may be called a medium distance, the expense, in general, is not found to exceed 6s. 6d. If it be from five-and-twenty to thirty feet high, and from three feet to three feet six in girth, the expense is not found to be more than 12s. 6d. This is as accurate an estimate as can be made of the present expense of transferring park-wood at this place, with expert workmen; which must necessarily vary as the size increases, or as the rate itself is varied by circumstances, or controlled by unavoidable and unforeseen accidents. But I have scarcely known an instance, in which plants of the largest size in question cost from 15s. to 18s. Estimates of the particulars for both sizes may be given as follow:

For a tree from Fifteen to Eighteen feet high, with lime-compost.

Preparation of the pit, as above, ...	£0	0	8
Three cart-loads of compost, at 6d.	0	1	6
Three workmen taking up, half a day, at 1s. 6d. . .	0	2	3
Transporting and planting, say	0	2	1
	£0	6	6

For a tree from Five-and-Twenty to Thirty feet high, with dung-compost.

Preparation of the pit	£0	0	8
Three cart-loads of compost, at 9d.	0	2	3
Three workmen taking up, a day, at 1s. 6d. . .	0	4	6
Transporting and planting, say	0	5	1
	£0	12	6

Of these composts it is understood, that they are to be made up, in the manner already directed in Sect. VI. pp. 186., 187.; the lime-compost, at from one fifth to one sixth part of the lime, to four or five sixths of the peat, according to the weather, and the state of the materials. The dung-compost is to be mixed, according to the judicious directions of the late Lord Meadowbank, with important improvements which experience has suggested, and which are detailed in the Notes referring to the above passages.

In respect to close-woods, it is to be observed, that the expense of removing the trees which compose them, if of the heights just now mentioned, is necessarily much less than the cost of such, as would suit the open park. The former possess the non-protecting properties, especially small tops, and correlative roots; hence, they are far more easily transferred than the others. For close-woods, for obvious reasons, subjects will always be chosen, that are endued with the non-protecting properties; and therefore, the expense of removing them half a mile, as already mentioned, does not exceed 3s. 6d. each, for the standard or grove trees, and from 1s. to 2s. per stool, for the underwood.

The rates thus specified for woods of all sorts, are given with great care, as the result of many years' experience. If planters could be persuaded to confine themselves, at least in their earlier essays, to subjects of moderate dimensions, such as are from five-and-twenty to thirty feet in height, but of some stoutness, that is, from a foot to fourteen inches in diameter (and these are quite sufficient for Immediate Effect, and picturesque beauty,) they might confidently rely on the power of the art amply to gratify their wishes, at *a very moderate cost.* It is the ambition of undertakings, beyond the accomplishment of any man without extraordinary skill, and without machinery far surpassing in magnitude and expense what is generally constructed, that misleads and discourages many, and prevents those habits of accurate observation, and patient industry, without which no art useful or ornamental ever yet was carried to any degree of excellence.

I will now proceed to give a few examples of work executed solely by day-labour, which, on an estimate of time, are also susceptible of an intelligible result. Of effects both rapidly and cheaply produced, and likewise on a scale of some extent, it would not be easy to give better instances, than what are to be found at this place. To state facts, not to excite wonder, is the sole object of the following short detail; and in truth, both the time and the manner, in which the objects in question have been accomplished, are so well known to many persons, that all disguise or concealment on my part were impossible, had I any wish to practise arts so disingenuous.

On turning to the Frontispiece, the reader will perceive, that, in this view of the Park, considerable woody effects have been realized, and that they are very favourably seen, with water as a foreground. Between the years 1816 and

1821, the former inclusive, the whole of this, whether park trees or copsewood, was executed by means of the transplanting machine, excepting as to the distant and bounding lines of wood, which on the spot are easily distinguishable. Within the above space of time, it rarely happened, that more than eight or nine workmen were employed, unless for the trenching, which, as has been recommended in Sect. VI., was generally done by contract. The months of the year, in which transplanting-work is performed here, are usually four, namely from January till May. The wages paid to workmen have, for some years, been 9s. and 10s. per week: hence, supposing one week in the month to go off for unfavourable weather, the entire amount would, at the latter rate, be L.58, 10s. yearly. This is a considerable sum, no doubt; although it allows but a small portion of expense for each tree and bush of the many hundreds that have been removed. But it would admit of but few plants indeed, at the rate of ten and fifteen guineas, which folly or ignorance has supposed them to cost.

Let it be observed, moreover, that there is included in the same estimate, the planting of a considerable island in the lake, and four different promontories of some extent; besides the woody accompaniments of the bridge, seen in the second distance, and sundry other groups and open dispositions of trees in the Park, which were viewed by the Committee of the Highland Society, and cover a large surface; but they could not all be given in this landscape. In these circumstances, probably L.58, 10s., laid out annually for six years, will not be considered, by any one conversant with wood, as an extravagant, but rather as a very moderate sum to dedicate to the speedy accomplishment of the objects, which it has been thus attempted to delineate.

It is true, it may be said, that this is a vague statement, consisting only of a general view of expenditure, without the detail of particular items, and therefore, without the grounds of conclusive proof. For this reason, it will be proper to select one or two recent instances for the purpose, in which certain work has been done, at some certain and specific price.

Of all the ways, in which the art of transplanting can display its power, there is no one more conspicuous, than when it is employed to relieve or decorate ornamental buildings, or to mask such as are obtrusive or unsightly, and for that reason require concealment. If a new approach, for example, be made to a place, and a new entrance-gate and lodge be executed, in a situation where no wood exists, there is nothing more common than to see such erections, handsome perhaps in themselves,

"Standing in blank and desolated state,"

for fifteen or twenty years, and exhibiting to the traveller that want of power to give Immediate Effect to Wood, which, as has been already stated, is a desideratum in the landscape gardener's department, and which the art under consideration is calculated to supply.

It so happened, about five years since, that a new entrance was made to this place, and a new lodge and gateway erected. It being from a quarter of secondary importance, and other works being on hand at the time of a more pressing nature, the wooding of the spot was deferred, and the building allowed to stand for four years, in the bleak condition just now described. The lodge was placed near the top of a steep bank, overhanging the Calder, which is here an insignificant stream; and it had no wood of any sort to cover it, excepting four solitary fir-trees, of about sixty years' growth, and at some distance from one another. It is impossible, therefore, that any thing could be more "blank and desolate," or, as the landscape gardeners phrase it, more completely "staring." Being aware that these defects could be at any time remedied, I did not resolve, till the spring of 1826, to do away the reproach of so unmeaning an object. To effect this nothing but wood was wanting, as the ground round the building to some extent was in a favourable state, and had been trenched some time before, and manured to a potatoe-crop.

The lodge stands on a gentle swell, somewhat elevated above the turnpike road, and, instead of being placed quite close to it, as is commonly done, and rendered nearly invisible by shrubs and creepers, it is thrown back into the park about fifty feet off the road. Across the coach-road, and at right-angles with it, runs an open railing in front, terminating in a hedge, which, at some distance, falls easily into the general line of the road-fences; leaving, on the outside of the gate, an open space or grass-plot, an hundred-and-four yards in length, and comprising about the fifth part of an acre. This space is kept with the sythe, and is separated from the turnpike road by a low rough fence of larch stakes something less than two feet high, of which the bark is allowed to remain upon the stakes. On the sides of the coach-road, through the whole breadth of the bounding line of plantation, run two grassy margins of the park, about five-and-thirty feet broad, which come down to the gate, and seem to form a part of the external grass-plot, being separated from it only by the open railing, so that the sheep browse up to the gate itself. These two margins within, and the grass-plot without, are completely wooded with grove or standard trees, from twenty-five to thirty-five feet high, scattered in an irregular manner, eighteen or twenty feet asunder, with copse or underwood in the intervals, which last are from four to six feet in height.

Thus, the open but woody character of the park is continuous, and extends the whole way to the public road; while the traveller, in passing along, catches here and there glimpses of the lodge, with the light foilage of the trees playing on the porch, and other parts of the building. Beyond the limit of these park-like margins, all the adjoining space, to the extent of more than three quarters of an acre, is massed up with grove trees and underwood in the closest manner, and the whole forms the space of ground, which was wooded on this occasion. The lodge itself forms a pleasing object from the road, when lighted up by the gleams of the morning or evening sun, which, darting across the grove trees in the woody margins, give considerable animation to the picture.*

In the last days of February 1826, eight persons commenced the work of creating these effects, over the three quarters of an acre of entirely open ground, just now described. The trees and bushes were brought from the distance of half a mile, or more, and in the course of a month (that is, four working-weeks) and two days, the whole was completed. A single horse, with a driver, drew the machine, and worked fifteen days; so that the expense stands as follows:—

Eight workmen 26 days, at 1s. 6d. per day . .	£15	12	0
One horse and driver 15 days, at 5s. . . .	3	15	0
Lime-compost 44 cart-loads only (the ground having been previously trenched and manured to a potatoe-crop,) at 6d. per cart-load	1	2	0
In all	20	9	0

N. B. It was omitted to be mentioned above, that one or two of the foreground trees were planted two years previously, which would make little difference in the estimate.

Now, if the interest and importance of these effects, to any one having a lodge and entrance-gate to wood completely, be considered, and that it was so wooded *within the space of a month*, every candid person will admit, that supposing the sum to have been double, or even triple, it could not be regarded as a very exorbitant purchase.

* Note I.

The soil being light sand, the grove trees chiefly employed to form this plantation are beech, sycamore, birch, and a few limes. The copse or underwood consists of oak, mossy-cup oak, beech, chestnut, birch, Norway maple, holly, hazel, mountain-ash, and birds-cherry common and Canadian. Of the grove-wood it is a singular circumstance, that not a tree failed last season, notwithstanding the endurance, as well as severity of the drought, during a summer truly tropical. Some of the bushes, however, died, and particularly the holly.

Another example of a similar sort shall be merely alluded to, as an account of it, much better than any I could give, is to be found in the Report of the Committee of the Highland Society. It relates to the wooding of two acres of ground in 1819, as a close plantation, in order to give effect to another part of the same approach. It was executed in the space of three months, that is, from February to May; and the entire expense (which I ascertained for the information of the Committee) amounted to about 30*l*. per acre; but some of the grove trees were of large dimensions. Of the sudden and successful formation of this skreen, the able committee just now named are pleased to express themselves in the following terms:*

"When the extreme beauty of the effects produced is considered, it cannot be thought extravagant, that the plantation of grove and copse-wood, on the two acres already mentioned, should amount (as appears from Sir Henry's memoranda (to about 30*l*. per acre. On the contrary, the committee believe, that no visible change on the appearance of nature, however trivial in comparison, could have been effected by the landscape gardener in any other manner, under three times the sum."

These will probably be deemed sufficient, as positive

* See their Report in the Appendix.

examples. Perhaps a single one, given in the comparative way, and contrasting the expense of wooding a space of ground, by means of the transplanting machine, and wooding it after the common method of planting, with nursery plants, will appear still more conclusive and satisfactory to the reader.

In looking up the lake, the reader will observe a bold promontory or headland (See Frontispiece,) situated on the right-hand side, near the bridge, which was seen by the Committee of the Highland Society. This prominent spot was wooded in 1817, by an open disposition of trees, twenty-two in number, and consisting mostly of sycamores, with a few oaks and elms interspersed. A few bushes, which are close to the water's edge, have been recently added.

The dimensions of the trees were from five-and-twenty to eight-and-twenty feet high; and, as the situation was one of very open exposure to the west, care was taken to select such subjects, as possessed, in a considerable degree, all the protecting properties. This plantation was executed in nine days, by nine workmen, and a horse to draw the machine, the distance not much exceeding a quarter of a mile. The expense, which amounted to about 10s. per tree, is as under:—

Nine workmen 8 days, at 1s. 8d. per day . . .	*L.* 6	0	0
One horse and driver 15 days, at 5s. . . .	3	15	0
Dung-compost 44 cart-loads, at 9d.	1	13	0
In all .	*L.* 11	8	0

Now, we shall suppose, that the art of giving immediate effect to wood had been altogether unknown to me, and that I had wished to procure two-and-twenty fine trees, for so prominent a station, by the ordinary system of planting; the first thing I should have had to do, according to the most speedy method, would have been to enclose, trench, and manure the ground for a green-crop, and then to plant it with nursery plants of four years' growth. The next thing would have been, to keep it with the hoe for two years, until the plants shot freely, which they were likely to do within that period; and after about thirty years in this climate, the whole would have been of the size wanted. Had no means been taken to cultivate and prepare the ground, forty years, at the least, would have been requisite.*

According to the former supposition as to time, and that the trenching and manuring for a green-crop were properly executed, the crop would, in common cases, pay the cost of both of these operations; and the ground being rather more than a quarter of an acre, and ready for planting, without preparatory expenditure, the outlay would be the following:

Enclosing one fourth of an acre of ground with double railing, and stakes $4\frac{1}{2}$ feet high, for sheep and lambs, 92 yds. at 6d. per yard	*L.*2	6	0
Planting the ground with various trees, including the expense of the plants	1	10	0
Keeping with the hoe, for two years	0	16	8
Renewing the railing 4 times	9	4	0
Rent of one fourth of an acre of ground for 30 years, at 15s. yearly	22	10	0
Accumulated interest on the above sums for 30 years, say only	115	10	
Total expense of the ordinary method . . .	*L.* 151	16	8

N. B. Some labour and expense being obviously necessary, to grub out the superfluous Trees, and reduce them to the number wanted; also to level and dress the ground, and re-

* Note II.

store it to proper pasture, the value of the thinnings of the wood may be allowed to cover those items.

Thus, then, it appears, that by the ordinary method, you may have a group or plantation, consisting of two and twenty trees, for *L.*151 16s. 8d.; and by means of the transplanting machine, for *L.* 11 8s., or nearly the *thirteenth part of the money!!!* I conceive, that it would not be easy to give a more complete answer than this comparative statement to those persons, who object to transplanting on the score of *expense;* exclusively altogether of the difference of obtaining the Effect of Wood, in the one case *at once*, and of waiting *thirty years* to obtain it, in the other.

Having now adduced a sufficient number of examples from my own experience, it will be proper to add some corroboration of them, from the experience of others. But it must be the experience or practice of such persons only, as have acquired some idea of the *principles* of the art. It is true, many persons of late years, have professed to follow my system and have failed in the attempt, merely from a want of acquaintance with the principles on which it is founded. This, it is obvious, is a sort of communication, which I could make only to particular friends. But it is quite erroneous to suppose, that, from superior dexterity alone in my workmen, the consequence of long practice, any thing can be done *here*, that may not, with the same care and attention, be done elsewhere.

The first person I shall mention is my friend James Smith, esq. of Jordanhill in the county of Renfrew, but in the neighbourhood of Glasgow. The mansion-house of Jordanhill is situated on an eminence, about four miles west of the city, and commands a most extensive view of that fine vale, in which the Clyde majestically flows towards Ruthglen and Dumbarton. The place in general is handsomely wooded, but is deficient in the quarter which overlooks the vale; and, as the latter skirts the principal approach, it was desirable, by means of a number of foreground trees, to break so wide an expanse into separate portions. By obscuring the less interesting points, and bringing forward in detail those that were more important, a far greater interest might be conferred on so noble an assemblage of objects.

In these circumstances, Mr. Smith, who was about to plant the open ground in the ordinary manner, applied to me for advice and assistance : and I recommended it to him to improve the spot, by transferring Large Trees at once, and thereby to produce whatever effect he pleased on the foreground, and the middle distance of the landscape. Understanding that his subjects for removal were rather older than was desirable, (some of them being trees of from fifty to sixty years' growth,) the first thing to be done was, to procure him a machine of the intermediate size, very strongly made. See Plate, and the relative specifications. Two of the most experienced of my workmen were then sent down from this place, in order to instruct his people in the use of it; and in less than three days, they made wonderful proficiency in the practice.

Mr. Smith, who is a man of science as well as various accomplishments, soon acquired a conception of the principles. He saw, with pleasure and surprise, the striking improvements, that by means of vegetable physiology might be communicated to an art, of which the vast power was unknown to the public ; and he resolved to avail himself of it, in his own improvements. Instead of indolently trusting to others, he ardently entered into the details of the execution. He often became the director of his own work ; and so rapid was his advancement in practical skill, that, in the space of a fortnight, he removed trees of thirty and five-and-thirty feet high, and of great thickness, with the utmost success.

The effects at once produced on so bold and beautiful a subject, on which not a tree nor a bush had previously stood, were as astonishing as they were delightful. When I saw the place, in the spring of 1825, several groups of fine foreground trees with extensive tops were already formed, and had attracted the notice of the scientific and the curious. All united in admiration of the skill and ingenuity of the planter; but no one, who saw the trees, except Mr. Smith himself, was prepared to believe, that they could without propping withstand the western gales. The old men about the place reminded him, that, at the equinox, those blasts were so terrific, as sometimes to endanger even the stoutest of his trees, which had been reared on the ground for nearly a century, and which must far exceed in stability any plants, that art or ingenuity could at once bring upon an open surface. The gardener who was a planter of the old school, loudly declared, that, "*all the men of Renfrewshire* could not keep them up in the face of a real and genuine south-wester, unless their heads were taken off, according to the good old method." Yet, notwithstanding these confident opinions, and disastrous anticipations, not one of the trees has ever been moved or blown down; and, from their healthy appearance, they promise to continue fine examples of the art, and especially of the use of the retaining-bank in transplanting, in the west of Scotland.

The trees removed by this intelligent planter, both on the fine hill or slope above described, and in other parts of his place, are oaks, beeches, limes, sycamores, elms, and horse-chestnuts. From two letters, which I have from him, on the subject of the expense, I learn, that it was in the beginning a good deal enhanced, by his "dashing at once (as he said) at the largest and heaviest subjects," ere sufficient dexterity had been acquired by his workman, or sufficient experience by himself. In this way, at thirty feet high, they cost him from 15s. to 18s. each, when brought from any considerable distance, that is, a mile or more; but that, at one size under, he afterwards transferred very handsome subjects for 8s. and 10s., and inferior ones for 6s., and less. Mr. Smith's practice, therefore, may be considered as an instance of both good management, and moderate outlay, as well as of considerable dexterity and perseverance.

During the severe and continued drought of last season (1826), and his own absence from Jordanhill, I understand that he lost some fine oaks. Not being sufficiently aware of the importance of afterwork, both the necessary covering of shows, and likewise the watering had, it seems, been neglected; which sufficiently proves, what I have endeavoured already to enforce, that attention to afterwork, instead of proving expensive, is the truest economy; and that neither the oak nor the beech can be safely trusted, or left to themselves in the second season, how vigorous soever they may appear during the first.

The second person, whom I shall mention, is John M'Call, Esq. of Ibroxhill, who is brother-in-law to Mr. Smith, and resides in his immediate neighbourhood. Ibroxhill is, as well as Mr. Smith's, a high place, and commands a splendid view of a fine country. On the lawn immediately in front of the house, there were, two years ago, no trees; so that it became an object of first-rate importance to the judicious owner, to remedy so striking a deficiency. In the spring of last year, 1826 (an unfortunate season for a beginner), this gentleman, by the aid of Mr. Smith's workmen, commenced his operations with great spirit; and after successfully removing forty-three trees, completely changed the appearance of his place. The prospect, instead of being bleak and cold, became, in the course of a few weeks, woody and delightful. The plants were nearly of the same species, as those transferred at Jordanhill. Their size was from eighteen to eight-and twenty feet high, and from two to three in girth, or, in other words, from eight inches to a foot in diameter. The whole expense amounted to only *L.* 19, or about 8s. 10d. per tree.*

The third person who shall be named, is Robert Watson, Esq., banker in Glasgow, who has a beautiful villa, named Linthouse, on the Clyde, in the neighbourhood of Govan, with some extent of ground belonging to it. The place was planted between thirty and forty years since; and, as the soil is deep, and the climate of a superior sort, the wood has rushed up with far greater rapidity, than could have been expected in most situations. As the owner likewise, or his predecessors, have in some degree thinned the trees, there was a better choice of large subjects, than at Ibroxhill.

In a situation like this, and with a noble river in view, our forefathers were of opinion, that they could never see too much of it; and therefore, their custom was, to plant long and formal rows of trees on the flanks, and leave their front wholly open, in order to have the fuller enjoyment of the prospect. Of late years, however, as good taste, and a knowledge of landscape have increased, we begin to discover, that a fine expanse, whether of land or water, rather suffers an accession to, than a diminution of its extent, from being broken into parts by trees, as the imagination never fails to magnify the extent of what is concealed; and hence, new combinations are formed, and fresh landscapes arise, from the variety produced by concealment.

It was probably on some such principle as this that Mr. Smith proceeded, in advising his friend to diversify his front towards the river, by the removal of trees of a large size. Accordingly, during last spring (1827), the field in front of Linthouse was most respectably wooded, with detached and open dispositions of wood. Whether they be very accurately disposed according to the principles of landscape I cannot state, as I do not happen to be personally known to the re-

* Note III.

spectable owner, neither have I lately seen the place from the river: but I understand, that they consist of oaks, beeches, limes, elms, and horsechestnuts, of which some are more than thirty feet in height, and ten, twelve, and fourteen inches in diameter.

The trees were all transferred on the preservative principle. They are thirty-two in number; and the gross amount of the expense is *L.*25 5s. But, deducting *L.*2 for the removal of earth, subsequently to the planting, which was not a constituent part of the work, the actual cost of each tree is nearly 14s. This sum, considering the magnitude of several of the trees, and that it was Mr. Watson's first essay, he has reason to regard as a cheap purchase for such effects. And most men so circumstanced, we may venture to say, would have given three times the money, for the striking increase of comfort and seclusion, which, independently altogether of picturesque considerations, was in this way communicated to their residences.

The fourth person whom I shall specify, is Mr. James Hamilton, overseer to Sir Charles M. Lockhart Lee, Bart. in the county of Lanark. That gentleman, who has a fine place in the neighbourhood of the county town of Lanark, is at the head of the ancient family of Lee and Cartland, whose representative, in the beginning of the fourteenth century, Sir Simon Lockhart, is said to have carried King Robert Bruce's heart in a golden box, from the Holy Land.

Owing to Sir Charles's residence in another county, during a great part of the years 1826 and 1827, he could not personally attend to the spirited improvements that were carried on at Lee: he therefore intrusted the management of them to a person, every way adequate to the task, namely, his judicious overseer, Mr. James Hamilton, who, in the spring of the year first mentioned, was sent over to this place, in order to receive some instructions from me, in the art of transplanting on the preservative principle. These that intelligent person seemed at once to apprehend, and soon began to apply them to practice.

In the middle of March of the same year, he removed to the open park eleven oaks and ashes, of from five-and-twenty to thirty feet high, and in girth from two feet to two-and-a-half. One or two of the oaks were as high as forty feet, and they had all handsome tops. In April, 1827, he transferred six or seven trees, and of nearly similar dimensions, and at the average expense, in both years (according to a statement by himself in my possession), of somewhat less than 8s. each. Notwithstanding the severe drought in 1826, it may be considered as a remarkable circumstance, that only two died, probably owing to the want of sufficient covering and watering; and when I saw, in July last, the trees of the present year, they all carried a healthy leaf, and promised to succeed admirably.

The plantations of Lee not having been thinned to wide distances, this ingenious planter was much limited in his choice of subjects; and, although what he has selected are very handsome and stately plants, they are yet somewhat deficient in the protecting properties, and consequently in fitness for the open field. He must not, therefore, be surprised or discouraged, if, according to the important doctrine stated in Section Fifth, the trees should become stationary for a few years, instead of being progressive, until, as I have said in the passage alluded to, these properties are supplied by time, and this deficiency is made up. The effort of Mr. Hamilton, nevertheless, is spirited and meritorious; and it serves to show what may be done by the diligence and attention of a single individual, who, with very cursory instructions from me, and with no assistance from experienced workmen, has been able to give Immediate Effect to Wood, in a manner so creditable to himself, and at so small an expense to his employer.

The fifth person, to whom I shall refer, is a particular friend of mine, in whose transplanting experiments I have had some concern, and on that account I can speak of them more particularly, and from personal knowledge. This is William Elliot Lockhart, Esq. of Cleghorn, representative in parliament for the county of Selkirk, and whose residence is at Cleghorn House, in Lanarkshire.

Cleghorn is situated on the steep and romantic banks of the river Mouse, which falls into the Clyde, a little below the town of Lanark. The banks of this stream, which may be called classical ground, and are abundantly celebrated in Scottish story, are rocky and precipitous, rising in many parts above the bed of the river, from two to three hundred feet in height, and every where wooded to the top. It was to the inaccessible caverns, natural or artificial, of these woody banks, that the renowned and patriotic Wallace used to retire and found a secure refuge from his own, and his country's enemies. It was also, as it is said, in the same fastnesses, that the well-known and intrepid Balfour of Burleigh, in a later age, was often able to set at defiance the utmost diligence of his pursuers. In the present day, the fine scenery of the Mouse is rendered familiar to the traveller, on the great line of the Carlisle and Stirling road, as he views it with wonder from the stupendous bridge of Cartland, at nearly an hundred-and-thirty feet above the bed of the stream.

Although Cleghorn partakes in the woody character of this singular and romantic district, and has been abundantly planted, according to the fashion of a former day, yet there are many parts of the park, and especially near the house, where the aid of the transplanting machine might be called in, with great advantage. This idea had frequently occurred to the good taste and discernment of Mr. Lockhart; but his occasional residence in a neighbouring county, and the reports, which had reached his ears, of *the vast expense* of my method of transplanting (which was confidently said to amount to ten and fifteen guineas per tree), for a considerable time prevented him from entertaining any serious thoughts of attempting the experiment.

In the month of December last, this gentleman, who is as intelligent in planting as he is in every other branch of rural economy, applied to me to learn, if I could put him in the way of procuring a few large trees, on any reasonable terms? He had heard, he said, on the best authority, that the art of removing trees, however it might be improved in my hands, was practised at enormous cost. To L.2 or L.3 each for handsome trees, he observed, no reasonable man could object, if of such a size and figure, as to give the Immediate Effect of Wood near his residence: but from ten to fifteen guineas, he certainly considered as rather *too expensive a luxury* for general use. To this I replied, that he had been misled by such information, be the authors who they might. But, in order to undeceive him, and that the cost should not *exceed* his own estimate of L.2 and L.3 per tree, I undertook, that a machine of the intermediate size should be provided for him, and that two of my best hands should attend at Cleghorn for the purpose of instructing his workmen, and of putting the thing to the test of *his own* experience.

Having explained to Mr. Lockhart the nature of the prin ciples, which had been applied to the art, he seemed quite satisfied, that they are consonant to the laws of nature, and to what we know of the anatomy of woody plants. Accordingly, in the middle of January last (1827), we commenced our operations on the spot. Having selected some trees with fine tops, which were far better subjects than woods not thinned for the purpose usually furnish, we very speedily transferred them. And, in order to show how readily my friend apprehended the different processes, he soon, like Mr. Smith, became his own director of the work, and managed the whole with singular address, and intelligence of the subject.

The trees removed were eleven in number, and consisted of oaks, beeches, limes, sycamores, and horsechestnuts. Among them was one beech of the pendent species, a very singular and valuable plant, which is worthy of an attentive cultivation, and is rarely to be met with. The dimensions of the trees were from five-and-twenty to five-and-thirty feet high, and from ten to fourteen inches in diameter, or from two feet six, to three feet six inches in actual girth. But, on casting up the expense, my friend was both delighted and surprised to discover, that, instead of *L*.2 and *L*.3, as he had anticipated, they had not cost him quite 10s. per tree!

The last person, the evidence of whose practice I shall adduce, is Sir Walter Scott, bart.; whom to name, is to name whatever is splendid in genius, versatile in talent, and correct in judgment. This eminent individual has a place, beautifully situated on the Tweed in Roxburghshire, near Melrose, in the midst of those scenes of traditional and peculiar interest, which have been illustrated and immortalized in his writings. To the variety of attainments, for which Sir Walter is distinguished, he adds the knowledge of arboriculture. He is ardently, and I may say enthusiastically attached to the cultivation of Wood. Though possessed of the property only sixteen years, he has planted nearly five hundred acres of surface; and by the acknowledgment of all his neighbours, few plantations are cultivated with the same skill, and none have grown with more luxuriance, than the woods of Abbotsford.

There is no one, as may be imagined, of all the advocates of the preservative system, who more freely and fully admitted its utility, and its consonance to the law of nature, than Sir Walter, as soon as its principles were made known to him. Attached, though not bigoted to whatever belongs to Scotland, perhaps he might regard the theory with an eye the more partial, that it had its origin in his native country. But neither his public functions nor his private studies have allowed him much time to enter extensively into the practice of the art. His chief experiments were made with subjects of no great magnitude, smaller, indeed, than according to this system were calculated to withstand the elements, in open exposures. In the sheltered vale, however, in which a great part of the grounds near his house is situated, and for the purpose of diversifying his walks along the river, Sir Walter removed in 1824 and 1825, forty trees from ten to fifteen feet high, and of proportional girth, oaks, beeches, limes, and sycamores; and nearly half as many more, in the following season. From a want of plantations thinned to wide distances, he possessed no extensive field for making the selection properly, and therefore the plants were rather deficient in the protecting properties. On this account he knew, that, according to the law of nature, they must be stationary at first, until time and exposure should supply what they ought previously to have possessed.

The trees had been cut round beforehand, which greatly facilitated the taking up, and they were all planted on the preservative principle. But, as they stood quite close to the spot, to which they were to be removed, they were transported with handspikes, and by expert workmen, in the most rapid manner, under the eye of the indefatigable owner. By a communication, which I have from him, it appears, that the plants are now in full health and foliage; and as no preparation of the ground and no manure were considered to be necessary, the entire expense did not exceed 2s. per tree.

But the department of transplanting, which has received the greatest advancement at Abbotsford, is bush-planting in the open field. On the sheepwalk at no great distance from the Mansion-house, Sir Walter has transferred some hundreds of bushes, or stools of underwood of various kinds, with great success; and these give a woody appearance to the hanging grounds and banks of the place; which style of wood would be perhaps more characteristic and pleasing to some persons, than if taller trees had been used by him in planting it. It is true, that trees of a certain height, say from thirty to five-and-thirty feet and upwards, have a fine effect in catching the horizon from a sloping bank, and showing the scenery of the foreground, and possibly of the middle distance, under their spreading branches: also, they are peculiarly useful, in masking or relieving such objects, on the opposite side of a river, as we cannot command, and which, for that reason, it is desirable to throw into the back ground of the picture. But on such subjects, as on most others connected with taste in the disposition of wood, great diversity of opinion must prevail; and that mode of arrangement or execution will generally seem the handsomest, in which the genius of the place is best consulted, and where the most luxuriant growths, and most careless dispositions of wood are produced. The greatest triumphs of art must always be those, in which, in rivalling nature, she most completely effects her own concealment.

There is at Abbotsford a new, as well as ingenious con trivance for defending underwood from the mouths of sheep, which, as it is so difficult at all times, and in this instance seems peculiar to Sir Walter himself, it may be worth while to mention. "Being in haste (says he) with the bushes set out on the sheep-ground, and really very indifferent whether they all grew or not, I had many of them stuck into the middle of whin-bushes, and there the sheep have done them no visible harm." Of the good effect of furze in adding wildness and variety to scenery, no one will entertain a doubt; and those, who have it in abundance in their parks, may verify the efficiency of Sir Walter's method. As to the expense of the bush-planting, as neither manure nor preparation of the soil was necessary, from the fine mould always to be found under the shade of furze; and moreover, as the plants and stools were obtained from the adjoining plantations, the expense was very moderate, amounting to considerably less than the one half of that of the grove-wood.

I believe it is needless to add any more on the subject of expense; and I should not have dwelt upon it at so much length, had it not been for the pains that have been taken, and the falsehoods that have been propagated, in order to bring the art into disrepute, by representing it as a costly wonder, not as a practice which is calculated to be useful.

It were easy to quote, were it necessary, the example of other friends, who, on being made aware of the principles, by which the preservative system is regulated, have made admirable and successful efforts to apply them to practice. But it would only prove, what, I trust, every candid reader will consider as proved already, that is, that wood of all kinds, on the preservative system, has been transferred at this place, and may any where else be transferred by others, at a moderate expense: that the larger trees usually removed here, being from twenty-five to thirty-five feet high, may be managed, with expert and experienced workmen, for from 10s. to 13s. each, at half a mile's distance; and the smaller, being from eighteen to five-and-twenty feet, for from 6s. to 8s. With workmen awkward or inexperienced, it will not seem surprising, were it to require a half more at first, or even double those sums, in order to follow out the practice which has been recommended. For close plantations, or for bush-planting in the park, the trees may be transferred for about 3s. 6d., and the stools of underwood, for from 1s. to 2s. per stool. Subjects considerably higher than any of the above I sometimes remove; but I place much greater value on a splendid and extensive top, for effect in park-wood, than on mere length of stem, unless for particular purposes. As to the rates stated, I believe there are few planters, who *have seen my trees*, that would not consider them as cheaply procured, at three and four times the amount.

It was held out, in the commencement of the present

Section, that by means of the new system attempted to be established, not only the exercise of the art would be brought within the limits of a moderate expenditure, but that the cost of both its present and former practice would be greatly reduced. It therefore becomes necessary, in conclusion to show, that the assertion, how bold soever it may seem, is not unfounded: and this, I apprehend, will be best done, by saying a few words on the labour and expense bestowed on the Removal of Wood, in both divisions of the island, at the present moment.

Whatever of Transplanting is known in Scotland, has undeniably been derived from our English neighbours, to whose superior intelligence, and earlier cultivation, we owe the rapid advancement we have of late made in the arts. He who does not feel, and frankly acknowledge this, is an uncandid Scotchman, rather than a generous descendant of the men, who, though they rivalled in arms their more ingenious opponents, boasted no competition with them, in either sciences or arts.

In giving a history of the art, which is the subject of these pages, it was stated in Section II., that Robertson, the well-known landscape gardener (who was sent down by Brown, more than seventy years since, to lay out the park at Duddingston, for the then Earl of Abercorn) was the first, who taught us to give Immediate Effect to Wood, and introduced the Transplanting Machine, as constructed by his master. Since that period, although the unwieldly platform, with low wheels, has not been unknown in this kingdom (as we have seen in the instance of Professor Graham of Edinburgh), yet the simpler machine of Brown is still the implement, most prevalent among Scottish planters; and consequently, wood removed here is transferred comparatively at less expense, than it costs in England. That it is still a matter of *physical force*, and by consequence of fortuitous result in both countries, is certain, and, for that reason, it must always imply *a vast portion of superfluous labour.* It appears, however, that the Scotch have hitherto shown much less predilection for anticipating the effects of time in this department, than the English; and certainly they possess much less the *power* of anticipating it, than that great and opulent people.

As to the present English practice, it seems to differ in nothing material from that, which was known in the time of Evelyn and Lord Fitzharding. If the *facility* and *dispatch* of the methods employed be regarded as the criterion, by which the expense is to be estimated, it will not be difficult to decide between those methods hitherto adopted, and the one recommended in this Essay.

When the English planter has to remove a tree, the first thing he does is, to cut or trench round the roots, a year, or perhaps two years beforehand, and at the same time he lops or lightens the top. This previous lopping I understand to be according to the most approved practice. But by what means he is then to ascertain the length or extent, to which mutilation is to be carried, so as that he may proportion the top (as Marshall directs) "to the ability of the root," I own, I am unable to perceive, unless the tree be previously taken up, and the size of the root clearly ascertained. But some more judiciously lop the branches, in the interval between the removal and the replanting; and some also make no preparation of the roots at all. In cutting them round, it is held by operators of the greatest experience, that a mass or ball of earth, beyond which few or no roots are found to extend, of seven or eight feet in diameter, for the largest subjects, is as much as can be properly carried away; hence, the one-half at least, or more probably two-thirds of a fine head must be sacrificed. But it may just as well be so sacrificed; as it is obvious, in the circumstances of the case, and without roots adequate to its nourishment, that such a proportion of the top would certainly decay and drop off, after the first season.

The next thing the planter does is, to convey to the spot, where the tree is to be taken up, a wooden crane of great strength, well provided with ropes and pulleys, and possessing sufficient power to raise the mass of roots and earth upon the platform. This is no very light or speedy business, as is well known to those who are in the habit of working such unwieldy machines. Neither is it a less laborious undertaking, to accomplish the raising of the tree from the pit. As the wheels, or rather rollers, on which the platform is to move, are very low, many horses, eight and nine frequently, are requisite to drag a load of any magnitude, owing to the immense friction occasioned by the lowness of the wheels; therefore, to transport a tree of considerable size (say five-and-thirty feet high, and sixteen inches in diameter), for a mile, or even half a mile, must in this way occupy many hands, and require much time and labour.

The next operation is, the planting of the tree. For that purpose, the crane must be again transported to the spot; where the same efforts, that were employed to raise the mass from its former situation, are now called forth, to lift it from the platform, and let it down into the new pit. The planting, we shall suppose, is an easy business, as there are few roots to be distributed in the ground; so that little remains to be done, but to fill in the earth, which finishes the process. As to the propping or supporting of the tree, which in exposed situations sometimes defies the utmost diligence and ingenuity, it involves an additional item for wood or ropes, and labour, and is essential to be attended to, for two years at least. However, should the plant be severely mutilated, and reduced to nearly a pollard, the lever furnished by the stem is sometimes unable to overcome the more ponderous mass of soil and roots; and the necessity of propping is in such cases superseded, by the superior weight of this load, and of the earth superinduced on it.

This, I imagine, or something similar to this, making a fair allowance for differences in persons, places, and circumstances, may convey a tolerable idea of the business of transplanting, as practised in England for nearly two centuries, and also in those districts of Scotland, in which the English method is still followed. In some districts, one species of machinery may be employed, and another in others. Some planters may be more, and some less skilful, and less accurate in their practice: but *physical force throughout, without phytological principle to guide the process*, together with *the labour of many hands, and the strength of ponderous implements*, form the general characteristics of this species of work. I have it from gentlemen of high respectability, that from *L*.2 to *L*.5 is considered as no unusual or exorbitant sum to lay out, for the removal of a tree of any size; and even *L*.10 and *L*.15 have been many times paid.

If there be any error or exaggeration in this cursory view of the labour and cost of such work, as it is now carried on in most parts of Britain, I entreat that the mistatement may not be considered as intentional; and it is, of course, open to the candid correction of those, who possess superior information. I have no desire to magnify the merits of my own system, at the expense of others, which have so long been held in general esteem. But if the impartial reader will compare it with the simple and rapid, but systematic field-practice and still more simple machinery, which have been delineated above at so much length, I trust it will not be too much to say, that he will find the expense of transplanting to be *reduced*, by the Preservative method, in any case to *the one-half*, and in many cases to a *third* and a *fourth part* of its present amount.

Having now, in the course of this Essay, offered what appears to me sufficient, respecting both the theory and the practice of this interesting art, to excite the public attention, I shall beg leave to conclude with one remark. The art of giving Immediate Effect to Wood, although, as I should venture to hope, it is now established on FIXED PRINCIPLES, will be generally cultivated, or utterly neglected, as the revolutions in science, or the caprice of fashion may direct. But whatever be its ill fortune as a theory, whether it be condemned as fanciful, or rejected as useless, I may venture to say, that it will not fail of success, from the extravagant expense that attends the practice.

POSTSCRIPT.

Had it not been for the unexpected length, to which the foregoing discussions have been drawn, it was my intention to have added to the present volume, a Review or detailed Account of the Forest-Trees, whether indigenous or of foreign origin, that are generally cultivated in Britain. Such a Review would have comprised an enumeration of their botanical descriptions, their properties, uses, picturesque characters, and fitness for removal, together with any other fact or circumstance respecting each, that seemed to bear upon, or illustrate the different objects of this Essay. As a statement like this, however, must have occupied three hundred pages, or more, it was inadmissible in a volume, which had already swelled to its present size. It must, therefore, be reserved for some future occasion, or perhaps for a supplement to another edition of the work, should such ever be called for.

In these circumstances, I have to apologize to the reader, for what may be considered an imperfection in any attempt to give a body of rules for the practice of an art, without some description of the objects to which it is to be applied, of their diversity as materials, or their aptness to practice. But, should the above arrangement be followed out, I should hope, that something might be brought forward, useful to the general planter, as well as to the landscape gardener, and calculated to render the Treatise itself more worthy than it is of the public notice.

It was my intention also, to have added another Section or Chapter, on the necessity of combining some acquaintance with landscape gardening with the art of giving Immediate Effect to Wood, either by very considerable skill in the former art, possessed by the planter himself, or by his obtaining it, when wanted, from its professed teachers. If by planting small trees in the ordinary manner, even flagrant errors in landscape be committed, a considerable space of time must elapse, ere they become distinguishable by the eye, when there is sufficient leisure for the planter to correct them, with little labour to himself. But, if the same errors be committed with plants twenty and thirty feet high, they are at once obvious to all, and being prominent and offensive, they cannot be remedied, without vast expense and labour. This, as I conceive, is a very important subject, and deserves the serious consideration of those who mean to practise the art which has been treated in the foregoing pages.

In respect to the employing of professional men, which seems the most advisable method, I meant likewise to have shown, in the intended Section, that that method is not always so easy to be adopted, as might at first sight appear, in the present neglected state of Landscape Gardening as an art, with the diminished numbers of its professors, and the unmerited disregard in which their useful labours have been held, for the last five-and-twenty years. In fact, few persons of education and talents, either in the south or north, are now found regularly to study this elegant profession. In Scotland, I could not name a man, who has attained even ordinary proficiency in it. If you want your land drained, or your kitchen-garden laid out or improved, the professional person who undertakes it will probably offer his assistance to improve your park; and he will to a certainty spoil your place, if you permit him.

The opinion, now nearly universally prevalent, that country gentlemen are *the best landscape gardeners for their own places*, has mainly contributed to produce this effect; and it is too flattering to their self-importance not to be highly relished, and to become universally popular among this class of men. The idea of imposing on them so difficult a task seems to have originated with Walpole. In an evil hour, it obtained the sanction of Sir Uvedale Price; and it has since been supported by nearly as high authority:* yet it needs only to be closely examined, in order that its fallacy may become apparent. Although there is neither space nor time, on the present occasion, for the examination of such a question, yet I cannot refrain from bestowing upon it a few cursory remarks.

If Landscape Gardening, or the art of creating Real Scenery, be a fine art, which no one, I think, will deny, it may be asked, in what manner is a knowledge of it to be acquired, any more than of the other fine arts, unless by previous study, and by long and assiduous practice? If we want a fine picture, or a well-proportioned statue, do we usually purchase the canvass and the colours, the marble and the chisel, and set about executing it for ourselves? Certainly not; for we can boast of no practical skill in these difficult arts. Why, then, should we suppose ourselves capable of performing a task, not less the result of previous study, namely, that of imagining and executing Real Landscape? Could this be successfully accomplished in one fine art, it could be accomplished in another; and thus the masters of all those arts would become supernumerary and useless, and every one, by the same rule, could successfully practise them, for his own accommodation.

But, say the believers in this sort of intuitive skill, painting and statuary are peculiar arts, and they are exercised on

* Sir Walter Scott.

peculiar materials. The materials of landscape gardening are every-day objects, such as trees, and ground, and water, with which every one is conversant, and on which, therefore, every one can certainly operate with effect. At all events, they add, we have only "to follow nature," and, by consequence, "to please ourselves." Now without entering into the difficulties of following nature, or of operating with her materials, which are neither few nor small, I would merely observe to these reasoners, that the facility with which they can "please themselves," is but an indifferent proof of the possession of either skill or taste. Persons of the best taste, (that is, of the truest discernment of beauty and deformity in the fine arts) are always the *least easily pleased*, and least of all with their own efforts. Beauty, wherever it exists, they readily discern; but they feel and acknowledge their inability to produce it. Persons on the other hand, of little taste are pleased with any thing, and every thing. To them change, merely as such, is highly gratifying; so that they never fail to be pleased with their own attempts at excellence.

The general error even of superior men, who become their own landscape gardeners, is, that they mistake taste for skill; or, conscious that they possess the former, they conceive that the latter is superfluous. Hence, when they come to work with materials so unmanageable as those of nature, they seldom succeed in pleasing themselves, and nine times in ten, they fail in pleasing others. Nevertheless it is undeniable that there may be, and are country gentlemen, who are quite adequate to the laying-out of their own places, without assistance from the landscape gardener, in the same way that there are others, who can construct their own houses without the assistance of the architect. But it is likewise unfortunately true, that whenever we meet with a bad house, or an ill laid-out place, it is, generally speaking, *the work of the owner*. Foxley, the beautiful residence of

Sir Uvedale Price, and Downton Castle, the romantic seat of that accomplished scholar, the late Mr. Payne Knight, afford, as I am informed, splendid examples of the contrary. Those fine subjects are said to have been laid out, or at least improved in their most striking features, by the owners themselves; from which we can only conclude, that those eminent individuals possessed great *practical skill*, as well as cultivated taste, however they might have acquired it. On any other supposition, it would be to believe an effect to exist without an adequate cause, which is impossible.

Perhaps the merits of both sides of the question may be shortly summed up, in reference to the example just now quoted. On the one hand, it is probable, that Sir Uvedale Price and Mr. Knight possessed a much more intimate acquaintance with the capabilities of their own places, than any professional person could have possessed, had he been consulted. On the other hand, without any disparagement of those highly-gifted men, we may believe, that such a person, if properly qualified as an artist, would no less have excelled them in practical skill, and useful experience.—It is impossible to pursue the subject farther in this place, but it well merits a separate discussion.

NOTES AND ILLUSTRATIONS.

NOTES AND ILLUSTRATIONS.

SECTION I.

NOTE I. Page 5.

WHOEVER is acquainted with the pursuits and information of the generality of land-owners and country gentlemen, will be disposed to give full credit to the assertion here made in the text, and also to the following anecdote, which I shall mention, for the amusement of the reader.

In the county of * * *, in which as large sums have been laid out in Planting, as in most others, within the last half century, a gentleman, who is curious and intelligent about Woods, and entertains the same opinion of the generality of our planters as I do, was, some few years since, remarking in a public company, the almost universal want of science, or even of ordinary knowledge, that prevails on a topic so generally interesting. Not finding many persons agree with him in this sentiment, he offered a bet of five to one, that no gentleman present should, within three months, name three persons, landholders in the county, who had executed large plantations, and were possessed of from L.500 to L.5000 a-year and upwards, that were able to "state with precision, the different sorts of soils, to which twelve of the principal forest trees planted in Britain were best adapted."

The bet was on all hands allowed to be a very "sporting" one, and was immediately taken up. The taker of it next day set to work with his search. Being no planter himself, though a good agriculturist, he had no acquaintance with the subject in question; but he naturally enough imagined, that the species of knowledge, which was useless to him, must yet be valuable to others; and that therefore a planter could no more be ignorant of *the soils best suited to his trees*, than a farmer could be of those *adapted to his wheat, or his barley crops.*

But at the end of the three months, he was reluctantly forced to acknowledge, that, in the existing circumstances, the analogy was not a correct one, and three persons not being to be found of adequate information, he paid his money accordingly. During the course of the investigation, more than twenty planters aspired to the honours of the competition, all confident that they could easily gain him his bet. But, when it came to the trial, the result was, that *one person only*, in the county of ———, was able to fulfil the prescribed conditions!

It has been remarked above, that so little are country gentlemen, or their gardeners, acquainted with either the planting, or the management of Woods, that it is truly "the blind leading the blind," in this important department of rural economy; and I cannot refrain from telling another anecdote, on the subject of soils, of which the facts came within my own knowledge.

A few months since, I was applied to by a friend, to give him some advice respecting his trees. Wood, he said, grew so badly about his place, that, after the experience of forty years, he was almost discouraged from the cultivation of it. On visiting the spot, I perceived that his representation was but too well founded. As he felt a great partiality to limes and sycamores, he had transplanted those two sorts of trees all over his park, of eight and ten feet high, many years before, and that the work was executed in the best manner, he said, it was impossible to doubt, as it was done under the direction of his own gardener, who had *extensive experience*, and *knowledge of wood*. But the gardener and himself both assured me, that the soil and climate were "altogether unfavorable to wood," however either might suit husbandry or green crops. In proof of which, they turned my attention to the trees, which, indeed, appear stunted and unhealthy, with leaves of a yellowish-green colour, and growing about an inch, or little more, in a season.

On examining the soil, the cause of my friend's want of success was at once apparent. It consisted of a rich, but thin clay, naturally inclining to damp in the substratum, from the retention of moisture. My advice to him was very short: "Grub up your limes and sycamores, which you should never have planted, and which, unless by a miracle, could never grow to timber, in such a soil. Replace them with oak and beech, of at least five-and-twenty feet high, and of two and three feet in girth, in order that they may be able to withstand the elements, and, within a few years you will have thriving wood. But let *oak* be the staple, whether of your plantations or your park-wood, with *such* a soil."

To get advice is one thing, to follow it is another. I know not whether the gardener's opinion or mine prevailed with the good-natured owner. But the probability is, that the place will remain *in statu quo*, and the badness of both soil and climate be deplored or reprobated, for another generation.

Note II. Page 7.

So general is the feeling, among the best-informed classes, respecting the want of intelligence on the important subject of Wood, that I believe, a proposal for the establishment of an Arboricultural Society in Scotland, if properly made, would be as ardently gone into, as it would be universally approved. It is astonishing to think, that, up to the present time, no such Society should any where exist in the United Kingdoms. The importance and the uses of Wood are so great and manifold, and its improvement of such paramount interest to the empire in general, and to individual districts in particular, that there are really few objects, which are calculated to unite so many suffrages in their favour.

In respect to the beneficial results, which the labours of such a society would produce, they are generally but very imperfectly hinted at in the text. Perhaps one of the most remarkable is, the change that would take place, in the character, education, and acquirements of our nurserymen, by far the most influential agents in the melioration of our future Woods ; because it is upon *them* that we must depend for the nature of the materials. Should such a society be soon established, I should yet hope to see nurserymen come forth as they ought to do, able botanists, intelligent agriculturists and gardeners, vegetable physiologists of respectable information, and, in a word, men of general science.

Probably the truth is, that reformation, if it be begun in earnest, must begin elsewhere. Were the class of persons *first*-mentioned in this enumeration in the text (namely, " well-informed landholders"), by any means to rise up, the two others would follow, as a necessary consequence. Let us hear one of the most candid and intelligent nurserymen in Scotland on the subject. On my observing to him lately, how much it was to be regretted, that there was " no science" to be found among men of his profession, he replied nearly as follows :

" Of what use or value, sir," would science be to us, while nothing of the kind is possessed by our employers ? As nurserymen, seedsmen, or florists, we are mere *dealers* in the articles we sell ; in the same way as the shopkeeper is in sugar, snuff, or haberdashery goods ; only with this difference respecting us, that we raise or produce the article we sell, whereas the other has to buy, or to sell it, after it has been raised by others. Give gentlemen, who are the most partial to planting, but *cheap plants*, and they neither know nor care about the quality!

"No nurseryman, believe me, sir (at least in this kingdom), ever raised his reputation, or extended his business, by the superior quality of his trees, because that must have implied a superior *price*. Boutcher, the honestest and most judicious one we ever had (a man more remarkable for the spirit of fair-dealing, than for any knowledge of the world), made an attempt, about threescore years since, to improve Scottish arboriculture, and to convince the public of their injudicious anxiety for low priced articles in our line. Had his merit been rewarded with that encouragement, which it so eminently deserved, arboriculture would indeed have been improved, under such an instructor. His excellent example would long erenow have rendered both science and information indispensable to our profession. But what happened? Boutcher was undervalued by the ignorance of his age. He was suffered to languish unsupported for years at Comely Garden, and died at last, in obscurity and indigence. It would avail little in the present day to dwell on the ignorance and quackery of the men, who supplanted him in the public favor. The work on 'the raising of forest trees,' which he published by subscription, to relieve his wants, is a sufficient proof of his professional skill; and the detail of his practice is the severest satire on that of his successors. I conscientiously believe, that the millions of young trees at present raised near Edinburgh, if raised after Boutcher's method, would cover a greater surface than is now covered by the entire metropolis of the North!

"Since the time of the Millers and the Boutchers, the little science that was then dawning on our profession, whether in Scotland or elsewhere, has utterly disappeared from it. Planting and gardening, however, since that period, have come much into fashion in this country. The seed and nursery business has surprisingly increased. Instead of being confined, as formerly, to a scale the most limited and insignificant, it has become one of the most important professions in the metropolis and elsewhere, and fortunes, by consequence, have been rapidly accumulated by it.

"In these circumstances, sir, I conceive, that we have been greatly enlightened, respecting the mysteries of the trade, by our brethren of the south. To furnish gardeners to the nobility and gentry, is now found to be the road to wealth; to sell cheap or dear, the only criterion of merit in the nurseryman. His study, therefore, never is nor can be science, or the quality of his plants, but solely and exclusively, the art of raising the *greatest* possible number on the *smallest* space of ground, and furnishing them to his customers at the *lowest* possible price. You may think, that in this stricture I bear rather hard on our profession; but, since you do me the honour to question me, I must tell you the truth."

All this, we must own, is extremely deplorable. It places in a strong point of view, the benefits that would flow from a society for the improvement of arboriculture, were it judiciously constituted, and the necessity there is for at length cultivating the art independently, and as a *separate* department. There is now sufficient wealth, and, what is of more importance, sufficient intelligence in the country to accomplish the object, and for once to enable us to *lead the way* in this instance, in the advancement of the arts.

Note III. Page 7.

It was not till after the civil wars, that the arts of planting and gardening were greatly cultivated in England. The immortal Bacon, in the preceding age, was certainly the first, who seemed to apprehend the true principles of beauty in the garden, and

> Taught a degenerate reign
> What in Eliza's golden day was Taste.*

See his 46th Essay; in which he directs, that a considerable portion of what he terms his "princely garden" should be "framed, as much as may be, to a natural wilderness."

The genius of Milton, likewise, at a later period, figured for his Eden a garden, which could have no prototype, but in his own taste and ardent imagination, but which might rather seem to have belonged to the richest garden and park-scenery of an after age. The passage is curious, and to some it has appeared not less prophetic than beautiful; as the only models, that were before our great poet's eyes, were the formal and rectilinear gardens, which we derived from antiquity, and which still exist in most parts of Europe:

> Not that sweet grove
> Of Daphne by Orontes, and the inspired
> Castalian spring, might with this Paradise
> Of Eden strive. * * * The crisped brooks,
> Rolling on orient pearl, and sands of gold
> With mazy error, under pendent shades,
> Ran nectar, visiting each plant, and fed
> Flowers worthy Paradise; which not nice art,

* Mason's English Garden, B. I

In beds and curious knots, but nature's boon,
Poured forth profuse on hill, and dale, and plain,
Both where the morning sun first warmly smote
The open field, and where the unpierced shade
Embrown'd the noontide bow'rs. Thus was this place
A happy rural seat of various view.

Paradise Lost, B. IV.

Kent, to whom we certainly owe the art of modern gardening, lived in the beginning of the last century. He was by profession a painter, and had the taste and ingenuity to superinduce the principles of the new art on his previous studies. No one, probably, but a painter would have thought of making use of the *colours of nature*, to improve and heighten the effect of *real scenery*. The great principles on which he worked (as Walpole truly observes), were perspective, and light and shade; and thus his imagination bestowed the arts of landscape, on the scenes which he undertook to improve. Bridgeman, the fashionable designer of the day, had, a short time before, invented the sunk fence, which was a material step to the connecting of the garden and the park: but "Kent (says the same lively writer) leaped the fence, and saw that all nature was a garden."—See Anecdotes of Painting in England.

Kent returned from Rome, where he had gone to perfect himself in his profession, under the patronage of Lord Burlington, about the year 1721. The first places, which he laid out in the new style, were Claremont and Esher. This happened in 1728 or 1730; so that, as Paradise Lost first came out in 1667, it may be said, that more than a hundred-and-thirty years intervened between the time of Bacon and that of Kent, and more than three-score, between that of Milton and the last mentioned period.

Note IV. Page 8.

"The Landscape," a poem, by the late ingenious Mr. Knight, and the "Essays on the Picturesque," by that accomplished scholar Sir Uvedale Price, are productions of high merit, which we must ever value, as having been the means of retrieving the public taste, and showing what is unnatural, formal, or monotonous in the character of the school of Brown and Repton. Yet, as these meritorious works were composed under peculiar circumstances, and during the bitterness of controversy, they should be perused with some allowance, on that account. Mr. Loudon's able treatise also, on the "Improvement of Country Residences" (which came out in 1806, and has not been half so much commended as it deserves), forms an admirable guide to the man of taste, or the country gentleman, who, having no practical skill himself, is yet desirous to improve real landscape where it already exists, or to create it where it is wanting.

As a proof that the professors of landscape gardening do not obstinately cling to antiquated errors, Mr. Pontey (who has usefully written on the planting and pruning of trees), a disciple and admirer of Brown, published, in 1825, a meritorious work on "the laying-out of grounds," though with an odd title, namely, "The Rural Improver." The book, though not well written, contains excellent matter: it shows much practical skill, and should have a place in the library of every country gentleman. It is certain, that considerable knowledge of the principles of landscape, however obtained, and some skill in the practice of creating it, are indispensable to every one, who would transplant with advantage. This is a subject well deserving of discussion; but it would require far more than could be comprised within the short compass of a note.

Note V. Page 47.

With respect to the Immediate Effect of Wood in town embellishments, it would prove particularly valuable for the squares, and other open grounds of a great city. Edinburgh, one of the most extraordinary places in Europe, whether for its picturesque situation, or the sudden erection of its finest streets and squares, lately lost an opportunity of obtaining wood in this way, which is not likely soon to occur again. The Royal Circus, Moray Place, Heriot Row, and other places and squares, having spacious open grounds attached to them, were built in the immediate vicinity of what was once the delightful Villa and grounds of the Earl of Moray, on the Water of Leith; and, indeed, nearly the whole of them have grown out of the destruction of that elegant little Park. Its woods had been admirably kept, and, what is more, judiciously thinned out, by the taste of the late, and the present Lord Moray, and would have afforded subjects in sufficient number, of nearly five-and-forty years' growth, and also in the very best rooting-ground, to wood *the one-half* of the metropolis. It is to be lamented, that there was no science at hand, to have achieved this striking improvement, as it would have done more to establish the power of the art in the public opinion, than twenty volumes like the present; and, moreover, it would have anticipated at least *thirty years*, in the picturesque appearance of the city.

I do not mean of course, to say, that this should have been *all* done with fine large grove wood, or standard trees. No man of good taste, I think, will so understand it. But the miserable single trees and detached groups, that now appear upon the open parts of the grounds in question, should have been of that large description, which would have given effect and consequence to their narrow, but undulating surface; while shrubs and underwood, abundantly intermixed, would have conferred on them richness and intricacy. There were a great number of the last mentioned subjects (I mean shrubs and stools of underwood), at this Villa, from five to eight feet high, that would have richly clothed the *entire* open grounds of the new part of the city.

In the same way, it would be quite practicable, if wished for, although the exposure is considerably greater, to wood the site of what will hereafter become our Acropolis, as soon as the projected Parthenon rises on the Calton Hill. But where are the subjects now to be found? During the provostship or mayoralty of the late excellent Mr. Henderson, in 1824, I had agreed to give a specimen of what might be done, by planting a very large sycamore, with a spreading top, on the very highest part of the Hill, near Nelson's Monument. The tree was selected in Lord Moray's grounds for the purpose; but the sudden death of this worthy chief magistrate put an end to the undertaking.

Note IV. Page 50.

Highly gratifying as the Report of the Committee of the Highland Society must be to me, as attesting the success of my improvements in the art, and that on authority too high to be called in question; yet I own, I was not less gratified by the flattering mention of them, in one of the productions of the Author of Waverley; works which will, in all probability, live as long as the language endures, in which they are written. I regret that I am prevented by circumstances from quoting the passage.

Soon after this report was made, the society advertised a premium of ten guineas, or a piece of plate of equal value, for the best Essay on the Removal of Large Trees and Underwood. As I had then collected materials for the present Treatise, which were of a more extensive sort than would have suited the Society's regulations, I declined entering into competition for this premium. It was gained by the overseer of a gentleman in Perthshire, a very meritorious person, who gave merely an account of his own practice, for some years back. But, as he was probably not conversant with science, and had no idea that the art was susceptible of fixed principles, I did not conceive that it precluded, or in any degree anticipated the present publication.

SECTION II.

Note I. Page 55.

"Fuit et arborum cura legibus priscis; cautumque est XII. Tabulis, ut qui injuriâ cecidisset alienas, lueret in singulas æris XXV."—*Plin. Hist. Nat.* L. XVII. 1.

Note II. Page 56.

Γεράνδρυον μεταφυτεύειν ;—Veterem Arborem transferre v. transplantare.—*Eras. Adag.* p. 419.

Note III. Page 56.

It is remarkable, that there is not to be found, in all Homer, anything like picturesque description, although Pope in his translation has abundantly supplied the want. On Virgil and the other Roman poets nearly a similar remark may be made: and this defect in ancient poetry (as Twining has well observed, in his Dissertations on the Poëtics of Aristotle), naturally proceeds from a similar defect, in the sister art of painting.

In Pliny's account of the Greek artists, we find no mention made of a landscape painter among them, nor anything like a landscape itself, in his list of their most celebrated productions. He informs us, however, that a Roman painter, named Ludius, who lived in the reign of Augustus, first struck out the art of painting landscape, which he executed *in fresco*, in so very pleasing a manner, and at so very moderate an expense, that every body employed him. His subjects, he says, were villas, porticos, gardens, groves, hills, rivers, seaport towns, and the like, and that they were enlivened with human figures in abundance, engaged in all sorts of occupations; the whole forming a most pleasing representation (*blandissimo aspectu*). Hist. Nat. L. XXXV. 10.

Twining likewise accurately observes, that landscape painting in Pliny's time, though known, was not an established branch of painting, as it had not even acquired a name; for Pliny, who on other occasions is not sparing in his use of technical terms, is obliged to call it by a periphrasis, "an agreeable sort of painting or subject" (*amœnissima pictura*). P. 35.

Note IV. Page 57.

"In arbustum Ulmos quinquennes sub Urbe transferunt, aut, ut quibusdam placet, quæ vicenûm pedum esse cœperunt. Sulco, qui Novenarius dicitur, altitudine pedum trium, pari latitudine, et eo ampliùs, circa positas, pedes terni undique è solido adaggerantur. Arulas id vocant in Campaniâ. * * Opulis eadem ratio semino, qua Ulmos serendi; transferendi quoque è seminariis, eadem et silvis."—*Hist. Nat.* L. XVII. 11. *See also Columella*, L. V. 5. 6.—*Cato, &c.*

Note V. Page 58.

"Hæc si tibi nimiùm tristia videbuntur, villæ imputabis; in quâ didici ab Ægialo, diligentissimo patrefamiliæ (is enim nunc hujus agri possessor est), *quamvis vetus arbustum posse transferri*. Hoc nobis senibus discere necessarium est, quorum nemo non olivetum alteri ponit. Quod vidi, hoc dico; illud arboretum trimum aut quadrimum fastidienti fructus autumno deponere. Te quoque proteget illa, quæ

Tarda venit, seris factura nepotibus umbram."

Sen. Epist. LXXXVI. p. 558. Edit. Lipsii.

Note VI. Page 58.

This skilful husbandman, says the poet, well knew how to order his slow-growing elms in even rows; to transplant the hardy pear tree, and the grafted thornstock, already yielding fruit; together with the platanus of such a size, that the votaries of Bacchus might enjoy its shade:

Ille etiam seras in versum distulit Ulmos,
Eduramque Pirum, et Spinos jam pruna ferentes,
Jamque ministrantem Platanum potantibus umbras.

Virg. Georg. Lib. IV. 144.

This version of the passage, I conceive, we are warranted in believing to be correct, although the word *distulit* is used, and not *transtulit* (from the peculiar epithets, which Virgil has bestowed upon the trees), distinctly showing them not to have been diminutive plants, but trees transferred to the spot when of some magnitude.

Note VII. Page 58.

Σφόδρα βαθεῖς βόθρους ποιήσαντες, καὶ περικόψαντες τὴν κόμην, καὶ ἀσινεῖς τοὺς παχυτέρους ἡλῶνας καὶ ἀκεραίους τὰς ῥίζας διατηρήσαντες, μετὰ πολλῆς τῆς οἰκείας γῆς, καὶ κόπρου ὀρθὰ βάλλουσι τὰ πρέμνα, φυλαττόμενοι, ἵν' ὅπου ἂν κλίνῃ, μείνῃ. Anatol. in Geopon. Vet. L. X. 85.

Note VIII. Page 28.

"Ad Olivetum revertor, quod vidi duobus modis depositum. Magnarum arborum truncos, circumsisis ramis, et ad unum redactis pedem, cum scapo suo transtulit; amputatis radicibus, relicto tantùm capite ipso, ex quo illæ pependerant: hoc, fimo tinctum, in scrobem demisit: deinde terram non aggessit tantùm, sed calcavit et pressit. Negat quidquam esse hâc (ut ait) spissatione efficacius; videlicet, frigus excludit et ventum. Minùs prætereà movetur, et ob hoc nascentes radices prodire patitur, ac solum apprehendere, quas necesse est teneras adhuc, et precariò hærentes, levis quoque revellat agitatio. Parum autem arboris, antequam obruat, radit: ex omni enim materiâ quæ nudata est, ut ait, exeunt radices novæ. Non plures autem super terram eminere debet truncus, quàm tres aut quatuor pedes: statim enim ab imo vestietur; nec magna pars, quemadmodum in olivetis veteribus, arida aut retorrida erit.—Alter ponendi modus hic fuit. Ramos fortes, nec corticis duri, quales esse novellarum arborum solent, eodem genere deposuit. Hi paullò tardiùs surgunt; sed cùm tanquam à plantâ processerint, nihil habent in se horridum nec triste." Epist. LXXXVI. p. 559. He says, that he had likewise seen old vines removed in the same way, in the months of February and March, and with the same success.

Note IX. Page 60.

"Hoc mense, locis siccis, calidis, et apricis, majores arbores transferemus, *truncatis ramis*, illæsis radicibus, multo stercore et rigationibus adjuvandas."—*Pallad. de Re Rust. in Novemb. Tit.* XVI.

Note X. Page 61.

Pliny gives us two descriptions, the one of his Laurentine, the other of his Tuscan villa, in which the garden is the most prominent feature (see Epist. L. II. 17. L. V. 6.): and the gardens of England, such as

Lord Burleigh's, and that at Hampton Court, as delineated by Hentzner are accurate copies of them. There wants nothing, as is justly remarked by Walpole, but the embroidery of a parterre, to make a garden in the reign of Trajan serve for a description of one in that of King William.—See Anecdotes of Painting, Vol. IV.

That horticulture was really introduced into Britain by the Romans, there is no sort of doubt, and that their proconsular governors brought it to a considerable height of perfection. Pliny tells us, that cherries were originally an Asiatic fruit, not known in Italy till after the triumphs of Lucullus, on account of the Mithridatic war, in the 680th year of the city, when they were brought over by that celebrated commander. But so diligently were they cultivated, that, within 120 years, they were carried over to Britain. *Hist. Nat.* L. XV. 25.

NOTE XI. Page 62.

Prince Maurice of Nassau, as Barlæus informs us, was appointed Governor of Brazil about the year 1636; and, after several successful efforts both of military and political talent, in defence of that province, he erected, in 1639, the palace or government house of Friburg, and laid out the luxurious gardens, of which an account is given in the text. In some parts, Barlæus is extremely happy in drawing after the manner of the ancient historians; and, although the passage is long, as he describes the site, and in some sort the particulars, of one of the greatest transplanting feats recorded in modern times, it may be worth while (the book being scarce) to give the passage entire, for the gratification of the reader. "Planities horrida, inculta, nullis arboribus, nullo frutice induta, sordebat situ. * * Ædificium ea cura à Comite fuit, ut spectata salubritas fuerit, curata tranquillitas, parta loco securitas, neque neglecta hortorum amœnitas. * * Surgebant Cociæ spectabili serie septingentæ, prociores aliæ, aliæ humiliores, quarum quædam caudicem attollebant quinquaginta, quædam quadraginta, quædam triginta pedum altitudine, priusquam ramorum attingeret divergia. Has cùm transferri non posse omnium esset opinio, scitè effossas, petoritis, trium quatuorve miliarum spatio vectari, et pontonibus trans fluvios deportari, in insulam jussit. Translatas, non labore solùm sed ingenio, excepit amica tellus, eaque fæcunditate, præter omnium spem, implevit annosas arbores, ut primo ab insitione anno mirâ nascendi aviditate, fructus dederint copiosissimos. Jam septuagenariæ et octogenariæ erant, veterique proverbio fidem imminuère, arbores annosas non esse transferendas."—*Histor. Rer. in Bras. gestar.* p. 240—242.

Note XII. Page 61.

As gardening, in its largest sense, is so intimately connected with our present subject, and as Le Notre was the person whose example swayed the taste of all Europe, Great Britain only excepted, for more than a century, and still continues to sway the greater part of it, it may be worth while, in this place, to bestow a brief notice on the style and character of both the man and his works.

Le Notre was by profession an architect, and by his uncommon turn for garden-decoration, became a first-rate favourite with Lewis XIV.; who, besides ennobling him, bestowed on him the appointment of comptroller-general of buildings, and director of the royal gardens. To the rectilinear gardens, and elaborate topiary works handed down from antiquity, he added rich parterres, and magnificent triumphal arches, long and straight alleys, lofty cascades and fountains, with their grotesque and strange decorations, grottos filled with architecture, and trellis-work covered with gilding; and these, intermixed with a multitude of thermes and statues, seemed to the French, unaccustomed as they were to relish the real beauties of nature, the *ne plus ultra* of human invention. Professor Hirschfeld of Kiel, the German historian of modern gardening, from whom we derive these particulars, says, that it was the personal character of the monarch himself, and the taste of the age, which began to be attracted towards the restoration of the fine arts, that chiefly raised Le Notre to the summit of fame and popularity. But the nation, as well as the court, wanted to be dazzled; and both were captivated and enchanted with what seemed at once to unite novelty with singularity. Ornament and tinsel, pomp and brilliancy were thus universally preferred to correct taste, and true greatness of design. It must, however, be acknowledged, adds this judicious writer, that Le Notre's genius was admirably suited to the taste of the times in which he lived, and fully gratified the leading prejudices of the French character. *Die nation, so wohl als der hof wolten nur geblendet, nur durch das neue und ausserordentliche angezaubert werden. Man sahe mehr auf das, was glanz und pracht hatte, als auf reinen geschmack, und stille grosse. Es ist aber nicht zu läugnen, dass die manier des Le Notre gerade dieses herrschende vorurtheil, diesen geschmack seiner zeit befriedichte.*—Theorie der Gartenkunst, B. V. p. 255.

Le Notre's masterpiece was the gardens at Versailles, which cost two hundred millions of livres. He laid out, besides, Trianon, Meudon, St. Cloud, Chantilly, &c. In 1678 he went to Italy, England, and other countries, which one and all adopted his style. King Charles II. sent for him, to improve the taste of the English, when he laid out St. James's Park and Greenwich; "certainly (as Walpole says), no great monuments of his invention."

Note XIII. Page 71.

It is to be regretted, that Sir Uvedale Price, in his very valuable "Essays on the Picturesque" (probably the most powerful example of controversial writing, and acute criticism in the language), should have somewhat lessened their effect, by personal sarcasm, and the bitterness of controversy. As to Brown, he has not (according to the vulgar phrase) "left him the likeness of a dog;" and his conceit, his ignorance, his arrogance, his vanity (of all which Brown had his full share), are blazoned forth in the most glaring colours. It is true, that to pull him down, while in the zenith of his fame and popularity, and afterwards to keep him down, surrounded as he was with followers and flatterers, required a vigorous and powerful arm like Sir Uvedale's; and no one, I think, will grudge the latter his complete triumph, or the castigation inflicted on his opponent, considering the lasting benefit which his own labours have conferred on an elegant art, and in elevating the fame and character of the country. Still I cannot help thinking, that poor Kent, though a man of rather limited genius, should have escaped more easily than he has done, from the great critic's hand; since it is to him that we as clearly owe the art of landscape gardening, as we owe the saving of it from disgrace, and the placing it on just principles, to Sir Uvedale Price. May we not, then, ask, looking to the fine genius of the latter,

"Tantæne animis cœlestibus iræ?"

Note XIV. Page 72.

This was James Earl of Abercorn, uncle to the first marquis who succeeded him in 1789. The earl was esteemed one of the best-bred men of his time, though his manners were distinguished by pomp and preciseness. It was said of him, that he made the tour of Europe in a posture so erect, as never once to touch the back of his carriage! The country must be considered as indebted to him, as a liberal patron of the arts, and as being among the first persons who introduced Landscape Gardening into Scotland.

Note XV. Page 81.

It is here said in the text, that the lightening, that is, mutilating the fine tops of trees, is the ordinary, and nearly the universal practice in England ; and it might have been added, with equal truth, that it prevails more or less, in every other part of the British empire, where the transferring of large trees is known and practised.

After all the investigations, which I have been able to make, into the practice of such English planters as the Marquisses of Londonderry and Stafford, Mr. Gibson, and Sir R. Arkwright in the north, the Duke of Portland, Marquis of Hertford, Lord Caernarvon, Lord Grenville, Sir James Gardiner, Mr. Thistlethwaite, and Mr. Long in the south, Sir Aubrey De Vere Hunt, and others in Ireland, who have removed Wood with various degrees of success, it appears, that they all adhere more or less to the Mutilating system : that they take up the tree, after lightening the top, with short and incompetent roots, but with a great mass or ball of earth attached to it : that they raise it with a strong crane, upon a low platform, with wheels, or rather rollers, still lower: and after conveying it upright and with much difficulty, they have as great difficulty in propping and supporting it, after being planted. The only improvement practised seems to be the cutting round the roots, according to Lord Fitzharding's method; but that is often done in the season immediately preceding the removal, when little benefit can be derived from it.

By this method, it is obvious that immense labour, and consequently very considerable expense, is incurred in the removal of Wood, and far more than should be incurred in an art, calculated to be generally useful. In fact, the objection of *difficulty and expense united*, is quite sufficient to counteract or limit the adoption of any art, however valuable, and render it unpopular with the public.

Note XVI. Page 85.

The following is a list of thirty-four of the largest trees and shrubs, with their height and girth, removed by Dr. Graham:

	Height.		Girth at 1 foot high.	
	Feet.	Inch.	Feet.	Inch.
Common Hawthorn (*Cratægus Oxyacantha*)	23	0	2	10
Scarlet-flowering Hawthorn (*Cratægus Oxyacantha var.*)	20	9	1	9¼
Great American Hawthorn (*Cratægus Coccinea*)	20	6	1	7
Spotted Hawthorn (*Crat gus Punctata*)	17	0	2	4
Cut-leaved Alder (*Alnus Glutinoso var.*)	43	0	3	11
Weeping Ash (*Fraxinus Excelsior var.*)	34	0	2	10
Heart-leaved Poplar (*Populus Candicans*)	29	0	2	1
Various-leaved Ash (*Fraxinus Heterophylla*)	34	9	2	7½
Flowering Ash (*Fraxinus Ornus*)	37	8	3	11¾
Common Lime (*Tilia Europæa*)	37	8	2	6
White Lime (*Tilia Alba*)	30	0	3	2
White-Beam (*Pyrus Aria*)	34	6	3	1½
Weeping Birch (*Betula Alba var*)	40	0	2	9
Montpelier Maple (*Acer Monspessulanum*)	19	0	2	5
Common Walnut (*Juglans Regia*)	24	6	2	4
Common Yew (*Taxus Buccata*)	23	0	3	5¾
Sugar Maple (*Acer Saccharinum*)	18	6	1	9
Scarlet-flowering Maple (*Acer Rubrum*)	19	0	1	1
Scarlet Oak (*Quercus Coccinea*)	18	8	1	5½
Shell bark Walnut (*Juglans Cinerea*)	17	0	1	5½
Perfumed Cherry (*Prunus Mahaleb*)	18	0	2	7½
Chinese Arbor Vitæ (*Thuja Orientalis*)	17	0	2	9½
Red Cedar (*Juniperus Virginiana*)	18	0	1	10
Common Holly (*Ilex Aquifolium*)	21	0	1	11½
Hedgehog Holly (*Ilex Aquifolium var.*)	11	0	1	1
Thick-leaved Holly (*Ilex Aqufolium var.*)	12	2	A bush	
Andrachne Strawberry-tree (*Arbutus Andrachne*)	13	0	2	7½
Shrubby Trefoil (*Ptelea Trifoliata*)	10	0	1	5¾
Blue Magnolia (*Magnolia Acuminata*)	13	6	1	3⅜
Constantinople Hazel-nut (*Corylus Colurna*)	25	4	2	0½
Cut-leaved Hornbeam (*Carpinus Betulus var.*)	12	0	2	3
American Nettle-tree (*Celtis Occidentalis*)	14	0	1	10
American Elm (*Ulmus Americana*)	25	6	1	9½
Curled-leaved Elm	28	6	2	2½

In a Note, at the bottom of the above list (which was furnished by the learned professor), he says, "we have, of course, removed more than a single specimen of the above; but I have not thought it necessary to state the measurements of more than one of a kind."

The idea, which is given in the text, of this meritorious horticultural effort by Dr. Graham, is given from the impression which I received of it, on visiting the Botanic Garden in June, 1823, when the oldest of the trees had not been longer than a twelvemonth in the ground; and this effort appeared the more admirable from the circumstance, of which, I was at the same time informed, that only one, or two at most, had died in the first season. On visiting the garden again in July, 1827, I was both pleased and surprised to observe, that the more delicate plants, such as the magnolia, the perfumed cherry, the arbutus, &c. had succeeded the best; which showed the extraordinary care and judgment, with which, on account of shelter, they had been massed up with others, and also the extraordinary attention, which had been bestowed upon them afterwards. Of the arbutus there is a noble specimen, supposed to be one of the largest in Britain.

The ordinary forest-trees, on the other hand, such as the lime, the birch, and the walnut, appeared by no means so successful, although powerfully supported with cordage, as described in the text; but they were placed in more exposed situations, and seemed less in possession of the Protecting Properties. This conjecture was confirmed to me by the intelligent Mr. Macnab, who stated, among other things, that in the tallest of these trees, which were from seven-and-thirty to three-and forty feet high, the roots did not exceed three-and-a-half or four feet in length; a style of roots, as I observed to him, wholly inadequate to nourish or support plants of a far smaller size. For the reasons, therefore, given in Section V. page 144 of the present work, the ingenious professor must wait with patience, " until the deficiency in these properties be made up." But I wish distinctly to repeat what is mentioned in the text, that I consider Dr. Graham as beyond comparison *the ablest, the most ingenious, and the most successful horticultural transplanter in Britain*, or perhaps in Europe; and I am certain, that he would render an important service to all others, who may be placed in similar circumstances, were he to publish an account of the particular process which he followed, on this interesting occasion.

It will, however, immediately occur to every reflecting planter, that, for the causes assigned in the text, and particularly at pages 98 and 99, Horticultural Transplanting and Transplanting in the Park are processes *extremely different* from each other, as hothouse culture is from the culture of husbandry in the open field. Had I thought it worth while, I might have stated in the text, and stated with perfect truth, that the forest-trees in the Botanic Garden of Edinburgh could not have stood four-and-twenty hours in the Park here, particularly about the equinox; and that the style of success, attending them where they do stand, seems to show, that, up to the beginning of the present year, when the first edition of my Treatise came out, nothing was known of the principles, on which *Park-wood* should be removed, even by persons the most able and scientific. And, I trust, it will not now be thought invidious, when I add, that trees planted at the same time as those in the Botanic Garden, in *the most exposed situations* of my Park, are seen to make shoots between two and three feet long, and that they never had props or supports of any kind.

The truth is, that horticultural planting and park planting being so very dissimilar, as just now observed (owing to the widely dissimilar circumstances under which they are executed), they never can come into comparison, far less into competition with each other. Modern botanists have thought good to divide themselves into two classes, namely, the Systematic and the Physiological; but under which of the two the ingenious professor ranks himself is not known to me, although it is pretty obvious in which of them a knowledge of the principles of planting of any sort is to be found. In *park planting* I think it probable, that the professor has no experience: but I venture to predict, to whichever of the two classes of botanists he may belong, that, should he try the practice, the difficulties attending a successful execution will perhaps surprise him, notwithstanding the light that has been thrown upon it by the present Treatise.

Before concluding this Note, there are two circumstances, which I think it proper to mention, as connected with the subject. The first is, that it has been alleged, by a very respectable and highly accomplished friend of Dr. Graham's and mine, that, in the note on this passage, in the first edition of the book, the doctor "has not been treated with perfect fairness." This allegation has given me great pain, as there is no man for whom I entertain a greater respect and esteem than himself. The former note I acknowledge, was hastily written, and therefore not so clearly expressed as it might have been. I have, therefore, re-written it as above, and I trust that it will now appear both fair and explicit.

The second circumstance is, that I understand it has been said by other friends of the professor's, that because, in imitation of my method, he did not decapitate or mutilate his forest-trees, according to the general practice in Britain, and all over Europe, his removals at the Botanic Garden had completely *anticipated* my system, and deprived it of any originality, which the public, as well as the periodical reviewers have been pleased to attribute to it. This allegation, I conceive, requires no answer from me. Our respective works, whether literary or arboricultural, will speak for themselves.

Note XVII. Page 89.

Mr. J. C. Loudon, in his Encyclopedia of Modern Gardening, one of the most useful and interesting publications of modern times, mentions the remarkable progress, which Landscape Gardening has made in Poland. The first example of it was at Pulawy, the principal seat of the Czartoryski family, on the Vistula, under the superintendence of the Princess Isabella Czartoryski, a lady of distinguished talents and accomplishments, and who had resided long in England. She carried over to Poland, Savage an English gardener ; and with his assistance, and that of Vogel and Frey, two artists of Warsaw, she laid out this magnificent place in the last century, and before 1784. In 1801, she published a regular Treatise on the style of English Gardening, with plates, which greatly contributed to bring the art into fashion among her countrymen. This is perhaps the best foreign treatise on the subject, excepting the large and excellent work of Professor Hirschfeld of Kiel, (*Die Theorie der Gardenkunst*), which for many reasons is well deserving of an English dress, as the French translation gives no competent idea of the merit of the original.

Mr. Loudon, who visited Poland in 1813, and saw many trees that had been transplanted by Stanislaus, soon after 1764, gives the following account of the palace and grounds at Lazenki, which contains a curious picture of the manners, as well as the Wood, at the residence of this unfortunate prince.

" By far the most remarkable of these gardens (says he), is Lazenki, or the Bath, formed by the last king, on the site of an ancient park at Ujasdow, within the suburbs of the city. At the beginning of the reign of Stanislaus, in 1764, it was a marshy wood, planted with alders, with some canals, and other stagnated pieces of water, near which was a grotesque edifice, called the Bath, from which this park takes its name.

" The Palace, a beautiful piece of Roman architecture, from the design of Camsitzer, a German artist, is placed on an island, in a considerable piece of water. It consists of a centre and two wings. The centre is placed in the middle of a narrow part of the lake, and the wings are on opposite shores, and joined to the centre by arches, with orangeries over them. The entrance is by a carriage-portico in one of the wings, to which you arrive, without seeing the lake ; and on entering the orangery, its first effect is surprising and delightful. On the north shore of this lake, there is an open amphitheatre of stone, with its orchestra, on the brink of the water; and near the margin is an island of trees, which served as the proscenium. This theatre was at all times open to the public; and in addition to the ordinary exhibitions, ships and naval engagements were occasionally exhibited. The gaiety which prevailed here, during the first years of the reign of Stanislaus, the singular effect of the illuminations, the ships, and the resounding of music in the woods, are still recollected by some of the oldest inhabitants of Warsaw, and spoken of with feelings of regret.

"The grounds were not extensive, nor, excepting near the Palace, much ornamented. They consisted of a number of broad green alleys, crossing each other at right angles; and of smaller *covered* paths leading to open circles of turf, for dances and music, and for tents and booths, on extraordinary occasions. In several places, coffee-rooms and ice-cellars were established, and still remain. And there are two pavilions for the king's mistresses; and another, which served as a seraglio for strangers, or visitors of the king; the three being connected with the palace by arbour-like paths, or arcades of trellis-work, covered with creepers.

"One thing deserves to be remarked as to these gardens, which is perhaps not to be found in any others in Europe. Pedestals, as for placing statues, were ranged in different parts of the grounds, particularly along the broad walk, leading from the palace to the amphitheatre. On these pedestals, on extraordinary occasions, selected *living* figures, male and female, dressed in character, were placed, and taught to maintain certain attitudes, after the manner of the representations called *tableaux*; and which are sometimes, though rarely, produced in private circles, at Paris and Vienna, on days when theatrical amusements are forbidden. In 1813, this seat was nearly in the state, in which it was left by Stanislaus; but we understand, that it has since undergone several changes."—*Encyclopedia of Gardening*, p. 54.

SECTION III.

Note I. Page 93.

Marshall has a specious way of adjusting the differences between these conflicting systems; although he seems to give it, in the end, in favour of the former (that is, of the system of raising trees from the seed), in situations, where the nature of the ground will admit, "The dispute about sowing and planting (as he observes) may in some measure be reconciled in the following manner. Where the strength of the land lies in the substratum, while the surface soil is of an ungenial nature, *sow*, in order that the roots may strike deep, and thereby reap the full advantage of the treasures below. (Qu. Where did Marshall meet with land of this description?) But, on the contrary, where the top soil is good, and the bottom of an opposite quality (a *very* common case), *plant*, and thereby give the roots the full enjoyment of the productive part of the soil. Or, under these last circumstances, *sow*; and tap the young plants as they stand, with a tapping instrument, and thereby check their downward tendency, as well as strengthen their horizontal roots.

"By this method of treating seedling plants, the peculiar advantage of planting is obtained. The dispute, therefore, seems to rest entirely upon this question; which of the two methods is least expensive? To come at this, there are two things to be considered; the *actual expense of labour*, and other contingent matters, and the *loss of time* in the land occupied. With respect to the former, sowing is beyond comparison the cheapest method: but in regard to the latter, planting may seem to gain a preference; for the seed-bed is small compared with the ground to be planted, and while that is rearing the seedling plants, this continues to be applied to the purposes of husbandry. However, if we consider the check, which plants in general receive in transplantation; and if the interspaces of an infant wood, may for several years after sowing be still cultivated to advantage, the preference, we conceive, is evidently and beyond all dispute, on the side of sowing."—Rural Ornament, Vol. I. p. 121—123.

As this is a question of some moment, and has divided the most judicious writers and planters for a century back, it must be interesting to the young planter to have a concise summary of the evidence, as furnished by our best writers, on the one side, and on the other, such as may assist him to determine which is most consonant to rational theory, supported and enforced by the best practice.

Miller, no mean authority as an arboriculturist, says (as we have seen), that no trees transplanted, and especially the oak, will ever produce such valuable timber, as those raised from the seed. Marshall, as we have seen also, prefers sowing the seed, wherever the ground is capable of being worked with the plough. Evelyn, Emmerich, and though last, not least, the intelligent Speechly, are of the same opinion, although Speechly's extensive pratice was sometimes at variance with this sentiment. Nicol and Pontey have practised both methods extensively, and they offer no arguments against sowing, where situation and circumstances admit. Sang, who in point of practical skill is not inferior to any of these writers, says; "It is an opinion very generally entertained, that planted timber can never in any case be equal in durability and value to that which is sown. We certainly feel ourselves inclined to support this opinion, although we readily admit, that the matter has not been so fully established by *experiment*, as to amount to *positive proof.* But, although we have not met with decided evidence, to determine on the comparative excellence of timber raised from the seed, without being replanted, over such as has been raised from replanted trees, we are left in no doubt as to the preference in respect to *growth* of those trees which are sown, over such trees as are planted."—Planter's Calendar, p. 43. The same writer prefers, and with great justice, this mode of raising the Scotch pine, and the larch.

The late Dr. Yule, an able botanist, in an excellent paper, which he gave to the Horticultural Society of Edinburgh (for want, as he remarked to me, of a more *appropriate* body to which he might communicate it), strongly recommends the sowing of seeds, for permanent plantations. "It is a well ascertained fact (he says), that seedlings allowed to remain in their original station, will, in the course of a few seasons, far overtop common nursed plants, which are several years older. This principle, however, is of course strictly applicable to forest-timber trees. Where shelter or ornament is speedily wanted, the transplanting of grown trees, laying, budding, inarching, and other means must consequently be substituted."—Horticult. Mem. Vol. II. pp. 418, 419.

The ingenious author of the Encyclopedia of Agriculture, on impartially considering these different opinions, observes, respecting those of Sang and Yule in particular, that they seem to be founded on the idea, that the taproot is of material importance to full-grown trees, and that, when that is once cut off, the plant has not the power of renewing it. "That the taproot (he observes) is of the utmost consequence, for the first three or four years, is obvious from the economy of nature, at that age of the plant, perhaps for a longer period; but that it can be of no great consequence to full-grown trees, appears highly probable from the fact, that, when such trees are cut down, the taproot is seldom to be distinguished from the others."—p. 572. Forsyth, an arboriculturist of considerable experience, has distinctly shown by experiments, that, trees have the power of renewing their taproots; and he further proves the great advantages, that are derived from cutting down trees, after two or three years' planting, in order to form healthy and vigorous woods. He transplanted, as he states, a bed of oak-plants, cutting the taproots near to some of the side roots, or fibres springing from them. In the second year after, he headed down the one-half of the plants, and left the other half to nature. In the first season, those headed down made six feet long, and upwards, and completely covered the head of the old stem, leaving only a faint cicatrix, and produced *new* taproots, upwards of two feet-and-a-half long. That half of the plants, which was not headed down, was not one-fourth part of the size of the others. Some time after, when he wrote the account, one of the plants cut over was found to be eighteen feet high, and fifteen inches in circumference, at six inches from the ground; while one of the largest of the plants not cut over, measured only five feet-and-a-half in height, and three inches and three quarters in circumference.—See Treat. on Fruit Trees, p. 144.

On considering the whole question, it appears to me, that, as the pine and fir species receive the greatest check from transplanting, and as, when planted at four and five years old, they do not readily grow to timber, it is clear, that they should always be sowed, or at least planted very young, in high and cold regions. Respecting all Trees that stool, I entirely concur in opinion with the intelligent author of the Encyclopedia of Gardening, that, with any tolerable soil and situation, *planting will be found preferable to sowing*, if strong and healthy plants be used, and such as have not been too much drawn up by the heat of the nursery, taking care to *cut them down*, after the second, or much better, after the third year, when they have been established in the ground.

Note II. Page 94.

As I consider Miller as one of the greatest authorities we have, for whatever relates to trees, I shall beg leave to give his opinion at large, on the subject of the removal of large trees. To this art he undoubtedly was not partial, from the great want of *science*, which he saw displayed by those who practised it in his day; and he could form no conception, either of the general progress of science which we see now attained, or its application to this particular branch of rural economy.

"The modern practice of transplanting forest-trees, from hedge-rows and woods, of large size, and at a great expense, has too generally prevailed in this kingdom (England), the generality of planters being in too great haste, and by a mistaken notion of saving time, begin by transplanting such large trees as they find on their own estates, or that they can procure in their neighbourhood, and please themselves with the hopes of having fine plantations soon: but if, instead of removing these trees, they would begin by making a nursery, and raising their trees from seed, they would save a great expense, and much time, and they would have the constant pleasure of seeing their trees annually advance in their growth, instead of growing worse, as will always be the case, where old trees are removed; though many persons flatter themselves with the hopes of success, when they find their trees shoot out the following season. * *

"I have seen great numbers of tall oaks transplanted, which have appeared to thrive for some years, when first planted; but in five or six years after, they have begun to decay at top, and have leisurely died to the ground, than which nothing can be a more disagreeable sight to the owner. And the method which is commonly practised in transplanting these trees, would destroy them, were there a possibility of such large trees surviving their removal, which is, that of *cutting off all their branches:* for were the same practised on a tree of the same age *unremoved*, it would stint the growth so much, as not to be recovered in several years, nor would it ever arrive to the size of such as have *all their branches left on them.* But the reason given for this practice is, that if the branches were left upon the trees, they could not be supported; the winds would throw them out of the ground; and another (which is bad philosophy) is, that, *as the roots have been greatly reduced by transplanting, so the heads of the trees should be reduced in the same proportion.* As to the first, it must be allowed that trees, which are removed with great heads, are with great difficulty preserved in their upright situation; for the winds will have such power against the branches as to overset the trees, if they are not very strongly supported with ropes: therefore, this may be brought as an *objection to the transplanting* of large trees, rather than in *support of a practice which is so prejudicial to them.* And as to the other reason, it has no foundation: for, if large amputations are made at the *root*, there should not be the same practised on the *head;* because the wounded part of the head will imbibe the air at every orifice, to the great prejudice of the tree.

"Besides this, if we pay any regard to the doctrine of the circulating of the juices in plants, we must allow, that *the heads of the trees are equally useful to nourish the roots, as the roots are to the heads;* so that, if there is a waste of sap, both at the top and bottom of the trees, it must weaken them in proportion. For whoever will be at the trouble to try the experiment on two trees of equal age and health, and cut the branches off from one, and leave them upon the other at the time of transplanting, if the latter is well secured from blowing down, it will be found to *succeed much better* than the other. Or, if the same thing is practised upon two trees left standing, the tree, whose branches are cut off, will not *make half the progress of the other*, nor will the stem increase in its bulk half so fast. Therefore, where trees are transplanted young, there will be no necessity for using this unnatural amputation, and the success of these plantations will always give pleasure to the owner."—Gardener's and Botanist's Diction. *in voc.* "Planting."

I have particular satisfaction in quoting these sentiments from the great work of Miller, and I have little doubt of their being perused with equal satisfaction, by the discerning reader. In fact, no advocate of the system, which is attempted to be established in this Essay, could have given this material part of its principles with greater force and truth. It clearly shows, that, if arboricultural science, in respect to this art, had not been *stationary for a century* in England, the giving Immediate Effect to Wood, instead of being, as it now is, a rude and uncertain practice, would long since have risen to the rank of a regular art, justly esteemed, and as generally cultivated.

Note III. Page 98.

According to the best late phytologists, water is an agent as necessary to the development of vegetable life, as it seems to be a constituent of vegetable organization. A dry seed does not act on the surrounding air, until it has imbibed water. Water is likewise the vehicle, by which nutrient matter is carried into plants, and in the opinion of some, is even reduced in them to a solid form, and applied to the purposes of nutrition. —See Ellis, Veget. Physiol. in Suppl. Encyclop. Britan.

Notwithstanding what is here said in the text, respecting light as a condition of internal development peculiar to plants, it may be doubted, whether it be not nearly as necessary to animals. Cattle will not fatten so well, when stallfed or shut up, as in good ground, and in fine weather, with the free enjoyment of light. Light is caloric; and the difference between night and day in this respect is extremely curious. The substratum of ground, on which beasts feed, as affected by caloric, is a subject which deserves greater chemical and physiological investigation than has as yet been bestowed upon it.

Note IV. Page 100.

It has been doubted, by some phytologists, whether trees generate heat. I believe it is certain, notwithstanding what is cursorily stated in the text, that frosts of very extraordinary severity will destroy trees. The non-conducting property of wood may in some measure protect the juices; but their chemical composition, as here stated, is such, that they do not congeal, unless the cold be of the severest sort, and many degrees below the freezing point of water. In weather so hard as to occasion the juices to freeze, the wood, in the act of congelation, is violently rent asunder: but in the more common destruction of woody plants, it is not so much the degree of cold that kills them, as the too sudden reapplication of heat.

The ingenious Hassenfratz, to whom the chemical world is under some obligations, held, that vegetables are not fed by carbonic acid. In a Memoir on the Nourishment of Vegetables, read in 1792, to the Royal Academy of Paris, having shown, as he conceived, that water and air are insufficient for all the purposes of vegetation, he attempted in a second ingenious paper to prove, that carbonic acid gas is not decomposed and digested in the organs of growing vegetables, and that they cannot be fed by it; because oxygen, escaping from combination in the decomposition of carbonic acid, and water escaping in vapour in the state of gas, would absorb caloric, and produce cold: whereas, by the experiments of the late John Hunter, living vegetables contain a degree of heat greater than that of the surrounding atmosphere. The reason of this difference in opinion between these two accurate inquirers may possibly be, that Hunter's experiments were made only in the autumn, the winter, and early in the spring, when the activity of vegetation was suspended, which does not seem to have been the case respecting those of Hassenfratz.

It appears, however, that both Rüchert and Senebier ascertained, that vegetables do decompose carbonic acid, retaining the carbon, and emitting the oxygen. Dr. Woodward made many experiments with plants of mint growing in water, and found that a plant, in water from the Thames, which must certainly have contained a large share of carbonic acid, increased considerably more in weight, than a plant growing in pure water. Schoppett, who examined the temperature of growing trees in New-York, found, that from November to April, when the bulb of a thermometer was put into a hole made in a tree, the mercury rose higher than in the open air; and that the colder the weather, the greater of course, was this difference. From April to November, on the other hand, the thermometer showed a lower temperature in the tree, than in the open air. And Ingenhoutz found, that a piece of green paper, hung on a tree, in a warm summer-day, felt sensibly warmer than the leaves. Hunter likewise, who was fond of trees, used to keep thermometers in them for months together, and obtained similar results.—The subject is curious, and is the more deserving of the planter's investigation, that the state of the bark, and its power, when thick and indurated, to protect the sap-vessels, are so intimately connected with all facts, that tend to illustrate the subject.

Note V. Page 101.

Of the close analogy, which subsists between the animal and vegetable kingdoms, many other examples respecting the former might be adduced, besides those mentioned in the text, in order to show, how universally nature generates provisions for individuals, in order to fit them for the situations, in which they are placed. The general rule seems to be, as mentioned in the text, that where there is a great external application of cold, an adequate non-conducting covering is supplied, to prevent the subtraction of internal caloric; and in the same way, that covering is withdrawn, on a greater application of heat. Of the latter the coach or race-horse furnishes a familiar example, with his smooth and silky coat, enjoying the warmth and shelter of a well-constructed stable, when we compare it with the rough and shaggy one which he wears, when running out in winter. The coats of warm-blooded animals appear to be thick and fine, in proportion to the intensity of the cold they are destined to endure; and they are always thicker and finer in winter, than in summer. Accordingly (as stated in the text), the fur-bearing animals all inhabit high latitudes, and the value of their skins increases, in proportion to the severity of the cold, in which they are killed.

Of the natural clothing of animals in cold countries, the musk ox of Melville Island, as observed by late voyagers, furnishes a striking instance ; as the immense mass of non-conducting matter, which covers that animal, renders him capable of existing in a temperature, where even mercury freezes, and of which we can form no adequate conception. The long, hairy, and dense garb of the Kamtschatka mammoth, that most powerful of quadrupeds, embalmed in ice, sufficiently proves the nature of such a coat, as enabled him to live in the coldest latitudes ; and which the elephant of tropical birth, with his unprotected hide, could not certainly have endured. In the same way, between the tropics, were the trunks of trees not defended from the downward and burning rays of the sun, by a thick, expanded, and umbrageous foliage, there is reason to think, that their bark would be scorched, and severely injured: While the same vertical rays harmlessly descend on the woolly head of the Negro; who, without that light and natural turban, would, like the defenceless European, often fall a victim to the "stroke of the sun:" *coup de soleil* I will not call it, because the phenomenon is just as well and clearly expressed in our own language.

Note VI. Page 102.

Aristotle, who enjoyed the double honour of being the father of Natural History, as well as of Metaphysics, intimates that nature bestows not, on either animals or vegetables, any thing in vain ; that, while she wisely effects her purposes by the easiest and most direct methods, she withdraws the interposition of the agents, as soon as their office becomes superfluous. This principle is exemplified in no instance better than in trees, and in their uniform possession of properties, which are best adapted to their peculiar circumstances.

Note VII. Page 104.

The great and leading doctrine with the planters of England, respecting the Removal of Trees, seems to be, that "old trees and young possess similar properties ; therefore, they should be removed on similar principles ;" which principles, as they sanction the unnecessary retrenchment of both the tops and roots of young plants, the same retrenchment is applicable to those organs, in plants of any age. This doctrine is not new, as it was known and acted on, more than a century ago. About forty years since, it was revived by Marshall and others, and is now a favourite one with some of the best writers of the present day, from whom I regret being under the necessity of differing. The fact is, that the basis of the proposition, in respect to young plants, being unstable, any superstructure raised upon it must fall to the ground. But were this otherwise, and that it were *right* to mutilate young plants, it would not from thence follow, that old plants should likewise be mutilated; because (as has been explained in the text) plants, like animals, being the *creatures of circumstances*, circumstances in both old and young are *perpetually changing;* therefore *similar properties* never can be possessed by both.

In one of the most scientific, and justly popular works of the present times, "The Encyclopedia of Agriculture," we find the above proposition, respecting old trees, enunciated in the broadest and most unqualified terms; and so clear and undeniable does it appear to the author, that he reduces its application to a sort of arithmetical proportion, and in that condensed form delivers it as an axiom, for the guidance of the young planter, in retrenching the tops, as well as the roots of his large trees.* "As the whole quantity of roots (says he), which the tree had before removal, is to the whole quantity of branches which it now has (i. e. when not mutilated), so is the quantity of roots which it now has (after mutilation), to the quantity of top which it ought to have." In other words, as you have no means of taking up roots, in sufficient number to nourish the branches, and must on that account retrench and mutilate them, so you may even lop and mutilate the branches also, to the limited number, which can be nourished by your roots. Now I should conceive, that the more philosophical way of proceeding would have been, first to ascertain, by facts and experiments, whether it were right and salutary, for the well-being of the tree to lop and lighten the branches at all? And, if it appeared to be proper *not* to lop, but to *preserve* them, then to seek for some method of taking up the roots in such numbers, as were adequate to the sustenance of the branches. This, as appears in the text, is the very object and basis

* Lest there should be any doubt, that the lightening of the tops of the trees is meant to be a complete one, we find, that the two trees, shown attached to the transplanting machines, in the two wood-cuts in the Encyclopedias of Gardening and Agriculture, are effectually lightened, and reduced to nearly the conditon of pollards. See Gard. p. 335 Agricult. p. 454.

of the system recommended in this treatise, which, being the one pointed out by nature herself, must necessarily be the true one.

Let us hear what the sagacious and experienced Miller says, as to the propriety of retrenching the roots and branches of young woody plants, as is recommended by the present method. "First (says he) as to the roots. All the small fibres are to be cut off, as near to the place from whence they are produced as may be, *excepting such trees as are to be replanted immediately after they are taken up*; otherwise, the air will turn all the small roots and fibres black, which if permitted to remain on, when the tree is planted, will grow mouldy and decay. * *

"After having displaced the proper branches, you should also cut off all such parts of branches, as have by accident been broken or wounded; for these will remain a disagreeable sight, and often occasion disease in the tree. But *you should by no means cut off the main leading shoots, as is by too many practised*; for those are necessary to attract the sap from the root, and thereby promote the growth of the tree: for, from several experiments which I made in the winter of 1729, by cutting off the branches of several sorts of trees, and putting them into phials filled with water, whose tops were closely covered, to prevent the evaporating of the water, I found that those shoots, whose leading buds were *preserved*, did attract the moisture in much greater quantity, than those shoots, whose tops were cut off. * *

"But being willing to try this experiment again, in the month of October, 1733, I made choice of two standard almond trees, of equal strength and age. These I took up as carefully as possible; and having prepared their roots, as before directed, I pruned their heads in the following manner, viz.; from one of them I cut off only the small branches, and such as were bruised or broken, but *preserved all the strong ones entire*: of the other *I shortened all the strong branches, and pruned off the weak and broken shoots, as is the common practice*. These two trees I planted in the same soil, and in the same situation, gave them both equal attendance, and managed them both as nearly alike as possible; yet in the spring, when these trees began to shoot, that *whose branches were entirely preserved, came out early*, continued *to shoot stronger*, and is at present *much larger*, and in *better health* than the other. And, since this, I have made several other experiments of the like nature, which have constantly succeeded in the same manner: from whence it is reasonable to conclude, that *the shortening of the branches is a great injury to all new-planted trees*; but especially to cherries and horse-chestnuts, which are frequently killed by shortening their large branches, when they are removed."—Gardener's and Botanist's Dict. *in voc.* "Planting."

Here, then, is the most satisfactory evidence, deduced from facts, and from the practice of a man of acknowledged science and observation, that it is utterly injurious even to *young trees*, to mutilate their roots or tops, in the way commonly practised . hence we must *a fortiori* admit, that it is *far more injurious* to those of old trees ; and that *the more sedulously both are preserved entire*, the more vigorous will be their development.

In Note II. of the present Section, page 94, &c., Miller, as we have seen, so strongly reprobates the " bad philosophy" (as he terms it), or want of science, displayed by transplanters of large trees in his own time, in lopping and lightening their tops, that it would be superfluous to repeat it here ; but it is particularly deserving of the attention of the reader. I have myself made several experiments, in order to compare the different progress of trees, both young and old, that had their tops lightened, with that of others, in which the tops had been left untouched, and the results have been similar to those experienced by Miller ; only in the latter, the results were more striking, on account of the more advanced age of the trees. But I feel peculiar satisfaction in being able to strengthen my own opinion, by the authority of so eminent a phytologist, whose great work cannot be too frequently recommended to the young planter's notice. It is most particularly valuable, in the edition of the late Professor Martyn of Cambridge : who, besides nearly doubling the whole matter contained in the original work, has added some new and valuable articles, and brought the history of the plants enumerated down to the present times.

Note VIII. Page 106.

If the reasonings in the foregoing part of this Section be well founded, the proposition in question here must necessarily be true, in respect to trees removed from exposed to sheltered situations, as well as its converse ; but probably there is no one who has verified it by experiment.

In 1818, I transferred some beeches, oaks, witch-elms, limes, and sycamores, from an exposed situation, in order to form a close skreen of some size, in conjunction with underwood, which skreen or plantation was accordingly executed. These trees possessed, in a very considerable degree, what has been called in the text the Protecting Properties, so that they might with great advantage have been set out in the open park. In 1826, at the distance of eight years, it was quite visible, that these properties had greatly disappeared, and that the non-protecting were about to be superinduced in their stead. In the spring of the year last mentioned, I removed, to an exposed situation in the park, a few of the oaks and beeches, from the centre of the wood, where the warmth was the greatest, and where they had begun to be drawn up; and I am persuaded, that, in ten or twelve years more, the former properties will return, and be *as fully* developed, as they were in the beginning.

In 1809, I took two fine sycamores, about five-and-twenty feet high, amply provided with the protecting properties, and fitted for situations of the greatest exposure, and removed them into the centre of a close wood. Being well supplied with roots, they were soon established in the ground, and began to push vigorously towards the light. Their stems were speedily elongated; their bark became smoother; their side-branches more slender, and thinner in spray and foliage; and by 1816, that is, after seven years, they could scarcely be recognised as the same plants. Soon after the fall of that season, I once more transferred them to the open field. Here, although they carried a good leaf, they appeared for some time altogether stationary in their progress, as was to be expected. In the absence of the shelter and warmth, which they had so long experienced, they could not at once generate provisions to enable them to resist the cold; but in consonance to that law of nature, by which "plants as well as animals accommodate themselves to the circumstances in which they are placed," they began gradually but slowly to generate them; so that it was only in 1824, that I observed the trees to display any decided symptoms of induration of bark, increase of roots, stoutness of stem, and closeness of ramification, which constitute such provisions; and it is evident, that it will require some years more, to effect a *complete* renovation of their former character.

From this short account, we may perceive, that while trees retain their full vigour, that is, while they continue in a rapidly progressive state, they may be made alternately to assume or lay aside those properties, which best fit them for removal. Moreover we see, that, as vegetation is always greatly more active in shelter than in exposure, the properties just now mentioned, that is, the protecting properties, are *far more slowly* obtained or reassumed, than the non-protecting. From such facts and experiments, therefore, as well as from analogy, we are warranted to conclude, that the doctrine held forth in the text is fully confirmed, namely, that, "by the law of nature, shelter and exposure, that is, heat and cold, have the power alike of diminishing or increasing, of bestowing or taking away, what may be called the protecting properties."

SECTION IV.

Note I. Page 121.

Malpighi was born in 1628. He was a native and physician of Bologna, and professor of medicine in the university of that city. For his discoveries in anatomy he has been justly celebrated, in conjunction with the well-known Borelli, and for having thrown light on the diseases of the liver. He was the first writer who gave to the world a system of the true anatomy of plants, of which one of the most important doctrines is the theory of the circulation of the sap, its ascent in the wood, and its descent in the bark. His work seems to have appeared in 1671. In 1669, he was admitted a Fellow of the Royal Society of London; and he kept up a regular correspondence with several of its members till his death.

Dr. Nehemiah Grew, the father of English phytology, and one of the most eminent physicians of his time, was a contemporary of Malpighi. He published, about the same period, his "Anatomy of Plants," wherein he advanced, on similar principles, the doctrine of the circulation of the sap. The *second* edition bears date London, 1688; so that, as they investigated and wrote in different countries, and without communication with each other, on this obscure subject, so they justly divide the honour of realizing the conjectures of the Greek naturalists. Notwithstanding the importance of later researches, their works are held in high esteem, down to the present period.

Note II. Page 122.

It was extremely natural for phytologists, after the discovery of the circulation of the blood in animals, to extend the analogy to the vegetable kingdom. They had, in the latter, no visible organs, corresponding to the stomach, the intestines, or the lacteals, and above all, to the heart, the mainspring and centre of the circulation of the blood; but these wants were readily supplied. The root was supposed to correspond to both the mouth and the stomach, and to effect such a change on the fluid which it absorbed, as fitted it for the nourishment of the plant. It was supposed also to have the power of propelling the digested fluid, when impregnated with the principles of nutrition, growth, and development, to the summit of the leaf. From thence it was again returned to the root; where, mingling with the newly-digested fluid, it was again propelled to the summit, as before; and in that way a regular circulation was maintained. In this process, these propelling vessels were said to be arteries, and the returning vessels were considered as veins. Such is the theory of the circulation of the sap, held forth by the earlier phytologists; and as it was found to rest on a very slender basis, they did not fail to prop and bolster it up with a multitude of ingenious arguments.

Of late years, the doctrine has been revived, as mentioned in the text, and supported by some of the most distinguished modern phytologists; but it has been improved by patient investigation, and accurate experiment, and cleared of all ill-founded analogy to animal life. Hedwig declared himself to be of opinion, that plants possess a circulation of the fluids, in some sort similar to that of animals. Costi united in the same opinion, and is said to have found it exemplified in the stem of the *chara*, and other plants. Professor Wildenow, in his Principles of Botany, has also introduced the subject, and defended the doctrine, (See Eng. Translation, p. 85.) He confidently asserts, that he believes a circulation to exist; because it would be utterly impossible for the leafless tree to resist the cold, if there were no circulation of the fluids. This, as Mr. Keith observes, "is no argument, and therefore merits no reply;"—yet, we must admit, that it is a *presumption*, of which the force is more easily evaded than invalidated.

It is impossible, in the narrow compass of a Note, to give a detail of Mr. Knight's ingenious and valuable experiments, to account for the conversion of the alburnum into wood; but the reader is referred for them to the Philosophical Transactions for 1805 and 1806. By these experiments he will see, that it is rendered *in the highest degree probable*, if it be not altogether certain, that a circulation of the vegetable fluids actually exists: for, if it once be admitted, that the descending or proper juice forms not only a new epidermis where it is wanted, and a new layer of liber and alburnum, but that it also partly enters into the alburnum of the preceding year, where it mingles, and is again carried up with the ascending sap, it cannot well be denied, that a circulation is completed. That Mr. Keith is *pretty nearly* of this opinion himself, may be gathered from the following concise summary of Mr. Knight's hypothesis, by that acute and ingenious censor.

"Although the doctrine of a circulation (says he), as maintained by Mr. Knight, *should be false*, yet the account which he gives of the progress and agency of the sap, and proper juice, short of circulation, *may be true*. The sum of the account is as follows: When the seed is deposited in the ground, under proper conditions, moisture is absorbed and modified by the cotyledons, and conducted directly to the radicle, which is, by consequence, first developed. But the fluid, which has been thus conducted to the radicle, mingling, no doubt, with the fluid which is now also absorbed from the soil, ascends afterwards to the plumelet, through the medium of the tubes of the alburnum. The plumelet now expands, and gives the due preparation to the ascending sap, returning it also, in its elaborated state, to the tubes of the bark; through which it again descends to the extremity of the root, not only forming in its progress new bark, and new alburnum, but mixing also, as Mr. Knight thinks, with the alburnum of the former year, where such alburnum exists, and so completing the circulation."—Physiolog. Botany, V. II. p. 244. See also, on the same subject, Kieser, Organ. des Plantes, pp. 258, 259, &c.

This note has been extended to an unusual length. But I conceived that it would be interesting to the young planter, to have a brief account of the principal theories, which have been formed of the Circulation of the Sap, and the ultimate conclusion, to which late writers have come, as it is one of the most obscure, though important processes, in the whole of vegetable economy.

Note III. Page 126.

Although trees, as is said in the text, have no organs analogous to the mouths of animals, for receiving their food, yet perhaps it may be said, that animals sometimes take in their food like trees. Men, for example, have been known to become so debilitated by age or disease, that they could receive no food by the ordinary organ of the mouth. The consequence has been that they were immersed in milk and veal-broth baths, and fairly subsisted by means of absorption. Thus, every one of their pores became like leaves, for the introsusception of food. Some few years since, an instance occurred, in a noble duke of sporting notoriety, who was so supported during the last months of his life.

NOTE IV. Page 128.

Opinions quite opposite to these are entertained by Dr. Yule, and also by Sang, who is a nurseryman and a planter of some experience; but they are not borne out by facts. The author of the Encyclopedia of Agriculture entirely agrees in the sentiment expressed in the text, regarding the renovation of the tap-roots in trees.

"The opinion (he observes), that young plants have not the power of renewing their tap-roots, will, we believe, be found inconsistent with fact; and we may appeal to Sang, and other nurserymen, who raise the oak and horsechestnut from the seed. It is customary, when these are sown in drills, to cut off their taproots, without removing the plants, at the end of the second year's growth; and when, at the end of the third and fourth year, they are taken up, they will be found to have acquired other taproots, not indeed so strong as the first would have been, had they remained, but sufficient to *establish the fact of the power of renewal.* We may also refer to the experiments recorded by Forsyth, which at once prove, that trees have the power of renewing their taproots, and the great advantages resulting from cutting down trees, after two or three years planting. Forsyth says, 'that he transplanted a bed of oak plants, cutting the taproots near to some of the side-roots, or fibres springing from them. In the second year after, he headed one half of the plants down, and left the other half to nature. In the first season, those headed down made shoots six feet long, and upwards, and completely covered the head of the old stem, leaving only a faint cicatrix, and produced *new taproots*, upwards of two feet and a half long." —Encyclop. of Agricul. Part III. B. II. p. 572.

The power, which taproots unquestionably possess, of *renewal after being cut*, is a point of considerable interest to the art under discussion, and it is important that it should be ascertained beyond controversy, that the cutting of them under ground does *no material injury to trees;* otherwise it would follow, that all removal is materially injurious.

Before we quit the subject of taproots, it is worthy of notice, that the ingenious Mr. Knight, to whom phytological science is under so many obligations, has suggested the notion that gravitation is the agent employed by nature, to make the germens of plants ascend in the air, and their radicles go down into the earth; and this doctrine he has endeavoured to establish, on the ground of experiment. See Philosoph. Trans. 1806, pp. 100, 101, *et seqq.* But it seems much more reasonable to believe, that the radicles of trees possess energies quite capable of counteracting the influence of gravitation, when needful, and that it does not constitute the sole, or even the principal agent of nature in this business. If gravitation were the sole cause of giving a direction to roots, it might be asked, why roots select the best soil in descending, which they are well known to do? Because, if acted on only by gravitation, they would have no choice but to descend, unless prevented by some obstacle that could not be surmounted. Such an obstacle might indeed stop them, or turn them aside, but it could not make them grow upwards, or ascend a bank, as they are also known to do, in search of food.

As to the taproot of the oak, about which so much has been said, Duhamel asserts its existence, and Mr. Knight denies it: but from my own experience, I am forced to agree with the former writer. I think, that, as stated in the text, a striking resemblance is found to exist between the leading branches of this and several other trees, and their taproots; and that as both, at the mature age of the plants, uniformly lose their preeminent character, so they are not only analogous to, but coexistent with each other. For an examination of Mr. Knight's theory as to gravitation, I refer the curious reader to a paper on that subject, by Mr. Keith, author of Physiological Botany, which is full of learning and ingenuity, and serves, in my opinion, fully to restore taproots to their place in phytology. See Thomson's An. of Philos. Vol. XIII. p. 252.

Note V. Page 131.

As there is no process, in the whole range of arboricultural economy, more important than pruning, it may be worth while to say something on it, in this place. Pruning may be said to embrace the five following objects; first, to advance the growth and bulk of trees; secondly, to reduce or lessen their bulk; thirdly, to modify or alter their form; fourthly, to renew their decayed parts; and fifthly, to cure and eradicate the diseases to which they are subject.

Of these the most important, and, till of late years, certainly the least attended to, is the first; as the ultimate value of the wood in most cases depends upon it, and the actual weight of the timber produced. With all deciduous trees cultivated for profit, the art is to cut off, at an early age, the weak and superfluous lateral shoots, so that the portion of sap, employed in their nourishment, may be thrown into the strong ones; and above all, to direct a proper portion of the ligneous matter of the tree into the main stem or trunk, and thereby generate clean and sound timber. But in effecting that purpose, *much judgment*, and *some* *science* are requisite; because, as branches are just as necessary to the nourishment of the tree as roots (namely, in elaborating by means of their leaves, and carrying down to the stem the descending sap), so, if they be retrenched *to excess*, the nourishment of the tree must be checked; or it may happen, although you succeed in advancing the *bulk* of the wood, that you may very sensibly deteriorate its *quality*, and consequently its *value*.

With a view to establish a proper system of pruning, Mr. William Pontey, an intelligent nurseryman and planter of Huddersfield, in 1806, published a treatise, entitled, "The Forest Pruner, or Timber-Owner's Assistant;" and the simplicity of the system there delineated, not less than its merit, soon contributed to bring it into very general repute. But, if the truth must be spoken, I fear, that it has done more injury, as well as more good to the Woods of Britain, than any other work, that has appeared within a century. Great good it has unquestionably done, wherever the system it recommends has been cautiously modified and controlled by science; and injury as certainly, where the instructions of the author have been literally followed out. The radical error of Pontey lay in this; that having once discovered, by cutting away the side-branches, that the stem was capable of being elongated, and its bulk in certain cases increased, he naturally enough thought, that too many side-branches could not be cut away. But let any one, acquainted with phytological science, or the anatomy of plants, only cast his eye on the frontispiece of that Treatise, which furnishes a specimen of the art of pruning, as approved and practised by the author; and to such a person no more needs be said on the subject. Here he will perceive the delineation of an immense tree, by name "the Woburn Beech," belonging to the Duke of Bedford, and growing at that place; a tree more than *seventy* feet in height, and *pruned up to fifty from the ground*, without a twig or a branch; and yet this great sweeping brush is held forth as an example of *perfect pruning*, and such as is calculated to increase the *value*, as well as the *weight* of the wood! See Forest Pruner, p. 150. *et seqq.*

Now, eminent as all men must acknowledge Pontey to be, in experience as a nurseryman, and a planter, and that he has brought out a work, in which much useful knowledge and practical skill are displayed, yet it is a curious fact, that he seems not to have been much acquainted with vegetable physiology, and the anatomy of plants, and by consequence, with the double current of the sap in trees. Whoever attentively examines his Treatise (and especially from p. 18 to 58, and p. 150, *et seqq.*), will perceive that he believed, that the sap in trees "ascends in the bark;" that the main office of the branches is "to produce and maintain a certain quantity of leaves;" and that the business of the leaves is "to attract the sap upwards!" pp. 155, 156. If such be the *principles of science*, on which this system of pruning is founded, there is little wonder that it should prove erroneous, when applied to practice. What should we think, in the present day, of a scientific agriculturist who was unacquainted with the chemical affinities? or of an astronomer, who assumed as the basis of a new system, that the sun and planets moved round the earth? Yet it is singular, that the ingenious author of the Encyclopedia of gardening (himself a skilful phytologist), is almost the only writer of note, who has ventured to cast a doubt on this rash system of pruning; or to observe the vast difficulty and delicacy that attend so scientific an operation.

"The great importance (says he) of the leaves of trees, must never be lost sight of. In attending to these instructions, their use is not, as Pontey asserts, "to attract the sap," but to elaborate it, when propelled to them, and thus form the extract or food taken in by the plant, into a fluid analogous to blood, and which is returned, so formed by the leaves, into the inner bark and soft wood. *It must be a very nice point, therefore, to determine the quantity of branches or leaves, that should be left on each tree;* and, if no more are left than *what are just necessary*, then, in the case of accidents to them from insects, the progress of the tree will be *doubly retarded*. Experience alone can determine these things. Both Pontey and Sang agree, that "strength is gained as effectually by a few branches to a head, as by many."—Encyclop. of Gardening, p. 582. It is true, Mr. Loudon might not consider his multifarious work as a fit place for controversy: yet no one must know better than himself the utter fallacy of the opinion last mentioned, though propped by the name of another very meritorious nurseryman and planter (Sang); and that it stands contradicted by the experience of our best phytologists, and our best planters, for more than a century back, from Grew and Miller, down to Boutcher, Knight, and Speechly. No good phytologist will doubt, that it is according to sound science, as well as good practice, in woods planted for profit, and in a soil and climate which are *natural* to them, or *below* that standard, to cut away a small proportion of the weaker branches, and turn the current of the descending sap more abundantly into the stems. *Such retrenchment, however, must always be modified, by the actual wants of the trees, and the fair proportion, which the size of the stem bears to the size and number of the boughs.* But to say, that "strength of stem is gained as effectually by a few branches to a head as by many," and that therefore many branches may be taken away, is to say in effect, that strength is not diminished, by diminishing the means of obtaining it; a contradiction in terms, wholly unworthy of any serious refutation.

Perhaps there is no author of the present time, who has written more judiciously on the effects produced on wood by means of culture, of which pruning necessarily forms an important part, than the ingenious author of the Encyclopedia of Gardening: and I feel the more particular satisfaction in appealing to him in this place, as I have above had occasion to differ from him, on another point respecting wood.

"It is remarkable," he observes, "that this subject has never specifically engaged the attention of those, who have written on planting. The effects of culture on other vegetables is so great, as always to change their appearance, and often in a considerable degree to alter their nature. The common culinary vegetables, and cultivated grasses assume so different an appearance in our fields and gardens, from what they do in a state of wild nature, that even a botanist might easily be deceived, in regard to the species. The same general laws operate upon the whole kingdom of vegetables; and thence it is plain, that the effects of culture on trees, though different in degree, must be analogous in their nature. * *

"The general effects of pruning I have already stated to be of a corresponding nature with those of culture, that is, to increase the quantity of timber produce. The particular manner, in which it does this, is by directing the greater part of the sap, which generally spreads itself in side-branches, into the principal stem. This must consequently enlarge that stem, in a more than ordinary degree, by increasing the annual circles of the wood. Now, if the tree be in a worse soil and climate, than those which are natural to it, this will be of some advantage, as the extra increase of timber will still be of a quality *not inferior* to what would take place in its natural state; or, in other words, it will correspond with that degree of quality and quantity of timber, which the nature and species of the tree admit of being produced. If the tree be in its natural state, the annual increase of timber, occasioned by pruning, must necessarily *injure its quality*, in a degree corresponding with the increased quantity. If the tree be in a better climate and soil, than that which is natural to it, and at the same time, the annual increase of wood be promoted by pruning, it is evident, that such wood must be of a very different quality from that produced in its natural state (that is, very inferior).

"Now, though it might be shown in some degree, from vegetable anatomy, and analogy from what takes place in herbaceous vegetables, I prefer deducing from the facts already stated this proposition: that whatever tends to increase the wood in a greater degree than what is natural to the species, when in its natural state, must injure the quality of the timber. Pruning tends to increase this in a considerable degree; and, therefore, it must be a *pernicious practice*, in as far as it is used in these cases.—In this Section, I have not considered pruning in regard to eradicating diseases, preventing injuries, or increasing the natural character and tendency of trees. For those purposes it is of great advantage.

"Mr. Knight has shown in a very striking manner, that timber is produced, or rather, that the alburnum or sapwood is rendered ligneous, by the motion of the tree, during the descent of the true (or proper) sap. It is also sufficiently known to all, who have attended to the physiology of vegetables, and is greatly confirmed by some experiments recently laid before the Royal Society (Philosop. Trans. 1803-1804), that the solid texture of the wood greatly depends upon the quantity of sap which must necessarily descend, and also on the *slowness* of its descent. Now, both these requisites are materially increased by side-branches, which retain a large quantity of sap, and by their junction with the stem occasion a contraction, and twisted direction of the vessels, which obstructs the progress of the (proper) juice. That this is true in fact, is well known to those, accustomed to make wine from maple or birch-trees: for in this business it is found, that those trees, which have fewest side-branches, bleed more freely than the others, but during a much shorter space of time. These hints, therefore, afford additional evidence against pruning, and particularly against pruning fir-trees; which, as Mr. Knight justly observes, have larger vessels than the others; and therefore, when in an improved soil and climate, side-branches for the purposes above mentioned are essentially necessary to them, if solid, resinous, and durable timber be the object in view.

"From the foregoing remarks, I think the following conclusions may be drawn, respecting the management of trees.

"First; That trees should be planted as much as possible in soils, situations, and climates, *analogous to those of their natural state;* and that it is chiefly in this state, or where there are some defects relative to it, that pruning and culture can be exercised with advantage.

"Secondly; That in proportion to the superiority of the soil, &c. in which trees are placed, over the natural soil of those trees; in the same proportion pruning ought to be *avoided*, and thinning encouraged.

"Thirdly; That particular regard should be had to the soil and situation, where either larches, or any other of the pine tribe are planted, to remain as the final crop: for, as the roots of these chiefly run along the surface, and as in them the great current of the sap is chiefly confined to one channel, that is, the trunk, consequently, that tribe of trees is peculiarly liable to injury and change, when subjected to unnatural agency."—Improv. Count. Res. Vol. II. B. I. 8.

Nothing can be more ingenious than these speculations, or more physiologically just; and I rejoice to see, that the practice of the best planters is improving, with the advancement of science.

The practice of pruning, in respect to the objects to which it is applied, naturally divides itself into two parts, namely, the pruning of trees for ornament, and for profit. In pruning for ornament, as in park-wood, the less the knife is employed the better, except it be to keep the tops properly balanced, or to displace some luxuriant shoot, that appears to rival the main or leading stem. In close plantations, consisting of grove and underwood intermixed (supposing them to have been executed at proper distances), the only object should be, to preserve the spiral shape of the former, and the subordinate character of the latter, by timely retrenchment. If that be not effected, nature is prevented from generating such provisions, as are indispensable to preserve the vigour of both. In both of the above cases, the system of "cutting in," or what I shall venture to call TERMINAL PRUNING, will be found most consistent with science, and with successful practice.

In pruning woods for profit, the task is more complicated, and consequently more difficult, and the obtaining, as Pontey insists on, "the greatest weight of wood," is a material object, provided it be wood of *good quality*, which, according to his system, cannot always be produced. But experience has shown how miserably the means of attaining this object has been mistaken in Scotland, and *still more in England*, within the last twenty years. To call the lopping and hacking method a SCOTCH practice (as some late writers have confidently done), is nearly as absurd, as to call the "General method of Planting Waste Lands," as practised in every part of Europe, where the art of planting is known and cultivated, the "SCOTCH METHOD;" and it shows an extraordinary unacquaintance with the *history* of that art. Poor Scotland, indeed, labours diligently to follow John Bull in all his follies, as well as his improvements; but it seems hard to make her responsible for practices, which, whether good or bad, she unquestionably has derived from her neighbours of the south. It is a certain fact, that it is little more than a century since the arts of planting and gardening were generally cultivated in Scotland, and that they were, and are *now* cultivated, solely after the *English* methods: and it is as certain, that previously to the publication of Pontey's treatise on pruning, which came out in 1806, the barbarous method of lopping trees, with a view to their *improvement*, was nearly unknown north of the Tweed.

If planters could only be persuaded, that, by means of lopping and pruning, *they will not accelerate the growth of trees*, it would be a great point gained; and that if woods *be left to nature*, they will advance even more rapidly, than where the lopping system is adopted. The fact is, that no boughs should ever be removed, larger than what the growth of the bark will in two, or perhaps three years, fairly cover; and even with such a precaution, the evil of knotty and unsound wood (which invariably attends the lopping method) will not altogether be remedied. If we inquire how nature, in woods of her own sowing, raises *the cleanest and soundest timber of every species*, we shall find, that it is by displacing, early and gradually, the superfluous lateral branches, and thereby promoting elongation of stem. If we inquire how she produces the toughest and most durable wood, it will be seen, that it is by exposure to a colder atmosphere than that, in which such elongation of stem is generated. Let us, therefore, *prune early, and thin gradually and frequently*, after having first planted much more closely for profitable, than for ornamental purposes. Yet there is a closeness of collocation, if I may so speak, in natural woods, that is, in woods raised fortuitously from the seed, which the planter, for obvious reasons, will not venture to imitate.

With these objects in view, it is pleasing to observe, that the judicious system of "cutting in" is now adopted by many pruners of acknowledged reputation. This consists, when we displace side-branches, in cutting away at first a third part, or more, at the extremity, and retaining two-thirds, or even less; but we must defer the removal of the entire bough till the following, or even another season. Thus it is found, on the simplest principles of vegetable physiology, that the power of increasing in size, which the bough possessed, will by this process be sensibly diminished; so that, after a year or two, it may be entirely removed, *with the least possible risk of injury to the quality of the wood.* In the same way, if a terminal bud be removed, whether by intention or accident, a similar result will follow, although naturally in a lesser degree. According to this principle, which I have of late years adopted, I can show entire young plantations at this place, which have been very rapidly and successfully pruned, and their progressive vigour wonderfully increased, by the removel of terminal shoots, and terminal buds only, as circumstances required; and the most effectual assistance has thus been given to nature, in the production of sound wood.

Whoever was the author of this system of pruning, which I have ventured to name the TERMINAL, is entitled to great praise; and I am inclined to think, that, if it ever have been known in horticulture, it has not been applied to woods, till of late years, and even now, that it is not commonly so applied. The Encyclopedias of Gardening and Agriculture, in which every thing useful and scientific is generally to be found, but very obscurely allude to such an operation.

There is a meritorious nurseryman in this kingdom, 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 uniform success. He was surprised 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 opinion, 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 numbers 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 arboricultural knowledge, I am of opinion, that a present more acceptable than such a treatise could not be made to the British public.

I request forgiveness of the reader for this long discussion, which has altogether transcended the bounds of a note, and swelled to a sort of disquisition. But, independently of my own observations on the above interesting subject, I was desirous to give as much publicity as possible to Mr. Loudon's ingenious speculations, and to the TERMINAL METHOD OF PRUNING, which promises to be productive of such general utility.

NOTE VI. Page 133.

It gives me great satisfaction to find, that the opinions here held, respecting the character of the ramification on the warmer and the colder sides of trees, are supported by those of a scientific planter, and ingenious observer, the late Lord Meadowbank, whose important discovery of the method of decompounding peat, by means of animal manure, is so well known to the agriculturist. To a pamphlet printed in Edinburgh, in 1815, in which the theory last mentioned, is clearly given, there is annexed a small tract, entitled "Instructions to Foresters," in which he states as follows: "If trees are vexed by the winds of an exposed situation, but not destroyed by them, their lateral shoots towards the exposed point are shortened, and the branches multiplied; and a similar appearance may be expected at the tops of lofty trees, however naturally vigorous, which have reached an unsheltered situation, where the winds sweep along the upper surface of the forest, without interruption. These winds must prove unfavourable to the quiet deposition of prepared sap, on which growth must in some degree depend; but, of course, the surplus sap will be employed by the plastic powers of most trees, in multiplying buds and branches, which, however, must be comparatively short, and crowded together. And according to the wise economy of nature, as very often happens, there is great reason to think, that the thick clothing of leaves and branches thus provided for the tops of trees, and for their exposed sides, is of great importance to their health and preservation." p. 56.

Note VII. Page 138.

I have now practised this method for so many years, that it comes to be pretty generally known, in different districts of the kingdom. In Perthshire, Forfarshire, Berwickshire especially, I have found it quite prevalent, chiefly through the communications of my worthy friend Mr. Thomas White, the celebrated landscape-gardener, and his father of the same name; and in other districts, as I am informed, it is familiar to planters, who are utterly ignorant of the source from whence it originated. On inquiring lately of a Perthshire gentleman, what benefit he promised himself, from the practice of reversing the position of his trees, on removal? He candidly replied, "that he knew no benefit at all, that could be derived from it: but understanding that it was the *fashion of the day*, he followed it implicitly, as he followed other fashions, without thinking it necessary to inquire about the matter." Now this gentleman is a person of large property, and an extensive planter; which sufficiently shows *the state of our general intelligence on the subject of wood*, and how important it is, if fashion *must* regulate the business, that the fashion should be founded on some principles of science.

Some little time since, I was applied to for advice, by a gentleman, whose place lies on the west coast, and whose park descends in a gradual slope, to the margin of the Atlantic. In this situation, his trees are severely exposed to the western and south-western gales, which though mitigated in some sort by the skreen of Ireland, occasion his single and detached trees to lean in a remarkable manner to the east and north-east, and become objects of deformity, rather than beauty. This, he said, was the case with the whole of them, that had not been thinned out from old grove-wood, and which for a considerable time had had the benefit of shelter.

I advised him, in all prominent or favourite situations, in the vicinity of the mansion-house, of approaches, or the like (where the trees were otherwise of fine figure, and of no very great size, that is, not exceeding from six to eight feet in girth), to loosen them in the ground, as if for removal, according to the method practised here ; raising the ball or mass of earth round the stem, and with it the turf unbroken, nine feet out from the stem at the least ; and endeavouring beyond that distance, for seven or eight feet more (according to circumstances), to preserve the whole of the roots, if possible, and especially the minute fibres entire, in extricating them from the ground. In this way, in good rooting-ground, he would have roots sixteen or seventeen feet long of a side. As soon as the tree was pulled down, and that the depth or thickness of the mass, or ball of earth could be ascertained, I further advised, that the bottom of it should be worked as flat as possible, even should some downward or perpendicular shoots suffer in the operation ; when, if there were the slightest declivity in the ground (as generally happens towards the exposed side), the ball or mass might be *wheeled round on its bottom the entire circle*, and thus the position of the branches be completely reversed.

During this process, it is to be observed, that the most favourable opportunity would be afforded, supposing the land to be of a shallow description, to extend the pabulum of the tree, by the introduction of fresh mould, and suitable compost, during the replanting. No lightening or mutilating of the top or lateral branches would here be necessary ; because the person directing the work would necessarily take care to ascertain, before its commencement, the proper extent of the excavation, and the due length of the roots and fibres, so as to *proportion the roots to the wants of the top.* Were this process conducted with tolerable judgment, and according to the directions given in the present Treatise, I ventured to promise the owner, and I think not rashly, that with expert workmen, and at the expense of from 15s. to 20s. per tree, he might substitute a very handsome, for a very unsightly object. In a few years likewise, it would happen, that the tree would be beautifully balanced, by *an extension of its branches on the deficient side*, now turned to leeward, without any loss of the powers of development, in either its branches, or its roots.

I think it worth while to state the above, as being in a great measure a remedy for that, for which no remedy seems as yet to have been discovered, and which is an evil of considerable magnitude, to persons so circumstanced. 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 exposure is not excessive, and the two angles formed by trees with the ground, on the sheltered and the windward sides, are not *extremely* different, judicious pruning may certainly cure every deformity of top. But in any case, much will depend on the judgment displayed in the execution.

Note VIII. Page 136.

The notion that trees, whether young or old, suffer greatly on removal, if not replanted in the same exposure, and also in the same position according to the points of the compass, in which they previously stood, appears to be a prejudice of great antiquity. Theophrastus, the only writer in ancient times deserving the name of a phytologist, gravely states the opinion, and gives his reasons for entertaining it, namely, the power which habit exerts over all plants, and their inability to resist the elements. In all this he is accurately copied by the Geoponic writers, as may be seen by the quotation from Anatolius (Sect. II. Note VII. *anteh.*), also by Cato, Columella, Palladius, and others. The mode prescribed by the whole of them, is to mark the trees, before being taken up, with white, or other colours, so that the sides, which faced the north or south, &c., may be regularly turned again to the same quarters. Pliny, though usually not slow in retailing the fables or the prejudices of others, is the only ancient writer, who treats the doctrine with indifference or contempt (See Hist. Nat. L. XVII. 2.). Virgil, like those who went before him, describes the same process of marking the south and north sides of trees, but he describes it like a poet;

Quin etiam cœli regionem in cortice signant;
Ut quo quæque modo steterit, quâ parte calores
Austrinos tulerit, quæ terga obverterit axi,
Restituant: adeô in teneris consuescere multûm est.
Georg. L. II. 269

It is not to be supposed, that, among the phytologists of the 17th century, there would be any dissenting voices against such ancient authorities. Wise, Austen, Cooke, and all our other early arboriculturists advocate the same system. Even the father of English planting, the respectable Evelyn, who united practice to theory, is so convinced of its soundness, that he is regularly angry with Pliny, for treating it with contempt. "The southern parts of trees (he says) being on a sudden turned to the north, does starve and destroy more trees, how careful soever men may have been in ordering their roots, and preparing the ground, than any other accident whatsoever, neglect of staking (i. e. propping), and defending from cattle excepted****. Which monition, though Pliny and some others think good to neglect, or esteem indifferent, I can confirm from frequent losses of my own, and particular trials, having sometimes *transplanted great trees at midsummer* with success, and miscarried in others, where the circumstance of aspect only was omitted."—Silva, Vol. I. pp. 98, 99. But it may be observed, that unless these great trees were fir-trees, or other evergreens, this worthy man should have reflected, that the extraordinary season he selected for the work (a season which, on other occasions, he himself is far from recommending), suggested good ground for miscarriage, without having recourse to imaginary causes.

There is no writer, ancient or modern, who ever had more science, and more practical skill united, than Miller, in the cultivation of wood, and he distinctly states, that from repeated trials, "he could not observe the least difference in the growth of those trees, which were so placed (that is, as they had previously stood), and others which had been reversed." See Gardener's and Botanist's Dict. *in voc.* "Planting." A few of the later phytologists support the same opinion, in which long experience obliges me to coincide; although I am surprised to observe, that modern writers of some name are not wanting, to perpetuate the prejudice.

Note IX. Page 136.

Although I have never, in my own practice, made an exception to this rule, yet were I to make any, it would be respecting the small terminal shoots of trees, which certainly might be retrenched without injury, and perhaps with advantage. In a communication with which I was honoured, from the illustrious President of the Horticultural Society of London, Mr. Knight, after approving generally of my theory as to the preservative principle, he has the following valuable remarks.

"I have only one suggestion to offer, for your consideration. All trees have, I think, after they arrive at the age of puberty, generally more slender shoots at the extremities of the branches (which slender shoots are intended to bear blossoms), than are beneficial to the tree itself: and if the number of these were reduced in the transplanted tree, it would still expose as much foliage to the light, as if many more such slender shoots remained, while the expenditure of sap in forming *shaded*, and therefore *useless* foliage, would be saved. I have transplanted fruit-trees of different kinds of a large size, without shortening their large branches, and I have always found much advantage, in diminishing considerably the number of their slender terminal shoots."

SECTION V.

Note I. Page 152.

The important principle here touched upon is not so fully illustrated as it might have been. If the reader have attentively considered, first, the principles promulgated, and next their development and application in the selection of subjects, the conclusions which he should arrive at will necessarily follow. In the words of the text, "he may rest assured, in this case, that his success or miscarriage will be in the precise ratio, in which his subjects may have obtained the Protecting Properties. If fully obtained, the progress of the trees will be visible from the beginning; but if imperfectly, their progress will be retarded, until the deficiency be made up." Yet, as the errors most commonly committed by planters, and the ill success that attends them, usually result from an improper selection of subjects, I shall say a few words upon it here, by way of practical commentary.

Nineteen times in twenty, or, much more probably, ninety-nine times in a hundred, planters, who remove large trees, select their subjects injudiciously. Perhaps, more correctly speaking, *they make no selecttion at all*, according to any preconceived principle, or rule of choice. Supposing a man carefully to take up and plant a tree so selected, which has tolerable roots, it necessarily follows, that it must have tolerable branches. But it may happen, from the circumstances in which it has been placed, that it is deficient in stoutness of stem, and, what is still worse, it may have no proper thickness and induration of bark, to protect the sap-vessels. We shall further suppose, that he has only cursorily perused the foregoing pages; and without altogether denying the correctness of the principles laid down (because no man, attentively viewing natural causes and effects, can deny them), he considers this as a pretty fair experiment of the efficacy of the Preservative system.

What, then, happens? The roots being not extensive, and the stem slender, it is soon discovered, that without propping, the tree cannot stand. This is thought very strange, indeed, in the new system, which professes to discard all such unsightly appliances. We will next suppose, that the props are applied with due diligence and success for two or three years; and meanwhile, that the roots and fibres, being comparatively undisturbed, extend under ground for five or six years more. As to the branches, few or none having decayed in the beginning, the tree, by the second year, has probably carried a good leaf, but has made no shoots of any sort.

Now this tree, as it is not in possession of all the protecting properties, can develop those which it possesses, only in an inferior degree; therefore, "its progress must be retarded (as the text has it), until the deficiency be made up." If it chance to be in a situation relatively sheltered, and in a favourable soil, it will, after five or six years more in this climate, begin to obtain the proper stoutness of stem, and thickness of bark, which it should have had in the beginning: but if the exposure be great, whatever be the soil, ten or twelve years still may elapse, ere "the deficiency be made up." Thus, in the last mentioned case (which is by far the more common of the two), after about eighteen or twenty years, the tree, having struggled under the unnatural circumstances of cold and exposure, to generate provisions, which warmth and shelter, in the previous plantation, or transplanting nursery, would have speedily conferred on it, at length surmounts the evils incident to injudicious selection, and begins to shoot forth with proper vigour.—Such at least is its progress in the climate of Scotland.

This is no exaggerated picture, but a plain statement of facts, such as always occur, when the laws of nature are disregarded, and the development of the properties she confers are checked in their progress. The above illustration of the doctrine set forth in the text, that "we must wait till the deficiency be made up," is given on the supposition, that the tree has tolerable roots and branches, but is without the other prerequisites. But, on a supposition that the tree possessed the *other* protecting properties, and that roots or branches were deficient, there would be a corresponding result; and no vigorous progress could in the same way be expected from the plant, until the deficiency was made up, in like manner.

SECTION VI.

Note I. Page 160.

According to Bergman, the soil best adapted to culture consists of 4-10ths of clay, 3-10ths sand, 2-10ths calcareous earth, and 1-10th magnesia. Fourcroy and Hassenfratz found 9216 parts of fertile soil to contain 305 parts of carbon, together with 279 parts of oil; of which, according to the calculations of Lavoisier, 220 parts may be considered as carbon; so that the whole of the carbon contained in the oil may be estimated at nearly 525 parts, not reckoning the roots of vegetables, or about 1-16th part of its weight. Young, a scientific agriculturist, observed, that equal weights of different soils, when dried and reduced to powder yielded by distillation quantities of air, in some measure corresponding with the ratio of their values. The air was a mixture of fixed and inflammable air, proceeding probably from the decomposition of the water, but partly also, as may be supposed, from its power of abstracting a quantity of air from the atmosphere, which the soil is likewise capable of doing.

One of the most favourable soils in England, for the production of fine wood, is said to be Sheffield-place, the seat of Lord Sheffield. "What is most remarkable (as Pontey observes) is, that the oak and the larch flourish equally upon it; though it would seem too light for the former, and too stiff for the latter."—*Profitable Planter*, p. 106. In order to ascertain the constituent parts of a soil so celebrated for the production of timber, Sir Humphrey Davy submitted one hundred parts of the entire soil to analysis, of which the following was the result:

Water	3
Silex	54
Alumine	28
Carbonate of Lime	3
Oxide of Iron	5
Decomposing Vegetable matter	4
Loss	3
	100 parts.

This, no doubt, is a very favourable state of component parts; although we might have expected a greater proportion of decomposing vegetable matter, and perhaps of carbonate of lime. Considerable depth may be supposed to exist above the substratum, which it is surprising that Pontey should have omitted to mention. In as far as the growth of timber is concerned, any account may be considered as very imperfect, without a specification of it.

Note II. Page 161.

The ancients, although they knew little of the history and properties, and still less of the anatomy and internal structure of plants, were yet sufficiently conversant with arboriculture, as an art of practice, and particularly, they removed large trees with as great success, as any of our planters of the present day. Accordingly we find, that many of the best rules and maxims, in our books on planting, are taken from their writings. A more judicious one there cannot be, than that here mentioned in the text, namely, always to give to a transplanted tree a soil better than what it had before removal. Columella says, "prudentis coloni est, ex deteriori terrâ potiùs in meliorem, quàm ex meliore in deteriorem, transferre."—*De Re Rust.* L. III. 5. Pliny delivers the same maxim, but seems to consider similarity of soil as more important to be studied, even than superiority, for the new site; in which, however, he is not borne out by experience. "Ante omnia, in similem transferri terram, aut meliorem oportet: nec è tepidis aut præcocibus, in frigidos aut serotinos situs, ut neque ex his in illos."—*Hist. Natur.* L. XVII. 11.

Note III. Page 169.

Were I called upon to name the person, to whom the farmer, in most districts of Scotland, and in many of England, is under the greatest obligations, I should certainly name the late Lord Meadowbank. The arboriculturist in both countries must also rank him among his best benefactors. In ancient times, such a person might very possibly have been deified; at all events, a statue would have been erected to the memory of the man, who instructed his countrymen in the art of at once *doubling and tripling the whole mass of their farm manure*, by a very simple and certain process. In modern days, likewise, we erect statues, but it is not for achievements of this useful species.

It is now more than twenty years since Lord Meadowbank communicated his discovery to the public, in a small pamphlet, entitled, "Directions for preparing Manure from Peat;" but I do not know whether much improvement has since been made, in the art of fermenting that substance. The general complaint is, that it is nearly incapable of being decomposed, by the small quantity of animal manure, which Lord Meadowbank prescribes, that is, a third or fourth part; and indeed, that it cannot be decomposed at all, or reduced to the state of *a fine dark-coloured mould*, in which neither peat nor dung is discernible.

Having paid as much attention as most persons to this process, for several years back, for both arboricultural and agricultural purposes, I am satisfied, that the want of success, so generally experienced, is owing to two causes chiefly; first, the too moist condition of the peat, when it is made up; and secondly, the exhausted state of the dung employed in the fermentation; both of which, as stated in the text, prevent the antiseptic quality of the moss from being counteracted, and the peat from being rendered soluble.

As to the first point, the moist state of the peat, it seems clear, as Lord Meadowbank has observed, that, although no active fermentation can take place without moisture, yet *moisture may superabound*; and therefore, it is necessary to wheel out the peat some weeks beforehand from the pit, in order that the superfluity may be expelled, by exposure to the atmosphere. In this state, however, I have seldom found, that I could, by even thrice fermenting the mass, effectually decompose the peat, and thereby reduce it to a friable mould. In order to remedy this, I have successfully practised the following method of procuring peat-moss of superior quality; which, as it has succeeded with myself, I shall shortly communicate, in the hope that it may prove of the same use to others.

Whoever has the command of this valuable substance, must be aware, that, when dug out for fuel, it is done in sections or banks, from four to six feet deep; where, after throwing back the upper strata, on the spread-field (as it is called), the peat is set out to dry. These masses of the superincumbent strata, after some years' work, naturally extend, and soon cover the field to a considerable depth. They accumulate here and there in irregular mounds; and being exposed to the elements, and particularly to frost, they gradually advance in decomposition, and assume the appearance of a black mould, sometimes of a foot and eighteen inches deep. In this desirable state it is to be carted away, and thrown up in heaps, for the purpose of fermentation; a process, which it is thus prepared *to undergo at once*, and with the one-half of the difficulty that attends the pure peat, as prescribed by Lord Meadowbank.

Besides this improvement, a great saving is made in dung and labour;

the one-half of the dung only being required to excite fermentation, and less than the one-half of the labour to turn the heaps. If the fuel be cut down to the clay in a regular manner, as should always be done; or if the spread-field in summer can be turned up with the plough, a considerable improvement may be made, in procuring a greater mass of materials, and also in exposing a larger surface to the action of the atmosphere, and preparing it for future use. With such materials I have found, that fermented moss-compost may not only be prepared more perfectly, than by the former method, but *at nearly one-half of the expense.*

In respect to the second point, the exhausted state of the dung, before being applied. There is nothing more common, than to take dung for this sort of compost, from the great mass, accumulated for months in the farm-yard, and never stirred, excepting for the spring or fallow crops. But for this purpose, dung, supposing it to be the joint produce of horses and cattle equally, should be regularly carried out, and applied to the compost-heaps, once a fortnight or three weeks, at the least. Thus, it will be applied, before much disposition to fermentation comes on; after which, it is plain, that all animal manure becomes nearly effete, and loses the greater part of its value. In order that the fresh manure may be applied with the greatest effect, sufficient masses or heaps of peat-moss must always be in readiness; and should it happen to be late in the season, that is, after the month of October, it will be necessary to cover them as soon as mixed up, with straw, rushes, shows, or such other substance, as will prevent the escape of the heat. Were a farmer or planter, who has the command of peat-moss at a reasonable distance, diligently to proceed in this manner, it is no exaggeration to say, that he would annually double, or more probably triple the amount of his disposable manure.

The preparing of moss-compost with lime in a proper manner, so as *really* to decompose the peat, and *preserve the qualities of the lime*, is a process which is not generally understood. The common way is to mix, in nearly equal portions, lime newly calcined (*Scot.* lime-shells), and peat-moss; by which means, heat being disengaged, in far too great proportion, and the lime suddenly slacked by the moisture of the moss, the heat becomes so violent as to reduce the peat to charcoal; to dissipate in a gaseous state all its component parts, excepting only the ashes, part of the carbonaceous matter, and the fixed air absorbed by the lime. Thus, the lime is rendered nearly powerless, as mentioned in the text, and brought back to the state of mere chalk, instead of forming such a combination with the peat, and the gas generated in the process, as, on being applied to the soil, will promote the growth of plants.

The late ingenious Lord Dundonald, our earliest writer on agricultural chemistry, was the first person who taught the method of preparing this valuable compost, both cheaply and scientifically, in his useful work on "The Connexion of Chemistry with Agriculture." From his residence at one time, in the higher districts of Lanarkshire, where peat-moss abounds, he had a better opportunity, than most of our chemists, of attending to its effects. I shall therefore give his directions, which are taken from real practice, in his own words. Lime-compost, he observes, is prepared, "by mixing newly made, and completely slacked lime, with about five or six times its weight of peat, which should be moderately humid, and not in too dry a state. In this case, the heat generated will be moderate, and never sufficient to convert the peat into carbonaceous matter, or to throw off, in a state of fixable air, the acids therein contained. The gases thus generated will be inflammable and phlogisticated air, forming volatile alkali, which will combine, as it is formed, with the oxygenated part of the peat, that remains unacted on by the lime, applied for this especial purpose, in a small proportion. By this mode of conducting the process, a soluble saline matter will be procured, consisting of phosphat and oxalat of ammoniac, whose beneficial effects on vegetation are already well known to the argriculturist."—Pp. 109, 110.

It appears, from what has been said above, that an ignorance of the true nature of these ingredients, has probably disappointed the farmer, not less than the planter, in the application of this excellent compound; which I can particularly recommend, either for a top-dressing for grass grounds, or a valuable compost for the roots of trees. The proportion of the lime to the peat-moss here given should be carefully observed: and it would be a great improvement, in order to insure its full effect, were the preparation to be made *under cover*, in a shed or outhouse dedicated to the purpose; because a superabundance of rain, or too great an exposure to the air, will prevent a due action of the lime upon the peat. As is truly remarked by the ingenious nobleman above referred to, the success of most operations, but more especially those of a chemical nature, greatly depends on a sedulous observance of circumstances seemingly trivial; and it is by the neglect of these, that the most important objects dependent on them are generally defeated.

I believe, there are many gentlemen good planters, but ardent agriculturists, who, in perusing this essay, and perceiving what science might accomplish, towards the improvement of their parks by means of the transplanting machine, might yet be deterred from a due preparation of the soil, by the seeming quantity of manure that is prescribed for it. But here is a noble, and valuable compound, adapted to all soils and climates, and which may be applied at a very small expense, without encroaching on the stercoraceous collections of their farm-yards. There are comparatively few situations in this kingdom, in which peat moss of tolerable quality is unattainable on account of distance ;* and it is fortunate that it is so ; because *we know no given substance that could supply its place.* In many districts (as is seen in the present section), it costs, when made up with lime, according to the above mentioned method, not more than 6d. per cart-load ; and there are others, in which it may be had at a still smaller cost. But much depends on the skill and attention that are bestowed on making it up.

Note IV. Page 192.

I conceive that I have made a considerable improvement on the ordinary method of trenching or double-digging of ground, whether for horticultural or arboricultural purposes. Common gardeners' trenching is often a mere turning up and turning down of the soil, in regular strata, without effecting any pulverization, or comminution of the parts ; and although it deepens, it generally does nothing more, especially when the trenching is done on grass-grounds. The method which I have practised with great effect, for twenty years, I can much recommend to others.

In trenching eighteen inches deep (and any thing less is of little use), instead of keeping the bottom of the trench eighteen inches wide, or, as it is generally done, only a foot, I would have it kept *two feet wide ;* and, instead of executing the two spits deep successively, with a regular shoveling after each, I would have *three spits executed, without any shoveling*, but with a good Scotch spade (as it is called), of which the mouth is at least ten inches in length. The solid side of the trench is, of course, cut perpendicularly ; but the loose side, or face of the work, should be kept at a slope of not less than an angle of fifty or sixty degrees, in such a way, as that in throwing on the contents, the surface

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* "In two-thirds of all the land in Scotland (says an intelligent writer), moss sufficient for making compost, may be found within a mile. Unless it be in some parts of the counties of Edinburgh and Haddington, there is scarce one farm in Scotland, south of the Forth, but can have moss within five miles; and not one farm in a thousand, but may find it within three miles."—*Aiton's Treatise on Moss-Earth.*—p. 174

mould may crumble down, and in some sort mix with the entire mass excavated. When I thought of this method twenty years ago, the workmen objected to the execution of three spits deep, at the same *price* per fall (*Anglicè* pole), as had been paid for two spits. But, on persuading them to try, they discovered, that instead of being more, it was *less* laborious than the two spits, with the two shovelings ; and thus, after a little practice, I was enabled to add another inch, and sometimes two, to the depth of the work, for the same expense, and likewise to obtain a far greater comminution of the parts. Since that time, we never trench according to any other method here ; and the benefit resulting from it has induced others to adopt the practice. In the Encyclopedia of Gardening (§ 236.), there is an excellent style of trenching described, for mixing soils, but on too extensive a scale for any thing but horticultural purposes of the most expensive sort.

The trenching or deepening of ground is a practice of first-rate importance in arboriculture, whether to trees during infancy, in the nursery-ground, or after they have obtained a more advanced age. In the present section, the benefit attending it has been so particularly insisted on, that no more could be necessary to be said upon the subject in this place, had not the public attention been particularly turned to it by a late writer, Mr. William Withers, junior, of Holt, Norfolk.

This gentleman has lately published two pamphlets on the practice in question, the object of which is to show, that by trenching the ground previously to planting, and then keeping it clean for some years afterwards, greater progress will be made by wood of every sort, and consequently a greater return to the planter, in ten or twelve years, than in five-and twenty and thirty, by the common method. The system is not new, having been well known in England for more than two centuries : yet the author, in the first pamphlet, makes out his statements in a manner so clear and satisfactory, as to excite considerable interest ; and as ingenious experiment is his forte, and not scientific inquiry, he corroborates the whole by an animated and confident appeal to his own practice. By all impartial persons, who are acquainted with the subject, the account given by Mr. Withers of his operations will be admitted to be extremely candid ; and I agree with Mr. Cobbett (See *Reg.* Nov. 1825), that it is "neat, plain, unassuming, and full of interest."

The fact is, that the practice of trenching and manuring land for plantations (as may be seen in Section VII. of the present work), had considerably attracted my own attention, about forty years ago. I have since made many comparative and pretty extensive trials of the deepening and the common method, which led to the same results as those stated by Mr. Withers; and, had not that gentleman brought forth his first pamphlet when he did, I probably should, ere now, have drawn up a similar tract myself, for the purpose of illustrating, to a certain extent, a similar practice.*

The principle of deepening and pulverizing soils, to forward the growth of trees, is, as already said, far from being new. It is a mode of culture, which was well known to the ancients. It was fully recognised and acted on in the days of Evelyn and Cooke; and it has, since their time, been familiar to every well-instructed gardener and nurseryman in the United Kingdoms, down to the present period. The main use, therefore, of Mr. Withers's pamphlet, is to show its superior advantages, and give a more extensive application. Why it has so seldom been applied by land-owners beyond the kitchen garden and the shrubbery seems very surprising, since the slightest trial is sufficient to convince any gentleman, that plantations made on any land susceptible of culture, may in this way certainly be more speedily raised, and probably more cheaply, than by any other method. The scientific principles on which the process should be conducted, and my anxiety to impress them on the minds of planters, are sufficiently shown in the present Section and Notes, whether for arboricultural or agricultural purposes, to which Mr. Withers's able pamphlet may serve as a practical commentary. The most material point, on which he has gone wrong, is the application of fresh-made dung or "muck" to the roots of woody plants, which, on considering what I have stated, he will readily perceive to be both phytologically and chemically erroneous; and that the intervention of a green-crop, while it constitutes a superior practice, creates a vast saving of expense in executing the work. See Section VI. of my Treatise (Second Edition) p. 190–200; also p. 202–204, *et seqq*.

For all plantations in parks and pleasure-grounds, and even in many that are intended solely for profit, I highly approve of previous trenching and manuring, and keeping the ground clean with the hoe, but by no

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* If Mr. Withers will take the trouble to peruse the next Note, namely, No V., being the last of the present Section, and the text to which it refers, he will see, that I have had some experience in the business of trenching, and that I have long had occasion to apply it to some striking objects of utility, as well as ornament.

means digging it with the spade, for a few years, that is, in situations where the nature of the ground will admit, and where sufficient manure for a green-crop can be procured. Having for many years successfully followed this method myself, I can with the greater confidence recommend it to others. But *from the very nature of the thing*, it is evident that it cannot be adopted for GENERAL PLANTING, or ever come into universal use. All men, however, will admit, that Mr. Withers is entitled to great praise, for so earnestly pressing it on the public attention.

There is one thing, at which I have been rather surprised, in Mr. Withers's pamphlet, and which cannot be passed over without notice, by any person of intelligence, and that is, his denominating the ordinary or pitting method of planting, as *every where* practised, without any previous deepening of the soil, "the SCOTCH system;" and for no other alleged reason that I can discover, on the most attentive perusal of his publication, than that some Scotch contractors had executed about forty acres of plantation for Admiral Windham, according to this method, and that the thing had turned out "a total failure."

It is certainly very candid in Mr. Withers to inform us, that he knows nothing of Scotland or Ireland, and that his observations on wood, and his practice in raising it, are wholly confined to Norfolk. His pamphlet as clearly informs us, that he knows nothing of general planting, or of its history and progress in Britain, and the rest of Europe; and that the anatomy of plants and vegetable physiology have not come within the range of his studies. Now, in these circumstances, it would have been as well, if he had not insisted on it, that the common and well-known style of executing *general* planting, in every country where it is known and cultivated, is peculiarly "the SCOTCH method;" because the English, Irish, French, German, or any other national epithet, would have equally designated the practice. The Germans have about a hundred writers on Woods and Forests (double the number that Varro enumerates in his time), among whom M. Bürgsdorf, Master General of the Forests of Prussia, and M. Hartig, who held the same situation in the principality of Solms, are the most celebrated. The French, in the same way, have nearly thirty authors on this subject, of whom MM. De Perthuis, Baudrillart, and Varenne-Fenille are the latest and best. These, together with our own Evelyn and Cooke, Miller, Pontey, and Speechley, all treat of both the trenching and the pitting method; but not one of them ever made the notable discovery, which has been made by Mr. Withers, that the latter is peculiarly the SCOTCH method. On the contrary, they all mention both systems, as *practised* in their different countries, and practised in each under *different* circumstances, as it is in England.* Had some conceited Scotch gardener, now fattening in that country, committed this "fundamental error" in a public statement, and on the titlepage of a book, we should not have been so much surprised, and attributed it merely to ignorance; but as it is, it certainly must appear very striking, in a person of Mr. Withers's education and intelligence. By a statement so often and so confidently repeated, uninformed readers are led to believe, that, in the arboriculture of Scotland there are some *strange* and *peculiar* modes of executing large designs of wood, quite *different* from those known in England, and which its gardeners (who every where abound) are desirous, from some unintelligible motive, to introduce into the latter country: whereas, the truth is, as I have more than once stated in the present work, that it is to the English alone, that the Scotch are indebted for any knowledge they possess of the useful arts, and of that of planting among others; that they are ambitious to practise, and do practise them, *solely* after the English methods; and, if they ever venture on any improvements of their own (which in this instance has not been the case), that it is with becoming deference to such able instructors. It is therefore to be hoped, that so judicious a writer as Mr. Withers, when he next publishes on the same subject, will correct a statement, which is *unfounded in point of fact*, and besides rather savours of national prejudice; a feeling decidedly illiberal, and altogether out of fashion in the present day.

The very favourable manner, in which Mr. Withers's first pamphlet was received by the public was, of course, very gratifying to the author, and seems to have led him to assert the universal applicability of the trenching method. What was good for Norfolk, he naturally thought, could not well be bad for any other tract of country, whether the Highlands of Perthshire, or Yorkshire, or Connaught; and that whatever system of planting was calculated to produce (as Pontey expresses it), "the *greatest weight* of marketable wood," and to produce it *soonest* and *cheapest*, must necessarily be the best for all possible purposes, whether manufacturing, agricultural, or naval. Fully impressed with

* Mr. De Perthuis is of the opinion usually entertained in England, and also by Sir Walter Scott, that trenching with the spade is too expensive to be practised by the landowner, unless for plantations intended for ornament near the mansion-house *On sent que le défoncement ne peut être fait qu' à bras d'hommes; et comme il occasionne une grande dépense au propriétaire, il ne peut guères employer ce moyen, lorsque ses facultés pécuniaires le lui permettent, que dans les plantations destinées à la décoration de sa maison.*—P 282. The French have likewise an odd way of cultivating plantations, *en rayons*, that is, in narrow strips for the trees, leaving the intervals uncultivated.

this conviction, Mr. Withers undertook to draw up a second pamphlet more extensive than the first, chiefly as it appears, with the view of IMPROVING THE MANAGEMENT OF THE ROYAL FORESTS, AND RAISING SUPERIOR TIMBER FOR THE NAVY.

The object, it will on all hands be admitted, was highly laudable, and, could Mr. Withers have accomplished it, was sufficient to have placed him at the head of the arboriculturists of the present day. Of the method in which he has attempted this (with the best intentions, as I truly believe), there is room only for a very rapid and cursory examination in this place; and as I have been indirectly called upon for an opinion upon his method by his majesty's government, I shall give it candidly, and in the most concise manner I am able.

It is well known to those, who possess the best judgment, and the best opportunities of judging, that there are few departments under government, which are managed with more diligence and ability than that of the "Woods and Forests." The noble lord and First Commissioner, now at the head of that department, are both unremitting in their endeavours to put the affairs of the royal forests on the best footing, and under the superintendence of men of the greatest skill and experience; and the late improvements made, as I understand, are such as entitle them to the highest praise. On comparing these forests with the best-managed woods and plantations belonging to private individuals, it will be found, that the defects in either are far more to be attributed to the general neglect of the art of planting in Britain, and to the want of that useful assistance which might be afforded to it (as I have already observed) by agricultural chemistry, as well as phytological science, than to any other cause. Whether Mr. Withers's pathetic lamentations of the defective management of the royal forests, and "the shame and indignation," which he virtuously feels on that account (p. 27.) proceed from an ignorance of these well-known facts, and an unacquaintance with the manner in which those forests *ought* to be managed; or whether they are put forth *ad captandum*, and for the purpose of catching that "gale of popularity," which every one in a free country is sure to obtain, who makes an attack upon the government, I shall not take it upon me to determine; but from the apparent sincerity and frankness of his whole manner and character, I should far rather attribute them to the former motives.

Not long before the appearance of his second pamphlet, that is, in the end of last year, it so happened, that the greatest writer of the age, Sir Walter Scott (who, to his other multifarious accomplishments, adds considerable experience in the management of woods), drew up an

"Essay on the Planting of Waste Lands." It appeared in the seventy-second number of the Quarterly Review; and I must say, that, as far as I am a judge, it is, independently of its other merits, one of the most powerful, judicious, and useful practical tracts existing in the language. Such is the essay, and such the author, whom, in his second pamphlet, Mr. Withers considers himself as quite able to put down! From the singularly rapid way, in which the great author is known to write, and from the circumstance of his professing no accurate knowledge of phytology, it cannot seem wonderful, that some errors, both in the theory and the practice, should have crept into the essay. But the celebrity of the illustrious person in question, and the fact of his belonging to this side of the Tweed (which gave an additional colour to Mr. Withers's misrepresentation as to the SCOTCH method), added to Sir Walter's speaking rather slightingly of trenching, as a preparatory measure, seem to have induced Mr. Withers to adopt a personal mode of address. The pamphlet, therefore, is thrown into the form of "A Letter to Sir Walter Scott, Bart., exposing certain *Fundamental Errors* in his late Essay on Planting Waste Lands, &c., the great loss and disappointment generally attending the SCOTCH STYLE OF PLANTING;"—*cum multis aliis.*

Respecting the *manner* of this composition I shall say little, as "plain and unassuming" are epithets which *cannot* be applied to it; and I shall say the less from being informed, that the public in general, and the author's friends in particular, loudly condemned the whole style of address adopted; and I entertain no doubt, but that his own good sense will ere long induce him to condemn it himself. Mr. Withers may rest assured, that neither the interests of learning, nor the advancement of science, among a polished nation, ever yet were promoted, by a gratuitous departure from the rules of decorum and urbanity. But the *matter* is an object of far greater magnitude than the manner; and as the former might, by possibility, have some weight with the Commissioners of Woods and Forests, I feel called upon to obviate, in as far as I can, the extensive injury, which the principle contended for might occasion, to the "future navies" of the empire.

The first thing, then, that Mr. Withers does, is, of course, to fasten with eagerness on some of those trivial errors, which, as already said, appear in Sir Walter's powerful specimen of didactic writing, and to magnify them into defects of the most portentous species. This is just the sort of tactic that might have been expected. The next thing is, to fasten as eagerly on Mr. William Billington, a good, plain, and commonplace person, who was, some years since, Surveyor General, under the authority of the Commissioners, for planting the forest of Dean. This worthy person is then completely shown up. His ignorance, his arrogance, his weakness, his self-delusion, are all depicted in glowing colours; and certain statements in his book,* which, to say truth, are neither the most able, nor the most luminous, are very adroitly turned against himself. In fact, they are made to prove, that by means of trenching, he might have executed the work much cheaper, than by what is pertinaciously called "the SCOTCH system," and thus have gone over the entire eleven thousand acres of Dean Forest! Flushed with this supposed advantage, Mr. Withers forthwith returns to the charge against the great author. "Why, Sir Walter (says he), his opinions are more erroneous than yours, which is saying a great deal, and may be some comfort for you to know.****This surely beats every thing that was ever put into print!" At last, he sums up his argument with great eloquence and energy: "If I were to cite all the authorities, urge all the arguments, and state all the facts, which could be brought forward in support of my position, that trees planted on prepared land will grow faster, and come much sooner to maturity than trees planted on 'the SCOTCH SYSTEM,' the present pamphlet would extend to as many volumes as your Life of Napoleon." May I be permitted to observe, with great deference to Mr. Withers, that, indeed, this *does* beat every thing that was ever put into print!

Having proved, to his own satisfaction and that of his friends, that the trenching system of planting is not only better, but also much cheaper than the pitting system (which he still persists in calling "the SCOTCH"), and the only one proper to be adopted by men of sense, the next point to be examined is: Is it a system of *general* application, as alleged by Mr. Withers, and fitted for "the planting of Waste Lands," the object of Sir Walter's able Essay?—As I conceive, it certainly is not. The most judicious critics, and those most conversant with Woods, (such as the Editors of the Gardener's and the British Farmer's Magazines), have fully decided the point, in their reviews of Mr. Withers's pamphlets. All experienced planters will agree with them in thinking, that in wild and mountainous regions, preparation must be *out of the question*; or wherever it would be obstructed by rocks, bogs, inaccessible steeps, or unstable surfaces; all of which regions being nearly useless, might, at

* A series of Facts, Hints, Observations, and Experiments on the different modes of raising Young Plantations of Oak, for Future Navies, &c. &c.—By William Billington, Member of the Caled. Hort. Soc., Superintendent of Planting 11,000 acres of land in the Forest of Dean, &c.—London, 1825.

a moderate expense, and by the pitting method, be made eminently productive in Wood.

But Mr. Withers has a ready answer to this. Instead of an entire mountain or moor, take (says he), a few acres only of the best parts of such districts: if you cultivate them highly, they will cost no more expense, than if you included the whole, and they will pay you sooner for your labour: "PROFIT, *and profit alone*, ought to be the object of the planter." p. 74. "Now (says Mr. Loudon, one of the judicious critics just now alluded to), every planter of general experience will differ on this point with Mr. Withers. What we maintain is, that in Scotland and Ireland, and in many parts of the North of England and Wales, 1000 acres of *wood of any sort* confer more *value* on an extensive territorial surface, than the most thriving plantation of a few acres, however profitable the latter might be, *when taken by itself.* In estimating the value of Mr. Withers's system, therefore, it is necessary to take this view of the subject into consideration; for a plantation may yield *no* profit for many years, and yet add greatly to the value of an estate, by its effects in an ornamental point of view, by its shelter for game, &c. and its ultimately forming a nucleus for raising the more valuable timber-trees." In this sensible opinion I fully concur, after many years experience; and I should certainly prefer, for most purposes, to plant a thousand acres of a moor or a mountain, rather than a few acres only of such a surface, if both could be executed at equal cost. Still I own, that I am extremely partial to the Trenching and Manuring system, (under certain circumstances, provided manure can be found for a previous green-crop,) and I trust, that it will be brought into much more extensive use than heretofore, where a *speedy return of crop, and marketable timber, but* NOTHING FURTHER, are expected.

The most material question, however, between the advocates for the Trenching asd the Pitting systems, remains yet to be examined; by which it will appear, that *profit* is by no means the only rule by which the merits of the former are to be tried. Mr. Withers, having performed so many feats of prowess in this controversy; having beat down the surveyor of eleven thousand acres of woodland, and contumeliously trampled him under foot; having had a tough encounter with one of the most successful planters, and certainly the greatest writer of the age, and, in his own opinion, discomfited *him* also, we cannot think it wonderful, that he should, after such a triumph, feel quite competent to the task of raising (as he says) a crop of oak, "to which we may look forward with some confidence, for future navies."—p. 29. The judicious phytologist, however, will pause, ere he assign, even to such a champion, his laurels, and anxiously inquire, whether the promised timber will be of the BEST QUALITY? For "good marketable wood," which Mr. Withers clearly may raise, and raise speedily, would hardly satisfy his majesty's commissioners of woods and forests, for the important purpose of constructing BRITISH SHIPS OF WAR. Whether high cultivation and manuring should now be introduced over the whole royal forests, because Mr. Withers *in Norfolk* is raising good wood by that method, and has written two successful pamphlets on the subject, is a question of some public interest. I must say, it is a method of obtaining the *most durable* oak-timber, which is certainly new, and is contradicted by all existing facts, as well as all former practice. Those facts, therefore, are deserving of a short consideration, which is all that the limits of the present discussion will admit.

The effects of CULTURE on the whole kingdom of vegetables (as the author of the Encyclopedia of Gardening well observes), are so great, as always to change their appearance, and in a considerable degree to change their nature. Culture, as phytologists admit, has nearly the same tendency towards affecting the growth of plants, as the removing of them to a better climate, by *expanding the parts* of the entire vegetable. To any one at all acquainted with vegetable economy this is well known, and it is remarkable in all culinary vegetables and cultivated grasses, which assume an appearance in our gardens and fields, widely different from that, which they display in their wild or natural state. In the same manner, the absence of culture, or the removing the vegetable to a colder climate, and a worse soil, tends to *contract or consolidate* the plant.

The same general law operates in a similar way on all woody plants, but of course less rapidly, owing to the less rapid growth of trees, from the lowest bush, to the oak of the forest. In all of these, the culture of the soil tends to *accelerate vegetation*, and by consequence, to *expand the fibre of the wood*. It necessarily renders it softer, less solid, and more liable to suffer by the action of the elements. Let us shortly give a few examples of the uniform effect of this law of nature.

Every forester is aware, how greatly easier it is to cut over thorns or furze, that are trained in hedges, than such as grow naturally wild, and are exempt from culture. Gardeners experience the same thing, in pruning or cutting over fruit-trees or shrubs; and the difference in the texture of the raspberry, in its wild and in its cultivated state, is as remarkable; for although the stem in the latter state is nearly double the thickness of that in the former, it is much more easily cut. On comparing the common crab, the father of our orchards, with the cultivated apple, the greater softness of the wood of the latter, will be found not less striking to every arboriculturist.

Further: The common oak in Italy and Spain, where it grows faster than in Britain, is ascertained to be of shorter duration, in those countries. In the same way, the oak in the highland mountains of Scotland or Wales, is of a much harder and closer grain, and therefore more durable, than what is found in England; though on such mountains it seldom rises to the fifth part, or less, of the English tree. Every carpenter in Scotland knows the extraordinary difference between the durability of Highland oak, and oak usually imported from England, for the spokes of wheels. Every extensive timber-dealer is aware of the superior hardness of oak, raised in Cumberland and Yorkshire, over that of Monmouthshire and Herefordshire; and such a dealer, in selecting trees in the *same* woods in *any* distrct, will always give the preference to oak of *slow growth,* and found on cold and clayey soils, and to ash on rocky cliffs; which he knows to be the soils and climates natural to both. If he take a cubic foot of park-oak, and another of forest-oak, and weigh the one against the other (or if he do the like with ash and elm of the same descriptions), the latter will uniformly turn out the heavier of the two.

As an analogous case, I may refer to some facts collected by Lambert (no mean authority), respecting the Scotch fir (*Pinus silvestris*). He says, that it does not stand longer than forty or fifty years on the rich and fertile land in both England and Scotland, where it is often planted, and where it rushes up with extraordinary rapidity. In the northern districts of Scotland, on the other hand (a thing well known to myself), the difference between park fir and highland-fir is universally known and admitted; and the superiority of the latter is proved, by its existence in buildings of great antiquity, where it is still found in a sound state; a difference, which can be ascribed to no other cause than the mountainous situations (that is, the natural state), in which the former timber is produced, and "where the trees being of *slower growth*, the wood is consequently of a harder texture."—Monogr. on the Gen. Pin. p. 34.

To the above I may add a circumstance connected with the larch, another tree possessing a dense, hard, and durable fibre in its natural state. A friend of mine had some trees of this species, which had grown nearly fifty years, in a deep rich loam, close to some cottages and cabbage-gardens, where they had amply shared in the benefit of culture from the latter. When felled, the wood was soft and porous. It turned out of no duration, when cut up into floors and field-gates; and it was even found to burn as tolerable fire-wood, which larch of superior quality is known never to do, at least without the assistance of some other wood.

From these facts, and others that might be brought forward (if room permitted), as well as from vegetable anatomy in general, and the nature of the sap's descent in particular, we may deduce the following Practical Conclusions, regarding the question at issue.

First ; That all timber-trees thrive best, and produce wood of the best quality, *when growing in soils and climates most natural to the species.* It should, therefore, be the anxious study of the planter, to ascertain and become well acquainted with these, and to raise trees, as much as possible, in such soils and climates.

Secondly ; That trees may be said to be in their natural state, when they have sprung up fortuitously, and propagated themselves without aid from man, whether it be in aboriginal forests, ancient woodlands, commons, or the like.* That in such trees, whatever tends to *increase the wood,* in a greater degree than accords with the species when in its natural state, must *injure the quality of the timber.*

Thirdly ; That whatever tends to increase the growth of trees, tends *to expand their vegetable fibre.* That when that takes place, or when the annual circles of the wood are soft, and larger than the general annual increase of the tree should warrant, then the timber must be *less hard and dense,* and more liable to suffer from the action of the elements.

Fourthly ; That a certain *slowness of growth* is essentially necessary to the closeness of texture, and durability of all timber, but especially of the oak ; and that, wherever the growth of that wood is *unduly accelerated by culture of the soil* (such as by trenching and manuring), or by *undue superiority of climate,* it will be *injured* in quality in the precise ratio, in which those agents have been employed.

Fifthly ; That, as it is extremely important for the success of trees, to possess a certain degree of vigour in the outset, or to be what is tech-

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* Some trees, however, and herbaceous plants may be said to be *naturalized* to certain situations, in which, without the aid of art, they never would have been found. Thus, says Mr. Loudon, we sometimes find mountain plants common in plains, and even in meadows ; and alpine trees which disseminate themselves in warmer, and more level districts. But the botanist, by comparing the effects of these different situations on the vegetable, always knows how to select, as general nature, that which *perfects* all its parts, and where the soil and situation are best suited to the reproduction of the species, and the prolongation of individual life. These rules, adds he, are founded in nature. For example : no person, judging from them, could mistake a warm English common, for the natural soil and situation of the Scotch fir, though it frequently is found growing there.—Form. and Improv. of Country Resid.

nically called "well set off," the aid of culture is not in *every* case to be precluded, by a consideration of the general rule. That if trees be in a soil and climate *worse than those that are natural to them*, then culture will be of some advantage; as the extra increase of wood will be of a quality *not inferior to what in its natural state it would obtain;* or, in other words, it will correspond with that degree of quality and quantity of timber, which the nature of the species admits of being obtained: but culture, in this case, must be applied with cautious discrimination, and a sound judgment. That, on the other hand, if trees be *in a better soil and climate than are natural to them*, and, at the same time, that the annual increase of wood be promoted by culture (as already said), it will be a decided disadvantage, and *deteriorate the wood.* In the same way, if trees be *in their natural state*, the annual increase of timber, obtained by culture, will *injure* its quality, in a degree corresponding with the increased quantity.

Sixthly: That such appears to be a correct, though condensed view of the operation of those general laws respecting growth, which govern the whole vegetable kingdom, and especially their effects on woody plants, and of the salutary restraints, which science dictates to be laid on artificial culture, of which pruning, as well as manuring, forms a constituent part, as has been explained above, at so much length. That it is by a diligent study of the peculiar habits of trees, and the characters of soils, illustrated and regulated by facts drawn from general experience, that rash or ignorant systems of arboriculture are to be best corrected, and science brought most beneficially to bear on general practice.

If the foregoing propositions be fairly deduced, as I conceive them to be, from facts, and be also consistent with phytological principles, it follows, that the pitting system, as already practised by most nations (but what Mr. Withers confusedly calls the SCOTCH method), if duly regulated by science, must be the best system for the "Planting of Waste Lands," or, in general, for large designs of wood, and especially for the royal forests, where the QUALITY OF THE TIMBER is the main object. That if the system of culture, by means of trenching and manuring, were, as is proposed, to be universally introduced into those forests, it would create a vast national loss, by *deteriorating* the value of this important part of the public property;—although particular spots in these, as in all extensive woodlands, might be advantageously managed by it, under *peculiar* circumstances.

Further, it follows, that Sir Walter Scott, in his able essay on the "Planting of Waste Lands," has committed no "Fundamental Errors" (as alleged by Mr. Withers), by advocating the pitting system of planting, but that such errors most obviously have been committed by Mr. Withers himself: that he has done this, by endeavouring to give general and indiscriminate currency to a system, which, how excellent soever for many purposes, cannot, any more than other systems of arboriculture, be properly practised, unless *under the control of science*.

For these, and other reasons that could be given, if room permitted here, I would humbly offer it as my opinion, to his Majesty's Commissioners of Woods and Forests, that the system of trenching and manuring could not be introduced into the royal forests, *with safety to the quality of British oak*, which it has been the pride of this country to raise, in such unrivalled perfection. I should, therefore, with great deference recommend it to them, to persevere in the same steady and judicious course of management, which they have been for some time pursuing. In this view, I should wish to see them employ, for the operative part, none but the most experienced foresters that can be had, whether in our own country, or in Germany, where the management of woods is better understood; and to procure, if possible, for the superior departments, superintendents, who are not mere gardeners, like Mr. Billington and others, but who, to a thorough knowledge of planting, as practised in the best districts, unite some pretensions to phytological intelligence. Mr. Withers has talked of a parliamentary inquiry, and even expressed an anxious desire for it. Let himself or his friends come forward with it when they please. The more that management like the above is investigated, the more it will merit the thanks of the country.

In respect to Mr. Withers's first pamphlet, I have already expressed the opinion which I entertain of its merit. It is impossible for me not to respect the ardent mind, and active industry of a writer, who is a fellow-labourer with myself, in the uphill work of improving British arboriculture. Although we differ on some points, yet I am certain that he will now agree with me, as to the low, or at least the unsettled state of our knowledge in the art of planting on scientific principles; of which a better example cannot be given, than that, in 1825, Mr. William Billington published an account of his own, and Messrs Driver's bungling operations in planting the Forest of Dean; and that three years after, namely, in 1828, as a remedy for those evils, and in order to raise the most *durable* Oak for "future natives," Mr. Withers himself brought forth his recipe of high cultivation and manuring of the soil. It is further worthy of remark, that in the numerous and excellent communications received by him (as appears by his book) on the same subject, from planters certainly of judgment and experience, not one of them, Mr. Cuthbert Wm. Johnson excepted, appears to be a man of science.

Nevertheless, it would be unjust not to add, that the reader will find, in this second publication, some valuable remarks on "the Pruning and Thinning of Trees." Also, he will find, in the more homely and unpretending production of honest William Billington, probably the *best instructions* for conducting those two important processes, that exist in the language, together with much good sense and judicious practice, in several other departments.

The truth is, although the public attention has been of late more excited towards the important department of planting than heretofore, it is yet too much regarded as a *mechanical art*. I entirely agree with the judicious author of the Encyclopedia of Gardening (from whom much of what I have said above is taken) on the effect of culture on trees, and that it is a branch of planting which seems to have been wholly neglected by practical men. They appear, as he justly observes, to have carried it on, with reference to no other end, than the increase it produces on the *quantity* of timber. To exclude either pruning or culture from a proper system of arboricultural management can never be the design of any sound phytologist: but they are both very *questionable* agents in the hands of unscientific persons, and they can be employed by no one without extreme caution, and a due regard to those laws, which nature has established as paramount in her works.

Messrs. Withers and Pontey, the most distinguished advocates of these practices, I take the liberty to think, have fallen into this general error; and content with the *bulk* of the marketable article, and the *shortness of the time* within which it can be produced, they have suffered the *solidity and durability of timber* to escape their notice. With a partiality to culture, nearly equal to Mr. Withers's, and deeming it applicable to many purposes to which it has not as yet been applied, I conceive that the indiscriminate recommendation of *any* practice, without a mature consideration of its nature and consequences, is inconsistent with sound science. We should reflect, that the practice we have been considering, would, with all its excellence, if *universally introduced*, be an evil the more formidable on this account, that its effects might not become apparent, until it was past a cure.

Note V. Page 176.

In the foregoing Note, a good deal has been said, respecting the nature and use of trenching. I will now make a few observations on one of the most important and interesting objects, to which that process can be applied, I mean the removal of rushes from land. A greater impediment to agricultural as well as arboricultural improvement cannot exist, than this unsightly weed; because wherever there are rushes, there must be *superfluous moisture;* and that excess of an indispensable element, is equally hostile to abundant grain-crops, good pasturage, and good wood.

To point out a method of eradicating the rush effectually is a problem that has not as yet been solved, by men in either of these departments. The causes which occasion it are twofold: first, underground water; in which case, it is completely to be removed by draining: and secondly, tenacity of soil, which retains moisture, as if in a cup; a species of evil, for which no cure has ever been found. Observing, some years ago, that, on no land where the *subsoil* was completely dry, were any rushes ever known to spring up; and reasoning on the indisputable maxim, that *Sublata causa, tollitur effectus,* I conceived, that if any means could be devised to carry off superfluous moisture, from *underneath* the soil, and to carry it off *speedily,* the rushes would disappear, as a matter of course. Experience had shown that, from underground drains, however carefully executed, no such effect would follow; because numerous examples exist of persons, who, from an anxiety to lay dry particular fields, have intersected them with drains in all directions, within five and six feet of one another, and still rushes have sprung up, even on the top of their drains. Nothing, therefore, promised to be effectual, except some method of *rendering the entire subsoil a drain,* and thus carrying off the water, which descended from the higher grounds, or fell from the sky, *before it had time to stagnate.*

For this important purpose, deep trenching seemed particularly well adapted; as the first principle of it consists, in reversing the order of the natural strata, and putting down, to any given depth, the loose and friable soil, which has been the subject of culture. By that means, a subsoil of an entirely different quality, namely, the fine mould of the surface, would at once be created at the bottom of the trench, and through which the *superfluous* water, formerly retained by impervious strata, would now readily percolate. Besides this, another object of immense interest presented itself, and that was, the sudden and effectual alteration, and therefore *melioration* of the soil, from wet to dry, from stiff to porous: and if it were true, as already stated, that "the best soil, whether for wood or agricultural crops, was one, that is at once loose and deep," here both depth and looseness would at once be obtained, with the power of retaining water only to the proper extent, and exerting a great chemical agency for the preservation of manures.

My first experiment in reducing this theory to practice, was made on about two acres of old meadow-land, on which rushes had been abundant from time immemorial, from two to three feet high. Having previously ascertained that there were no great underground springs, I directed the whole to be trenched, eighteen inches deep. The trenching was effectively executed in the line of the slope or declination of the surface, so that, if any interstitial mounds of subsoil (see the foregoing Note) had been inadvertently left in the bottom, no obstruction, after rain, should be given to the speedy descent of the water. The surface mould not being above six inches deep, the whole was deposited by the first spit, at the bottom of the trench. The next six inches consisted of strong loamy clay, and were thrown immediately upon the first; and the last six inches, which were of as obdurate a clay (*Scottice* till) as could well be imagined, formed the top of the new surface.

Being in haste to return the land to its former condition of meadow, I did not bestow the proper time, as I ought to have done, in working it, by means of a complete summer-fallow, or drill-crops well manured; but, after merely reducing the clay to a good state of pulverization, I gave it an abundant top-dressing, first of mild lime, and then of dung-compost, prepared with peat-moss, according to Lord Meadowbank's method, and immediately sowed it down with grass-seeds. This took place in 1810. The hay-crop that followed was immense. It has been cut in hay repeatedly since that period, and twice dressed with lime-compost: but since the time of the trenching (now *seventeen years*), *not a rush has ventured to put up its head.* Had the cure been only temporary, rushes certainly would have appeared again in greater luxuriance, in consequence of the culture, after the third or fourth season.

The next experiment I tried, was on the sheepwalk of the park, of which a particular quarter, near the margin of the lake, being of strong rich loam, eight or nine inches deep, with a clayey subsoil, was apt to be rushy, after being some years in pasture. This space of ground extended to about four acres. It was trenched in 1821, nearly twenty inches deep. It was treated nearly in the same style as the meadow just now mentioned, and got the same dressing of lime and compost slightly ploughed in, and completely pulverized, and was then sown down in pasture. After six years, I can truly say, that no rush has ever appeared upon it; and now, after another year, (in October, 1828), I can attest the same result.—Let it be observed, that this experiment differed somewhat from the other; for pasture immediately succeeded the sowing down, and no cutting of hay took place.

In 1822, I made various other trials, all attended with the same uniform success. From one and all of them I was led to the conclusion, that in *deep trenching on cultivated land*, properly executed, a certain cure will always be found for rushes, proceeding from the worst cause in which they originate, viz. *tenacity of soil.* The simple theory is this, that if a new and permeable subsoil, composed of the uppermost friable strata, be thus formed underneath, it will act nearly as if gravel or sand had been substituted : and we know that, if either soils or subsoils be once fairly *stirred*, no *complete* consolidation will afterwards take place.

It is probable, that this method of eradicating rushes has not as yet become very extensively known, and therefore has not been much verified by the experience of others.* In the end of 1821, or beginning of 1822, a scientific friend of mine, who saw the work going on in the park here, was so much struck with its importance and simplicity, that he drew up a short account of it as managed at this place, and published the article in the Farmer's Magazine of Edinburgh, where the reader will find it. But in that article, as far as I remember (for I have it not at hand), the depth of the trenching and the expense attending it, are both underrated. In respect to the trenching, I never trenched less than eighteen, and sometimes twenty inches in depth; and as to the expense, it never amounted to less than 1s. per pole, or per fall, Scotch measure (which bear the same proportion to each other, as the higher national rates do), or 8*l.* per acre, when spade work only was necessary. If the aid of the *pick* was called in, it amounted to 2d. more per fall, or 26s. per acre. But in such a case, previous outlay is of little moment, if we can only rely on an adequate or profitable return.

It is a curious fact, and may be verified by those who are disposed to make the experiment on a single acre, or less, that the trenching of ground, *if done only deep enough*, has (besides eradicating rushes), the extraordinary effect of *rendering wet land dry, and dry land moist*, for the most beneficial produce either in timber, or agricultural crops. In respect to the former soil, it is obvious on the face of the proposition, and from the foregoing experiments. As to the latter, I have more than once verified it, by trenching a sandy soil fifteen inches deep, when there were not more than four inches of good mould on the surface ; and when

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* So little does this seem to be known, that an intelligent friend of mine (than whom no man does more work, or does it in a better style of execution) is, at this moment (October, 1827), engaged, with the help of a professional drainer, brought at some expense from a distance, in endeavouring to extirpate the rushes in his park by *surface drains*, at twenty and thirty feet distance. It would be quite in vain for me to tell him, that his drainer has no science, and that his rushes, in this way, cannot be *permanently eradicated*. There are very few men, who put any value on advice that is gratuitous. Besides, I am too near at hand (not five miles off) to be of any use to him. Were I to come from Lincolnshire, or the Landsend, offering for fifty guineas to communicate my secret, I believe I could render him very material service.

the mould was unscrupulously put down to the bottom of the trench, and eleven inches of pure sand superinduced upon it! Nevertheless, the oats sown the first year upon this soil, and manured and treated as above, at once reached the mould at the bottom of the trench: and they would have gone down double the depth, had they had an opportunity. On trying oats in the mould of a hothouse, the roots were found to descend two feet nine inches!

I regret that there is not room, in the brief space of an ordinary note (which has been now so greatly exceeded), to demonstrate the reasonableness of the experiments made, on chemical principles, so as to satisfy the man of science. The man of practice may very easily satisfy himself. He, who tries the thing, will be convinced, that, while by deep trenching he will raise the value of his land (as held out in the text), by the one-half in some cases, and by double in others, especially if he take a green crop the first season, his entire expense, for both labour and manure, will generally be repaid by that crop: so that, whether he operate as a husbandman, or an arboriculturist, he will, by the second season (as the saying is) be fairly "on velvet;" or, in other words, that this improvement of the subject *will pay itself after a twelvemonth.*

I am aware that the trenching of land, whether in theory or practice, is a subject not fully understood, not even by Mr. Withers himself, notwithstanding his two pamphlets, which are drawn up to illustrate it. The extraordinary and wonderful effects, produced by deepening, and the comminution of the parts (but the one is useless without the other), are known comparatively to few persons, notwithstanding the success, with which chemistry has already been applied to agriculture; and none but gardeners and nurserymen are as yet prepared to believe the *vast power* which they put into the hands of a man of science and enterprise.

SECTION VII.

Note I. Page 194.

I feel particular satisfaction in paying this just tribute to the memory of a superior and ingenious artist. His professional character has been slightly, but justly sketched in the passage, to which this note refers; and all, who remember him, will unite with me in doing justice to his private worth, his pleasing manners, and his extensive information on all subjects connected with rural affairs. Mr. White was an excellent agriculturist, an ingenious mechanic, and a planter of great skill. Like his master, Brown, he was in the habit of undertaking the execution of his own designs, and also, of plantations of considerable extent, in both England and Scotland, until his business as a landscape gardener, in the latter country, became too extensive to admit of such undertakings. In this way he had planted, before the year 1780, for Lord Douglas, at Douglas Castle, about fifteen hundred acres of ground, which are now covered with fine wood, and of which the thinnings have long been a source of considerable revenue to the noble owner.

About the year 1770, Mr. White made the purchase of an estate in the higher parts of the county of Durham, on which he planted so extensively and successfully, that it may be worth while, for the encouragement of the young planter, to give some idea of the returns which it made to him. But these are so wonderful and portentous, that to the ordinary reader, they may rather seem referable to the feats of some arboricultural Münckhausen, than to the sober results of judgment and industry.

The territory of Woodlands (for so it was named by the new owner) extended to between seven and eight hundred acres, and cost Mr. White about 750*l.* It was situated in a high, and at that time a barren tract of country, about eighteen miles from the city of Durham, and wholly destitute of wood. But, as it was surrounded with coal-mines, he had the sagacity to foresee, that there was scarcely *any* return, that might no be expected from fir and larch, and other quick growers judiciously planted and on a suitable soil. The first thing he did, therefore, was to enclose with a strong ring-fence the whole estate, in which, of course, he had the benefit of aid from his neighbours; and having previously drained such parts of it as were swampy, he immediately proceeded to plant the whole excepting only an arable farm of a hundred and forty acres. This took place about 1777. The soil was a brown mould, the subsoil light and gravelly; and although he covered it with trees of every common species, yet he resolved that the *larch*, and the *Scotch fir*, for which he had a peculiar predilection, should form *the staple of his woods.*

The singular spectacle of nearly an entire property dedicated to trees, did not fail to attract the attention of his neighbours, who entertained no belief of the extraordinary success of wood, in these high latitudes; but the repeated premiums and medals, conferred by the Society of Arts, soon attested the importance of his operations. After the plantations had grown for five-and-twenty years or more, Mr. White began to think of establishing his residence on the spot. For that purpose, he built a commodious house and offices; he laid out an excellent kitchen-garden; and added shrubberies, a piece of water, and a handsome little park, all cut out of this extensive woodland. Enclosures adapted to tillage soon followed, which were added to the arable farm, already in his own occupation. But the wonderful part of the story still remains to be told. It is well known to those, who chance to have subjected to the plough old woodland, how inconceivably even the poorest soils are meliorated by the droppings of trees, and particularly of the larch, for any considerable length of time, and the rich coat of vegetable mould, which is thereby accumulated on the original surface. The first years' crops of corn were accordingly immense; and those that followed were such, as to give an extraordinary impulse to the good culture, which gradually took place. After the park was laid down, and the farm improved, the land-rent, fairly estimating its value to a tenant, amounted to no less than about 250*l.* a year.

In respect to the plantations, after the first ten or twelve years, they began to pay admirably in pit-wood, hedge-stakes, and other country uses; and the fir and larch the best of all; from the tanning principle so powerfully possessed by the latter, over and above the value of the wood. On inquiry many years ago, I found, that the larch-wood alone returned Mr. White 650*l.* a year, a sum not greatly less than the price he had paid for the entire estate: and five or six years since, it appeared, that his son, the present Mr. White, had often drawn more than 400*l.* a year, for his larch-bark only, and 1000*l.* a year, as the entire revenue from his woods!—This, it is to be observed, was derived merely from the *thinnings* of these thriving plantations, including of course, the cutting out of the place and park, as already stated.

To those acquainted with the rapid progress made by the larch, on a gravelly soil, on which any tolerable quantity of vegetable mould has been aggregated, it is a fact well known, that it doubles its value every *three years*, after fifteen years old, and every *five years*, after five-and-twenty ; so that it was obvious, that in that ratio it must soon reach the greatest size and value, which the soil and climate would admit. This period has now nearly arrived ; and a valuation having been made of the whole of the fir and larch wood on the estate, it amounted last year (1826) to the surprising sum of 30,000*l*., putting little value on any other species of wood !!! Whatever is at its best, it is pretty clear, can admit of no further improvement ; so that the judicious owner, as I am informed, has it now in contemplation to *cut down the whole* ; and, after taking two crops of corn (which must be of the most abundant sort), to plant the estate anew, in order to create a *second* fortune for his family!

I regret that I am not so much acquainted with the details, as to give a comparative view of the expenditure, and the returns from the beginning; as it might prove interesting to those who are embarking, or who may hereafter embark, in similar designs. But there is good ground to believe, that arboricultural skill and perseverance were never more amply or speedily rewarded, even during the lifetime of the planter, than by this judicious, and most successful speculation.

SECTION VIII.

Note I. Page 209.

I beg to take this opportunity of accounting to the critical reader for a few new words, which I have taken the liberty to introduce, such as the one to which reference is here made; and my only apology is, that, in a new art, the practice may perhaps be admissible.

"To machine a tree," is an expression, which I have, for many years, applied to the act of putting a tree on the machine. Hence, "the machiner" is the person who operates in this way; and both words have, for some time, been current in this part of the kingdom. In the same manner, I have taken the liberty to introduce the expression, that ground is "sinky," when it yields easily to the foot of man, or other animals; that plants are "stemmy," when they are tall and slender, and have few branches on the stem; and that earth is "spadeable," when it is capable of being worked with the spade. I have said "decalcation of the surface," for treading it with the foot; "to spade earth," for to throw or turn up earth with the spade; "to handle roots," for to distribute or arrange them with the hand; and hence, "a handler," for one that so distributes or arranges them. Of these it may probably be said, that some are fair derivatives, particularly "decalcation, sinky, stemmy, and spadeable;" and that, according to the rule of Horace, they may be considered as adding to the copiousness of speech. In favor of "machiner" and "machining," "handler" and "handling," I have little to offer, only that they stand us in good stead in field-practice.

On the same ground, I have also to apologize for the application of a few known and established expressions, which is rather different from that generally in use. Thus, I have said "to transfer a tree," for to transplant or remove it; and "transference" for transplantation. These, however, I consider as good words, though pure Latinisms. But "a severe exposure," for a place severely exposed; "a staring view," for a view stared at; these and such like terms are not so defensible, although they may have been used by landscape gardeners and others. In this understanding, it is merely (as the schoolmen say), taking the objective for the subjective, or *vice versa*, as may suit the circumstances of the case.

Note II. Page 217.

I am not certain, if" janker" be a term known to the English wood-merchant. In Edinburgh, Glasgow, and other great towns in this kingdom, a pole or beam, from fifteen to thirty feet long, of great strength, and fortified with iron, when mounted on a crossbar, with a pair of high wheels at each end, is called "a janker;" and the immense logs of wood, which are transported by means of it, from one place to another, are swung under the axle: and consequently under the pole also of the machine.

In the transporting, or the planting of spreading trees, with a machine constructed on this model, there could be no room for the tops; because the branches would be chafed to pieces, and destroyed by the hind wheels. But were the top to be much lightened, or still more, were it to be pollarded, as is often done in both Scotland and England, and reduced nearly to *a log of wood*, the janker would act as a most efficient implement, and very heavy subjects might be removed by it. Moreover, the work would be executed far more rapidly, and at a fourth part of the expense of the platform, and the preserving of the upright position of the tree. I have sometimes thought, that it might be practicable to apply this sort of machine with advantage to the Preservative system, by making the length of the pole equal to the full height of the tallest tree you mean to remove, and so the hind wheels would raise the top sufficiently off the ground. If the fore wheels, for example, were six feet high, the hind ones might be eight, which would afford sufficient room for elevation; and thus the branches might perhaps be managed with greater facility and safety, than by any other method. But the use of such a machine would necessarily be limited to operations on an open surface. It must be all "plain sailing," as the seamen say, and no sudden turns, intricacies, or narrow passes, such as often occur, would be admissible in its route.

SECTION X.

Note I. Page 249.

"Shows," as the refuse of a flaxmill is usually called, in this part of the kingdom, when freed of dust and other impurities, form an excellent thatch for houses, the peculiar qualities of which I shall mention here, for the benefit of those who may not have experienced their utility for that object.

Five-and-twenty years since, when no value was put on this useful article, it was generally thrown into the river or stream, on which the flaxmill was situated, and carried away by the next flood. Observing that when shows abounded, the people about the mill used to throw them on the roofs of the sheds, where they seemed completely to turn the rain, I believe I was the first, or among the first, who thought of applying them to the roofs of cottages. Accordingly, expert persons were here set to work to draw and bundle them up, like straw used for thatch; and the shows were put on, about twelve inches thick, either by sewing them with marline, or otherwise, by superinducing them on a thin coat of fresh turf, as is often done with straw in Scotland. About the same time, likewise, was contrived a wooden tool, of about fourteen inches long, but of the rudest sort, named a comb, for smoothing the thatch, after being fixed on, and properly laid with the hand, which soon brought it to a fine surface.

This covering was, of course, white, and when first put on, extremely beautiful: and although it might be supposed inflammable in its nature, and therefore hazardous on account of fire, yet it turned out on trial, to be quite otherwise: we found, as the shows lost their light colour, and became brown by the weather, they obtained a skin so hard and smooth, as equally to resist wet and drought. Even live coals might be thrown upon it without danger. In so far, then, this covering has been found superior to straw, while in point of durability, it greatly exceeds the latter. From any information that can be obtained from the flaxdressers, respecting the roofs of their sheds, it appears, that they will turn rain for *forty years or more.* Of that length of duration, however, I can say nothing, from my own experience: but on cottage-roofs, when the thatching is properly executed, I can answer for more than twenty years, with very little repair being wanted.

At first, this sort of thatch could be procured at a small expense, merely that of drawing or preparing the material; but, now, since it has got into some repute in this district, about a third part more than the price of straw is usually paid for the shows. As a substantial and durable covering for houses, however, I can much recommend it, and especially in situations where roofs are exposed externally to *risk from fire*. But it is to be observed, that this remark applies to the outside only; for internally, and on the *under side* of the thatch, which is beyond the action of the atmosphere, it does not lose its character as tow, and is very easily ignited.

Note II. Page 262.

As the banks of the Clyde, in this immediate neighbourhood, and the rich vale of the Tay, or Carse of Gowrie in Perthshire, are celebrated for their orchards, the hint here given respecting a method of manuring them, superior to the one commonly practised, may perhaps be worthy the attention of the owners or occupiers of such grounds, and it shall have a cursory notice in this place. In the district between Lanark and Hamilton *alone*, in a favourable season, the value of the fruit carried to Glasgow and elsewhere, independently of what is consumed on the spot, amounts to not less than between 3000*l.* and 4000*l.*

In these orchards, which are in general extremely well managed, the trees are planted in rows, about forty feet distant from one another, and from fifteen to twenty from plant to plant. When the ground is to be manured, which must be repeated from time to time, in order to refresh and invigorate the roots, the practice usually is, to dig in farm-yard dung over the whole surface, and to take a crop of potatoes; or sometimes to ridge in the dung, in the line of the intended potatoe-drills. Now, instead of this, let half the quantity of dung be taken, and made up according to Lord Meadowbank's method, with a like quantity of peat-moss, which last is to be had at no unattainable distance from any of these orchards. If the peat be in a *very* advanced state of decomposition (from having been wheeled out some time before, or any other cause), then only one-third part of the dung will be required, and two-thirds of peat. Let a trench then be opened, in the centre between the rows, four, or four-and-a-half feet wide, and cut as deep nearly as the depth of the trenched ground, or stirred earth, of which the orchard-soil has been originally formed, say from sixteen to eighteen inches. Let the contents be thrown up in the autumn, and spread out, in order to become friable by the winter's frost. In the month of March following, mix this earth, *as intimately as possible*, with the dung-compost, so prepared and fermented as above, turn it twice, and spread the whole round each tree in the rows.

From what I know respecting the quantity of dung employed, according to the ordinary method, the large portion of peaty earth, with which it is to be mixed as above, added to the contents of the trench, I am led to believe, that if *very intimately mixed*, it will form a mass of materials, well calculated to enlarge the pabulum of the trees to a considerable extent. If the soil be clayey (which is generally the case in these orchards), and sand be at no great distance, it would be a sensible improvement, to add a fourth part of that earth to the entire mass, even though in a state of considerable purity, and of itself incapable of producing vegetation. Let the whole mass then be regularly spread round each tree, beginning at the stem, at six or eight inches deep, as you can afford it, and ending at two or three inches; and lastly, let it be pointed with the spade, to the depth of two inches only, into the original soil. Thus, an area will be covered of twelve feet or more out from the tree, or as far as the branches extend. Lastly, let the new surface be levelled with the rake, and sown down with grass-seeds.

It will suffice to give the trees a supply of fine mould such as this, once in seven or eight years; and when this is laid on, if attention be paid to give the whole surface of the orchard a good top-dressing for grass, in the ordinary manner, I could venture to promise, that the superior produce, by the second year, in hay and fruit, will amply repay the extra expense and labour attending the work. Should this expense be grudged, and brought into a disadvantageous comparison with the immediate return from the potatoe crop, the following method may be tried.

Let the central trench be opened, as already directed, and the contents rendered friable, by a sufficient exposure to the elements. Let one-fourth part of quick lime (that is, lime-shells), in the succeeding spring, after being well slacked, twice turned, and brought to the most powdery state possible, be applied to the contents of the trench, and intimately mixed with them, observing that, by twice turning at least, *the minutest comminution of the parts takes place*. Let this compost then be spread round the stems of the trees, pointing it in with the spade, as before, two inches deep, and sowing down with grass-seeds, in a similar manner.

This species of top-dressing, though less expensive, will not pay nearly so well as the other, in proportion to the money laid out; but that will not probably amount to more than one-third of the former cost. In either case, the pabulum of the tree will be surprisingly enlarged, and in a way far more effective, than by any digging among the roots; while no injury will be done, by the former method, to the numerous, minute, and capillary fibres, which in every case form the true absorbents of the root.

To the fruit-borders of a kitchen-garden, the same sort of management may be very successfully applied. But in that view, I should recommend, that the compost be made up of one-fourth part of coal-ashes, completely freed of cinders, and three-fourths of any tolerable soil. The whole should be prepared, in the manner already more than once directed in the text, for planting, and also for invigorating trees in the open park. If the fruit trees to be manured be planted against a wall, the compost should cover the space of ten feet out: if they be in the open borders, six feet may sufficiently answer the purpose. This practice will by no means preclude the cultivation of leguminous crops, and those especially, of which the roots run near the surface, and which should always be preferred for such situations.

Note III. Page 263.

As the great object about all places, whether to the husbandman, or to the arboriculturist, should be to increase the quantity of disposable manure, it has been found by experience, that the juice or exudation from the dunghill may be far more advantageously employed for that purpose, than for watering the roots of trees. From this rule, however, we must always except the roots of vines in the hothouse; for no superior method has ever been found, of giving an immediate stimulus to the growth of these plants.

The object, to which I here allude, that is, the mode of employing the juices of the dunghill, was, I believe, first suggested by the late Lord Meadowbank, to whom alone we are indebted for the discovery of the method of converting peat into manure, by means of fermentation. The object is, to water peaty earth, if in a *very* decomposed state, and so produce excellent manure within a short period. That this liquid will decompose pure peat itself, we are well aware; but much time and patience would be necessary to decompose it to any extent, and also a greater command of the liquid, than could be easily procured. Whoever has dry peat-moss at hand, however, should not omit, when his dung-yard is cleared out, to lay a stratum of it at the bottom, so that, when the contents are taken out some time after, it will be found as valuable a manure, as any other in his possession.

Every diligent arboriculturist, and every one residing at a distance from a town or considerable village, where dung can be purchased at pleasure, should have a well or pit at the lower side of his dung-yard, to which the juice naturally tends, and without which great loss of a valuable substance is always suffered, especially in rainy weather. This pit should be carefully lined with dry-stone, and secured underneath, and at the sides, with a good wall of well made clay-puddle, a foot thick. It should have erected in it a pump of cast iron (for wood in such a situation, is of no durability), of which the working-barrel is about four inches and-a-half in diameter.

The method of making this manure is extremely simple. Once in ten days in winter-time, and about three weeks in summer, the liquor collected is pumped up into a large barrel, mounted with a three-inch brass cock. The barrel used for watering your trees in the park, will answer the purpose admirably. Having prepared a heap of peat-moss, *as dry, and as far advanced as possible towards decomposition*, and having conveyed the water-cart to the spot, the liquid is to be drawn off in stable-pails, and poured leisurely over the heap. As soon as it has in this way got two complete waterings, it is to be turned and thoroughly mixed; and, provided the liquid be pretty strongly impregnated with the fertilizing juices, a second course of both, that is, in all four waterings, the whole will be found converted into valuable manure, fitted for every purpose of husbandry, arboriculture, or horticulture.

One thing only in the department last mentioned, may be noticed, and that is, that the application of this manure, or indeed of any other, of which peaty matter forms a part, should be confined, by the gardener, to crops cultivated with the spade, or the hoe. For those raised from small seeds, and which require hand-weeding, it is not so suitable, from the quantity of chick-weed that decomposed peat is apt to engender, especially in the first season.

SECTION XI.

Note I. Page 285.

The lodge and entrance-gate to the park, with their combined features woody and architectural, if properly executed, should be one of the most pleasing accessories to the landscape, in a well laid out place. As they are the first to meet the stranger's eye, so they should, like a good saloon or entrance-hall to a house, convey a favourable impression of the propriety and good taste of the arrangements within. A good lodge should present the idea of an "ornamental cottage," always *harmonizing with the style of the mansion-house;* not a fantastical or non-descript hut, covered with thatch, and buried in creepers, and harmonizing with nothing good or bad, natural or artificial, about the place. But lodges and gateways, in which we should expect the joint skill and taste of the architect and the landscape gardener, are, generally speaking, very dull and monotonous things, which can do little credit to the artists, and give no pleasure to the owner.

It must, however, be acknowledged, that it is the landscape gardener, and not the architect, who is chiefly in fault in this business. Mr. Hunt, and other late architects, who have turned their attention to rural decoration, have sufficiently redeemed the credit of their art, by various sketches for buildings of this description, so that we are not now, as heretofore, without models, from which to form a very tasteful selection. With regard to the other department, I shall beg leave, as a sort of ex-professor of that art, to offer a few hints, for the improvement of park entrances, on the present occasion. By rendering them *better pictures*, than they now display, I should hope, that they might become at once more interesting to the traveler who passes by, and more attractive to the visitor, who enters the grounds to which they belong.

In accomplishing this object, I propose to proceed on two simple principles. The first is, to recommend the study of *open work*, more than has usually been adopted, in the disposition of the woody accompaniments of the buildings: and the second is, to give them *foreground* and *consequence*, by throwing them back from the public road to a certain distance, thus producing something like landscape effect, by the external wooding of the intermediate surface.

In respect to the first principle, it is plain, that the wholly shutting up, and rendering impervious to the eye of the traveler, the entrance to a park or place of any tolerable extent, can never be consistent with good taste. To admit, from this station, such open views of the internal scenery of the place, as often delighted our ancestors, is now out of the question; and it is accordingly not less reprobated than proscribed in an age, which places privacy and seclusion in the foremost rank of rural enjoyments. All that I should for our present purpose recommend is a *limited but striking landscape*, in which the lodge forms the central point of attraction, bounded on all sides by grove and underwood, and not stretching beyond a hundred yards in length, and half that number in breadth, towards the park side, both within and without the railing or pales of the entrance. This, for the largest places, I conceive would be sufficient; and for smaller ones in proportion, according to the taste and fancy of the owner.

As to the second principle, the throwing back the lodge to a certain distance from the road, thirty yards or ninety feet seem ample, for the residences of most private individuals; that is, allowing thirty feet or more of the number, as a sufficient space between the railing or open pales, and the lodge. The grassy margins along each side of the carriage-way (which should extend from the pales the whole way through the bounding-line of plantation, till they reach the open park,) might be from thirty to forty feet broad, having scattered over them, at wide distances, say, from twenty-four to thirty feet, stately standard or grove trees interspersed here and there with underwood, through which the eye might be partially let in, so as to catch a view of the park. These grassy margins, on which the sheep or deer could browse down to the gateway, would form a pleasing connexion with the external ground, which is also to be wooded, and being separated from it by the open pales or railing, would give considerable intricacy to the picture.

The external ground itself, on which the main effect depends, should be richly clothed, like the grassy margins as above, with grove-trees and underwood in the same way intermixed, relieving and massing up the building, so as to form the most interesting landscape, that the nature of the ground, and the limited view into the park will admit. In order to give proper effect to the lodge, as its distance from the open pales should be thirty feet or more, as already mentioned, so it should stand eighteen or twenty feet off the carriage-way. And to this it may be added, that the entire length of the external plantation or grass-plot, should be at least a hundred yards, if the ground will allow it, and that the pales and gateway should, of course, cross the coach-road at right angles. Moreover, the external grass-plot, which in front should be kept neat with the sythe, must be protected from stray-cattle on the turnpike road, by a low rough fence of larch-stakes, about two feet high, or less, of which the bark is allowed to remain upon the stakes.

If, in laying out an entrance-gate, on such picturesque principles, at an old place, where great trees could be commanded for the external wooding, and for the park-like margins on each side of the carriage-way, the effect would be splendid, were any tolerable skill displayed in the execution ; and it would, I am certain, do much to bring this style into fashion in any district, in which it chanced to be executed. Without the passport of *fashion*, I know, that nothing will go down in England ; as even there, *picturesque effect*, in the details of the handsomest places, is not always studied. In Scotland the thing is neither known nor studied at all : but wherever it does appear, it seizes our approbation we know not why, and powerfully detains it, without our being able to assign the true cause.—At places where great trees cannot be commanded, the power of the transplanting machine may be called in to our assistance ; and that with a good choice of subjects spreading and spiral, as the different parts may require to be brought out, will accomplish any design of ordinary magnitude, within a short period.

One of the chief recommendations of the plan of improving park entrances by external wooding consists in this, that it surmounts all obstacles, and cures all deformities, *at least possible expense*. The means of cure, namely Wood, is so beautiful in itself, that it throws its own delightful character over every thing which it touches. If your ground be high, it will give it shelter ; if tame and flat, variety and elevation ; and if it be irregular and deformed, it will oftentimes convert those seeming obstructions into playful intricacy, and unexpected beauty.

Note II. Page 288.

Although, from the estimate given in the text, it appears, that, by the common method of planting, park-wood may be obtained at *thirteen* times the expense of wood obtained at once by the transplanting machine, yet I believe, if full justice were done to the comparative statement, that the superiority of the latter would appear still greater.

There are many items, which have been omitted here, that would tell surprisingly in a correct estimate. For example ; independently of the *immediate and picturesque effect* of the removed trees, on which no value has been put, there is great *beneficial effect*, for which something considerable should have been allowed; first, in the direct shelter given to the ground by this plantation; and secondly, by the immediately increased value in pasture, in consequence of the grass-produce round each tree, to a wide distance, being doubled. This the manuring and pulverizing of the soil, at the time of planting, completely brought about, in the instance adduced; and, as these enriched spaces nearly touch, the pasture of the entire ground planted was fairly doubled, and must continue so for many years, until the roots exhaust the ground, or the branches overshadow it. On the other hand, although the expense of renewing the railing has been stated, yet no charge is made for keeping up the fence, for thirty years. Other items might be mentioned, such as the inconsiderable value of the thinnings of the wood, under this head; because the opening up must be performed at an early period, and continued to wide distances, on account of the severe exposure of the site, and the conferring on the trees that are to remain the protecting properties.

The truth is, that it is utterly impossible to procure such profusion of park-wood, as is desirable round a nobleman's or gentleman's residence, at a moderate cost, except by the transplanting machine. The ordinary modes of planting in very large masses, and afterwards cutting out the wood required, cannot be done without immense expense. But the reason why the expense, when laid out, often escapes observation, is, because it is laid out *gradually*, during a long course of years, and is therefore seldom paid by one generation. Perhaps the better way would be, to adopt the late Mr. White's system, and *plant the entire surface*. That would be a strong measure, where much revenue was to be sacrificed, although I have little doubt that it would pay the second generation, if larch were made the staple of the wood. Yet two generations could perhaps not easily be found, who would consent either to sink so large a capital as must inevitably be sunk, if the land were valuable, or to live for thirty or forty years in the midst of a thicket.

Note III. Page 293.

I regret lately to learn, that this gentleman, in the severe summer of last year (1826), had the misfortune to lose a good many of his trees, from not being aware of the necessity of *watering abundantly* during the first season, and *securing the roots with shows or moss*, against the drought. Although half a century might pass away in our variable climate, without the recurrence of a similar season, yet I think it of some importance to state, in this place, what happened to my own trees of that year, as it gives a strong view of the value of after-work (which has been fully treated in the foregoing section), and shows, that it is as deserving of the planter's notice, as any part of the treatment of wood.

During the spring, which preceded this truly tropical summer, that is, in February and March, 1826, I transplanted about a hundred and ten trees, partly in close woods, and partly in the open park, from twenty-five to thirty feet high. Within three weeks after being planted, they were carefully watered, and covered with shows, after the manner directed in Section X. By the end of May, we were forced to commence our summer watering of the roots. That of the tops was never attempted; nor was it necessary, from the copious dews, which fell during the night, and were, of course, absorbed by the leaves. And, as there is great command of water about the place, the former was continued more or less, between three and four months! Of the whole number of trees planted *I lost only* ONE, although they consisted mostly of oaks and beeches, the plants of all others the most sensitive of drought! Several bushes, however, or stools of underwood died, and I am persuaded, that it was in consequence of *over-watering;* an error which is more easily committed than planters will perhaps believe.

I am satisfied that, with workmen trained in the school of my ingenious friend Mr. Smith, the trees at Ibroxhill were just as skilfully taken up and planted, as those transferred at this place, although the latter might have the advantage, in the preparation of the soil. But I am the more anxious here to state the above remarkable fact, together with the circumstances which attended it, that it is impossible to press the importance of after-work too earnestly on the young planter's mind. For a similar object, namely, that of preserving the vigour of his trees *during his first season,* I earnestly request of him to give an attentive perusal to pages 262, 263, *et seqq. anteh.*, containing an "Inquiry into the Causes of Backwardness in Trees," as he will find, that the circumstances above stated bear strongly on that discussion, and tend to illustrate it in a very striking manner.

THAT the art, which has been the subject of the foregoing pages, will ere long be practised by many, with a success and a skill superior to mine, I entertain no sort of doubt. I have laboured, and, I trust not unsuccessfully, to refer to Principles of Science that which was vague and fortuitous, in this department of rural pursuit; and to induce planters to follow the Laws of Nature, by carefully studying them in her own ample volume, rather than by trusting to the dogmas, or the prejudices of any class of men. What I have in this way begun, I hope, that others better qualified may perfect, bringing superior ability, if not superior diligence, to the advancement of an art, which requires only to be more fully known, in order to become both popular and useful. For this purpose, however, I am aware, that it must be brought into notice by those, who *lead the fashion of the day*, in arts as well as letters. When Vegetable Physiology comes thus to be better understood, and Arboriculture, as an interesting art, more generally studied by land-owners and country-gentlemen, it will no longer remain doubtful that any man, possessed of science, and capable of industry, may give IMMEDIATE AND CERTAIN EFFECT TO WOOD in any manner, and to any extent he pleases.

APPENDIX.

APPENDIX.

REPORT of a COMMITTEE of the HIGHLAND SOCIETY OF SCOTLAND, appointed to inspect the operations of SIR HENRY STEUART of Allanton, Baronet, in transplanting Large Trees and Underwood, and to report to the Society thereupon.

AT the General Meeting of the Society, on 8th January, 1823, a Letter was read from Sir Henry Steuart of Allanton, Bart., stating his having, for several years, practised extensively and successfully on his estate, the operation of Transplanting Large Trees and Underwood, without mutilating their tops, or in any way injuring their appearance, and requesting, that the Society would appoint a Committee to inspect his operations. The Society accordingly named the following Committee of its members, for that purpose:—

The Right Honourable Lord Belhaven.
The Honourable Lord Succoth.
Sir Walter Scott, Bart.
George Cranstoun, Esq. (now Lord Corehouse.)
Alexander Young, Esq. of Harburn.
G. Laing Meason, Esq. of Lindertis.
Lieutenant-General Graham Stirling of Duchray.
G. Hamilton Dundas, Esq. of Duddingston.
Dr. Robert Graham, Professor of Botany in the University of Edinburgh.
Dr. Andrew Coventry, Professor of Agriculture.

Of which committee, Lord Belhaven, or, in his absence, Alexander Young, Esq. was named convener.

The following members of the Committee assembled at Allanton House, on the 18th September, 1823, viz.—

Lord Belhaven.
Lord Succoth.
Lord Corehouse.
Sir Walter Scott, Bart.
Alexander Young, Esq.

The committee had also communicated to them, in writing, the opinions of Gilbert Laing Meason, Esq., General Graham Stirling, and Mr. Hamilton Dundas, who could not attend, but who had previously examined the transplanting operations at Allanton House, during the planting season. And the committee, having afterwards more numerously met in Edinburgh, they agreed to the following Report.

In order to render the Report, which we are about to make, more distinct and intelligible to the Society, it will be necessary to give some idea of the soil and climate of the park or lawn at Allanton House, which has received most of its striking decorations, by means of the Transplanting system (the present object of our investigation), and under the direction of the proprietor's acknowledged accuracy of taste.

This park consists, as we were informed, of more than a hundred acres of sheep pasture, exclusive of the large external plantations, or bounding lines of wood, that surround the place. It is situated in rather a high country, being more than four hundred feet above the level of the sea (according to the late canal surveys), and nearly three hundred above Edinburgh. The soil is extremely various, consisting of strong clay, deep loam, and light gravelly soil. Peat-moss also for composts, is to be had in abundance, near at hand; so that a better subject could scarcely have been found, for making experiments on forest trees. What succeeded here, it is probable, would not fail in more favourable situations; and the science of the experimentalist would thus suffer no reproach, for owing too much of its success to the advantages of nature.*

The surface of these grounds is very irregular and diversified, well

* This observation is introduced at the particular desire of Sir Henry Steuart.

cultivated, and beautifully dressed throughout. It inclines, for the most part, to the West and South-West (usually the most stormy points in this island), and, by consequence, the exposure to the winds is very considerable. This we consider as an additional advantage; as, whatever experiments were made, the transplanted trees would thereby be put to a severe trial.

About the mansion-house there is not much timber of ancient standing. The entire number of old trees may not exceed between sixty and seventy, but they are happily dispersed over the surface. To these have been added by the owner a vast number of single and scattered trees, to the amount, as we were informed, of between six and seven hundred; which, with various enclosed clumps, or masses of different sorts, *all transplanted*, give to the whole a rich and woody appearance. But from the style, in which the removed are mixed and massed up with the older trees, the effect produced is extremely striking, especially when viewed from any commanding eminence.

In the park there is also a piece of water of considerable extent, and of very various outline, which shows the transplanted woods to great advantage. The grounds were originally laid out by Mr. White, the well-known landscape gardener; but Sir, Henry seems largely to have superadded his own improvements, and, in the management of both the woods and the water, to have profited by the principles of Mr. Price.

In following out the instructions of the society, to investigate the improvements, made in the art of transplanting at this place, the object of our inquiry naturally divides itself into three parts: First, to examine the single and scattered trees, and such as stand in detached groups on the open lawn; Secondly, such as form enclosed clumps, or masses of some magnitude; and, Thirdly, to discover how far the art is applicable to general purposes of utility or ornament.

First, As to single trees, and groups on the open lawn. Of this description, in every part of the place, we found the oak, ash, witch or Scotch elm, beech, sycamore, lime, horsechestnut, larch, and Scotch fir; all of which, having been at one time or other the subjects of transplantation, as we ascertained by accurate examination, are growing with extraordinary vigour and luxuriance, and shooting from six to eighteen inches yearly, in the *openest exposures*. Some sycamores, limes, and oaks, we particularly noticed, of which the shoots might measure more than two and a half feet, in similar exposures. This we consider as probably *unexampled*, in any part of the kingdom.

These single trees are of various sizes. Those transplanted some years since, are from thirty to forty feet high, or more; the girth of the largest being from five feet three, to five feet eight inches, at a foot and a half from the ground. Sir Henry acquainted us, that "he was by no means ambitious to remove the *largest possible trees*, but to attain the *greatest possible success* in those which he did remove. In respect to size (he added), if his principles were only followed out, *that* was a mere matter of *expenditure;* because one tree could be removed just as well as another, provided that the owner *did not grudge the cost.*" To the praise, then, of the most perfect success we consider his exertions as fully entitled.

Our attention was next turned to some single trees of the sycamore, horsechestnut, and beech species, which had been transplanted, during the first week of April in the *present* year, so that they had stood about six months in the ground, at the time of our inspection. The height, which, as we were informed, had been accurately taken at the time of their removal, is variously from twenty-eight to thirty-three feet; and the girth, which we caused to be measured by two of Sir Henry's servants, is two and a half and three feet, at eighteen inches from the ground. These trees were entirely in leaf, when we examined them, and their foliage was of a healthy and deep green color. Their branches were quite entire, and they stood firm and erect, without prop or support. The only difference that the most accurate eye could discover, between these trees and others long since planted, seemed to be, that their leaves were somewhat *smaller;* a distinction, which, as we observed in other instances, usually disappears after the first, but always after the second season.

In viewing these specimens of an art, of the power of which we had formed no adequate conception, the following facts and circumstances particularly struck us, respecting the single and detached trees: we will, therefore, concisely state them, as worthy the notice of the society.

First, the singular beauty and symmetry of the trees; the uncommon girth of their stems, in proportion to their height; and the complete formation of their branches, and spreading tops. In fact, they appear, instead of "stripling plants" (as Gilpin would have called them), to be fine *lawn trees in miniature*, and not young saplings, *in their progress* to that state of perfection. The peculiar and park-like appearance, which these give to the lawn (so different from what we have observed, in *other* instances of removed wood), must, of course, in some degree proceed from a judicious selection in the planter. But we learned, on inquiry, that Sir Henry considers it as mainly owing to a course of *previous training* in pretty open exposures, or in what he appropriately calls his " transplanting nurseries," or otherwise, in plantations thinned out for the purpose, to wide distances.

The second thing we shall mention, is the surprising health and vigour of the trees, considering the exposures in which they are placed, and the complete and perfect preservation of their branches, notwithstanding the operation of removal. In all, or most other specimens of transplanting, whether in this country or in England, it has been the uniform practice of planters, to lop and lighten the tops, to prune off the side-boughs, and often to pollard or decapitate the trees altogether. But, according to Sir Henry's improved and skilful method of managing the process, the necessity of this unsightly mutilation is completely obviated ; as in *his* trees seldom a twig or a branch appears to decay, in consequence of the operation. Thus, the *peculiar conformation and character* of each tree are preserved ; but it is obvious that by pollarding, or even severe lopping, *both* would be wholly destroyed. The above remarkable fact was clearly proved to us, by viewing trees of various sorts, in every stage of their progress, from the first year to the tenth, and upwards. It would be difficult to discover, that the trees had not grown from the seed, in the situations which they occupy, were it not for the ring of dug ground, which we observed round many of them, making a space, which is usually kept with the hoe for three or four years, in order to promote their growth ; and that labour is continued, until they begin to shoot with freedom.

The third circumstance which we shall state, and which seemed still more surprising to most of us, who had ourselves attempted the art, than either of the two above mentioned, is, that no *prop* or *support of any kind is ever used at this place*, to trees newly planted. So firmly are they placed, and so perfectly do they seem prepared to resist the elements, that in very few cases was any inclination observable, from the west and south-west, which are well known to be the most stormy quarters. This due balance of the transplanted tree is much aided by Sir Henry's practice, (contrary to the rule generally observed), of reversing the position of the tree in its transplanted state, and turning to the south-west, or stormy point, that side, where the branches had been longest and most luxuriant in the original position, precisely because they had shot more towards the north-east, or sheltered aspect. It does not appear, that the growth of the tree is in the least degree retarded by this change, which otherwise produces the effect of balancing the tree against the storm, and by bringing its branches to a regular shape, adds to its symmetry.

The time of our survey not being the planting season, we have to regret, that no account of this phenomenon (the absence of props), so clear as we could have wished, was obtained by us. From Sir Henry's explanations, however, we gathered, that the firmness or steadiness produced, was chiefly owing to the selection of such subjects, as had a certain weight and strength of stem; and more especially to a new, and peculiar method of *disposing and securing the roots under ground*, at the time of removal, attended with such advantage in giving stability to the tree, that when it is placed in its new situation, and *before* any earth has been laid on the roots, a very considerable force may be applied, without throwing it down or displacing it. But Sir Henry further informed us, that roots of great number and length (sometimes to the extent of twelve and fourteen feet of a side), were also employed to secure the larger trees, when set out single, in exposed situations.

Considering the season of the year, at which our inspection took place (although unquestionably the best for witnessing the *effects* of this interesting art), the Society will, of course, not look for any account, from our own knowledge, of the mode of *execution*. We may venture, however, to state from what we saw, that the unexampled success with single trees, necessarily the *most difficult* object, must imply methods not less new than scientific.

Respecting the management of this department, we were informed, in general, that the greatest attention is constantly paid to the previous cultivation of the soil, by meliorating and stirring it, to the depth of eighteen inches, or two feet, and to some little distance round the spot, on which the tree is to be planted. That for this purpose, no pure animal manure is ever used, but solely composts of different sorts, made up with dung, or a small quantity of lime; and that better effects are found to be produced, towards this primary and grand object, by *the intermixture of soils of different qualities* (for which the amplest opportunity is here afforded), than by any other given method. That for the rest, new modes have been discovered by experience, of training and preparing both the stems and branches of the tree; for multiplying and taking up its roots; and lastly, for removing it to its new situation. But that, which has contributed as much as any thing else to the success we had witnessed, is a careful and judicious *adaptation* of each particular species, *to that soil and situation in which it is best calculated to succeed.*

Next, as to the Second branch of our investigation, namely, Close or Inclosed Clumps or Masses of Wood. These are usually intended for the purpose of concealing such objects as require concealment, as accompaniments to the water, the approaches, or the like. They appear in considerable variety in this park, and are contrasted in a pleasing manner with the single trees, and open groups above described. There is one large mass of wood, of about two acres in extent, through which the Eastern Approach to the place passes. That plantation we will endeavour shortly to describe, both as showing the taste and skill, with which the park is laid out, and the general and extensive uses, to which the art in question may be applied, in similar situations.

This approach was originally laid out by Mr. White, and does credit to his professional talents. At one place, it seems, it appeared extremely desirable to that artist to mask or conceal the approach from the house and adjoining grounds, and it was equally proper, at the same place, to conceal the house from *them*. This desirable object could be effected only by means of wood; and as the ground, for the most part, hung or inclined pretty considerably towards the principal objects to be shut out from the approach, half a life-time might elapse, ere the desired effect could be produced from that quarter, by the ordinary mode of planting, as only four larches, and three beeches of considerable size, then stood upon these two acres of ground. But Sir Henry resolved to attain the desired end *at once*, by means of the Transplanting Machine, and he successfully accomplished it in a single season. Trees of various sorts, from twenty-five to thirty feet high, were then first planted as standards or grove-wood, at the distance of from eighteen to five-and-twenty feet, and the intervals were filled up with bushes, or stools of copse or underwood, from four to six feet in height, and five and six feet asunder. Thus, the appearance of a *plantation of considerable standing was immediately obtained*, and the eye effectually prevented from wandering among the stems, and discovering the actual extent of the boundary.

As the approach passes through this mass of wood, for about four hundred yards, we had an opportunity of viewing it to great advantage. The uncommon beauty, luxuriance, and closeness of the wood, together with the retired and sequestered appearance of the spot, struck us as particularly pleasing, contrasted as it was with the open lawn, which we had just before left. Here the standard trees, of course, were seen to make freer shoots, than those which stood singly upon the open ground, and the shoots of the underwood greater still. The underwood consists of oak, witch-elm, beech, birch, holly, hazel, mountain-ash, thorn, chestnut, English and Norway maple, common and Canadian birdscherry, and such other plants, as are usually found in natural woods; and from the shelter and warmth produced by such a mass of plantation, the luxuriance of these plants seemed wonderful, the shoots extending, in some instances of the maple, elm, and birdscherry, and even of the oak, to three and four feet in length, and upwards.

This plantation, which has all the natural luxuriance and wild richness of a natural copse, intermingled with grove or standard trees, had been formed only four years; and we are confident, that no less a space than from five-and-twenty to forty years, according to situation and climate, could have produced the same effect, by the usual process of planting and thinning out.

We proceeded next to examine other plantations or masses of wood, consisting of half an acre, a quarter of an acre, and less, in which grove and underwood are massed up together, in the same manner. We saw, at some distance, an island in the lake, which is wooded in this way. The ends of the bridge, which is thrown over the water, are likewise so wooded. Also sundry promontories or headlands, in order to break the water into parts, and give immediate effect to some prominent scenery; an object which they accomplish in a style very picturesque and pleasing.

We will now proceed to the Third head of our investigation, namely, to ascertain in how far the art is applicable to general purposes of utility or ornament.

It must be acknowledged, that the art of removing large-sized wood has hitherto been very limited in its application. The planting of a few pollarded, or at least mutilated trees, in a gentleman's lawn or pleasure-grounds, is all that it usually aspires to. In old books on planting, we read of princes and nobles, who removed individual trees, which it required twelve oxen to draw, and the most powerful machinery to lift or plant. But these were exertions of mere physical force, unaccompanied with skill or science. It seems to have been reserved for the present day, to establish the art upon fixed principles, and to turn it to any thing like practical utility.

From what has been stated above, it will appear to the society that, on Sir Henry Steuart's system, a lawn may, within a few years, be covered with single trees, and scattered groups of every description; and further, that inclosed masses of wood to any extent, and of such magnitude may be easily introduced into it, as will produce *immediate effect*, whether to persons on foot, or on horseback, and even from the first and second floors of an ordinary mansion house. For agricultural purposes, likewise, the art may prove eminently useful, in sheltering grounds, which are dedicated to pasture. To cover mountains with wood, to raise extensive forests, or even the broad bounding lines of a gentleman's place or park, the art would for obvious reasons be misapplied, and therefore, for those purposes, recourse will always be had to the common methods of planting. But we conceive it to be clearly made out, from what Sir Henry has done on a limited scale (and which may with the same certainty be applied to the most extensive purposes,) that *all objects of wooding for picturesque effect*, and for making, as it is termed, *a place*, whether on the foreground, or the middle distance of the landscape, *may be effected at once*, or at least within a very short period. Thus a man possessing extensive means, and having within a reasonable distance the command of a stock of trees fit for removal, may, in some sort, *create* what it used to take a lifetime, and sometimes two lives to obtain, namely, a park richly clothed and sheltered; and thus, the superlative luxury of well-grown woods, which was supposed unattainable unless by the slow effects of *time*, is brought within the reach of science and industry.

In proof of this, we will take the liberty of adducing one other example of what we saw at this place, the more particularly, as it is a striking evidence of the superiority in every way of *transplanted* over common woods, as the former are managed here. This illustration of the fact appeared likewise to us the more satisfactory, that it was given in a *comparative* way, and of which, therefore, we were fully enabled to judge.

At the western entrance-gate to the park, two plantations or masses of wood present themselves to the view, within about forty yards of each other, the one on the right hand, and the other on the left, and they run nearly parallel to the approach or coach-road, for some length of way. That on the left-hand side, as Sir Henry informed us, had been planted about five-and-thirty years since, in the ordinary manner. Nearly twelve years ago, the fir trees and larch had been cut away; and some time after, a certain proportion of the forest trees had been cut over, or copsed, in order to improve the closeness of the skreen at bottom. The plantation on the right-hand side is intended to cover the main head of the lake. It was executed with grove trees and underwood, in the style above described; and it was transplanted to its present site six years ago. On comparing these two plantations, the obvious superiority of the latter over the former was manifest to every eye. Its luxuriance, its strength, its closeness, were superior; and it seemed clearly more effective, for every purpose of either ornament or utility. In this contrast, the triumph of the *transplanting art* appeared complete, and its fitness for the general purposes of shelter or landscape seemed, in our judgment, very satisfactorily established.

The committee, having thus given their personal evidence to the complete success of Sir Henry Steuart's plan, will now proceed, agreeably to the Society's recommendation, to notice the two points specially recommended to their observation:—1st, the number of trees, which may have decayed after removal; and 2dly the expense of the operation.

On the first point, your committee are enabled to state with confidence, that the number of trees, which decay after having been transplanted, must be very small indeed. They had this point particularly in their eye; and, in traversing the whole of the grounds, they saw only one transplanted tree which appeared to have died, the others being all, to the number of many hundreds, in uncommon strength and vigour, those planted within the year only differing from the others, in the smallness, of their leaves, but exhibiting no symptoms of decay, either in bark or twig. The committee further beg to report, that if dead trees had been purposely removed out of the way, the operation could not, they think, have been so effectually done, but that vestiges of it would have been visible. Sir Henry supposes there may, in general, be *a failure of one in forty*, or *five-and-forty*. But doubtless, such complete success could not be attained in the first instance, until the planter had acquired a great degree of skill and experience, both as to the choice of the subjects, and the mode of carrying through the operation.

Upon the expense of the process, by which so pleasing and wonderful a change upon the face of nature is effected, with so much comparative rapidity, the committee are not qualified to speak with precision; for the season, at which they visited Allanton House, though the best adapted for seeing the *effects of the operation*, was not suited to the witnessing of the *operation itself*. In general, they beg leave to observe, that the Removal of Large Trees must be considered as a part of landscape gardening, and belonging, of course, rather to the fine arts, than to those which have utility only for their object; and therefore, the expense must not be weighed so scrupulously, as if a return of *actual profit* were the end to be obtained. Value, no doubt, every proprietor acquires, when he converts bare and unsightly grounds into a clothed, sheltered, and richly ornamented park. But excepting in the article of shelter, he must expect no more actual return* for his money, than if he bought a

* There is another species of "actual return," besides shelter, which does not seem to have occurred to the committee, and that is, the surprising augmentation of the *value of the pasture*, to a considerable extent, proceeding from the manuring and pulverising of the soil round the trees, at the time of planting.—See Note II. at page 402. *anteh.*

picture on canvas, instead of creating an original. When the difficulty of the task, which had hitherto amounted to an impossibility, is duly considered, with the extreme beauty of the effects produced, it cannot be thought extravagant, that the planting of grove and copse-wood on the two acres already mentioned, should amount (as appears from Sir Henry's memoranda) to about 30*l.* per acre. On the contrary, the committee believe, that no visible change on the appearance of nature, however trivial in comparison, could have been effected by the landscape gardener in any *other* manner, under three times the sum.

This is so obvious, that the committee conceive it to be only the purpose of the Society to ascertain, whether there is such, and so great an expense attending the process of transplanting, as to *interdict its being practised* by country gentlemen of ordinary fortune, who are neither willing nor able to bestow very large sums, merely, or at least chiefly, to attain external beauty. In this point of view, the committee are strongly encouraged to hope, that the Transplanting system can be adopted, with advantage in most circumstances, and at no extravagant expense. There are, upon most properties, strips and clumps of planting, in the taste which prevailed thirty or forty years ago, which have been thinned out, and they now furnish trees, at eighteen or twenty feet distance from one another. It is usually desirable to break the formality of such clumps or strips, and in such a case, the subjects for removal may be selected with advantage, both to the grounds which are to be clothed, and to the plantations, from which these individual trees are to be removed. Many of Sir Henry's subjects have been selected from such plantations as we have described. Where such do not occur, he proposes to raise nurseries, where trees shall be trained, for the special purpose of transplanting. But this mode of rearing subjects for future removal, your committee do not pretend to report upon, as they had not time to examine its advantages and disadvantages.

They cannot conclude this part of the subject better, than by an extract of a letter to their convener, from their experienced colleague, Mr. Laing Meason, who had an opportunity of witnessing the transplantation of several trees at Allanton House, and of forming a calculation, as to the expense of their removal.

"I regret very much (says he), that it will not be in my power to attend, as one of the committee appointed by the Highland Society, to report upon the system and practice of transplanting trees of a large size, as adopted by Sir Henry Steuart of Allanton.

"As I, however, passed some days at Allanton, in the planting season, and saw myself the whole process, I can, with some confidence, state my opinion to you, and the other members of the committee. It appears clear to me, that Sir Henry Steuart is the first person in this kingdom, who has adopted and practised, for years past, a rational system to insure success, in this hitherto difficult operation. The system appears to be, to disturb the processes of nature in the growth of the tree as little as possible, and when disturbed, to provide an efficacious remedy. It will naturally occur to the members of the committee, that it would be quite impossible to move the widely-extended roots of a twenty or thirty year old tree, without rupturing many, however carefully the earth were moved away; besides, the labour of following out long shoots would be immense. Add to this, that the nourishment drawn is almost entirely from the fine fibrous roots. Hence, the first operation is to cut off, at a due distance, the long horizontal roots, supply fresh mould, and allow, by waiting two or three years, the tree to form all around those fine fibrous roots, that are to nourish it in its new situation. This, and the actual removal, is all that the tree suffers in being moved to a new situation; and on this simple system, he seems the first, who has succeeded in any extraordinary degree.

"There are many very important considerations to be attended to, before that success can be secured, which have escaped others, who have attempted to transplant trees. One of the leading points is the choice of the tree. A tree taken from the interior of a plantation will not succeed, nor one of which the branches and spray, as well as the bark and stem, are not all *properly prepared* and in *due proportion.*

"Not less important is the care, with which the tree, and all its newly formed fibrous roots must be lifted; and again, these roots replaced in the new situation, as naturally as they were found, before the tree was removed. I decline entering into a detail on these important points, because Sir Henry Steuart, will, no doubt, favour the Society with a full and comprehensive narrative of his practice. I must, however, observe, that, although the detail would occupy many pages, yet when the operation is performed by his experienced workmen, it appears to a by-stander perfectly simple, and easy to be repeated.

"I beg on one subject to call the attention of the committee in a more particular manner, because it has been greatly misrepresented; and, unless the public be undeceived, the useful and ornamental practice of transplanting large trees never will become general. I allude to the expense. For the present, I set aside the consideration of the planting large portions of ground with young trees, to produce shelter or picturesque effect, which includes the loss of ground, and the expense of fencing, for twenty or thirty years. I confine myself to the mere expense of transplanting the tree, without the above comparison.

"I attended in March last, most carefully in the park at Allanton, to the operation of lifting, and placing in new situations two trees of about thirty or forty years' growth: the following is the result. Ten workmen began at six o'clock in the morning, to remove the two trees, the one twenty-eight feet high, the other thirty-two feet, by actual measurement; girth from thirty to thirty-six inches. The one tree was removed nearly a mile, the other about a hundred yards, and the whole operation was completed before six o'clock in the evening. The wages of the men amounted to 15s., so that each tree cost 7s. 6d. A pair of horses was used in dragging the machine, on which the trees were laid. Such was the expense of the operation. Now, if a comparison be drawn betwixt this expense, and that of planting groups of young plants inclosing and keeping up the inclosures, for five-and-twenty or thirty years; losing the value of the ground occupied by the groups or belts, Sir Henry Steuart's system cannot be *a tenth* of the expense of the common method. A few trees, of the growth of thirty or forty years, produce at once that effect, for shelter or beauty, that would occupy in young planting an acre or two of ground. On *the consideration of economy*, therefore, Sir Henry's system is most deserving of praise. But it is wrong to consider the practice of transplanting large trees, as confined to mere ornament, in the formation of parks and pleasure grounds.

"I have only farther to request the attention of the committee to the progress, that such trees have made, as have been transplanted some years, in the park at Allanton. I remarked more particularly the increase in circumference of the trunks of several of these trees, and the generally thriving state, and vigorous young shoots of those more recently planted. The committee likewise will not pass over the great disadvantages, that Sir Henry Steuart has to contend against. The soil of a great part of this park is most unfavourable for the growth of Trees. Some parts have a stiff and stubborn soil, others almost a dead sand. The district of country is high, and exposed to violent west and south-west blasts of wind.

"I have taken the liberty of giving this outline of Sir Henry Steuart's system, and of its utility to you, and the other gentlemen of the committee, as the result of actual observation, and a mature consideration of the benefit that may be derived from it. I trust, that the Highland

Society will soon be enabled to make more generally known the details of Sir Henry Steuart's practice." So far Mr. Laing Meason.

The process of Transplanting is beautifully simple. The tree having been well selected, which is a point requiring much skill and judgment (for both its stem and branches must be well prepared to resist the elements, and be duly proportioned to each other), undergoes the operation described by Mr. Laing Meason, of having its roots cut, and is, by the second or third year after, transported to its new situation, by a very simple engine, called the Transplanting Machine. In detailing this process, the committee had particular occasion to remark the openness, patience, and candour, with which Sir Henry solved every doubt, and replied to every question, which the details suggested. And, in general, the committee have no hesitation to say, that the operation is attended with no difficulty, which may not soon be overcome by attention and experience. They thought it best, however, not to attempt to describe with minuteness that which they had not seen in practice, having little doubt, that they may prevail on Sir Henry himself to afford these details in the form of an Appendix to this Report.

Upon the whole, it is humbly their opinion, that Sir Henry, by philosophical attention to the nature of the change, to which he was about to subject the trees which he has transplanted, has attained, at no extravagant expense, the power so long desired of *anticipating the slow progress of vegetation*, and accomplishing, within two or three seasons, those desirable changes on the face of nature, which he who plants in early youth can, in ordinary cases, only hope to witness in advanced life.

Signed, by order of the Committee,

Alex. Young.

THE END.