

FUNCTIONS OF THE FORESTER IN SOIL CONSERVATION.*

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When asked to discuss the application of forest restoration to land which has been tried by the farmer and found too poor for his purposes, I always find great difficulty in securing a common ground for discussion. My experience is that the forester is called upon under one or other of two assumptions. These are:—

- (a) That the land is too poor or too degraded for profitable farming, and that it therefore follows that it will grow trees successfully and yield a profit therefrom; or
- (b) That a sprinkling of trees will, sooner or later, restore the bulk of the area to farming use, and that it will thereafter yield a profit from both farming and forestry.

Now neither of these assumptions is correct, and when they are set out as simply as I have just done, it is fairly easy to see they are not correct, but it is seldom indeed that any layman has himself pre-analysed his assumptions as clearly as this when he sets out to discuss a forest question, and it takes much explanation before this common ground is reached. I may therefore be forgiven if I occupy some time in briefly explaining a few fundamental concepts of forestry which must be understood, if the function of the forester in soil conservation is to be understood. First of all, "What is a forest?" The legal conception of a forest is quite different from the popular conception of a forest, and the scientists' conception is something different again. Legally, a forest is an area of land to which forest law applies. It may or may not have trees on it. If they are there they need not form a continuous soil cover. Physically—and this is the popular idea of what a forest is—it is an area of land completely covered with tall trees, with or without undergrowth. Scientifically, it is a permanent or climax forest only if the tree species (they may in places be quite small and young) are growing in such a measure of harmony with soil and climate that, left to their own devices, they will perpetuate a soil covering in which trees will always predominate. These three conceptions (or definitions) of a forest have only this in common, that they all conceive of a forest as an *area of land*. This is fundamental to the degree that it may be deemed too obvious to mention, but by the same token, it is often found to be too obvious to remember, and the fallacy of many popular slogans concerning forests lies in their disregard of this simple fact that a forest is primarily an *area of land*. It is land *plus* trees, and our slogan builders, if I may mutilate a well known proverb, frequently cannot see the land for trees. This is the root, for example, of many fallacies propounded

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by what is now termed the "multiple use" forestry. Land and trees are one entity, the forest. Multiple users nearly always regard it vaguely as two separate components, land and trees. They would use the two separately, as well as in combination. Experience of centuries has proved the impossibility of this, unless a single *principal* use is protected by such stringent safeguards that the subsidiary users find their activities unprofitable. Failing such safeguards, the downward sequence is inevitable; forest degrades to jungle or second growth; jungle degrades to fern or grass land; grass degrades in turn to heath or to a broken association; heath degrades to desert. To show the matter in its simplest light, one need only say that, if a farmer plants trees to shelter his pastures, he cannot use all his trees for timber or firewood, and at the same time maintain his shelter. Forest science is frequently credited by the layman and by the publicist with skill to achieve this dual purpose. It just cannot do so in perpetuity from one small area of land. No one can eat his cake and have it, and no forester can teach or practise this art of double consumption.

Soil Conservation Forestry.

These two simple but extremely important considerations lie at the foundation of soil conservation forestry. The primary object of this type of forestry is to provide a soil cover all the time and for all time. The emphasis you will note is on "soil conservation" rather than on "forestry": the objective of the soil conservationist is to maintain the status quo of the soil under his jurisdiction, and particularly the physical status quo, and if he allows himself to be sidetracked by questions of timber production, of direct recovery of outlay from ultimate revenues, of rapid return of his forest land to agricultural uses, he is apt to find in the long run that he has achieved neither soil conservation nor forest production. His primary purpose of soil conservation and retention *must* be retained as paramount: all modifications of method based on expediency, cheapness, or ultimate profit from wood must be held suspect if they jeopardise in the slightest degree the achievement of the main objective. The forester must be allowed for this purpose to be the custodian of the land as well as of the trees.

Tree Planting not Necessarily Forestry.

This essential factor in any properly designed forest programme is apt to raise a storm of protest particularly in British countries, and New Zealand in this as in many other matters is even ultra-British in her point of view. It is immediately objected that millions of trees are grown on farmlands without interfering with farm production; that hedgerow trees and trees in odd corners have been very useful in the past and have provided thousands of farm posts and gates, millions of cords of farm firewood, even millions of feet of timber

saleable and useful. Just so, but they have not stopped erosion of the soil even on the more fertile types of farmland where they were grown, and they were not grown, nor will they grow successfully, as isolated hedgerow trees on the less fertile, steeper, more exposed pastoral country where the most complex erosion problems now arise. Parkland plantings of isolated trees or even small clumps of trees, and hedgerow plantings of trees are not forestry, and the forester is not a quack purveyor of patent tree species which will be effective soil holders or soil formers when used thus in conditions which are not forest conditions. Such work is arboriculture not silviculture; tree-gardening not forestry; and except in very localised cases cannot have any effect on soil fixation or erosion prevention. The forester, if consulted, will very gladly give his advice on species suitable for use in such arboriculture, but always with the proviso that he will accept no responsibility for their efficacy to achieve any results except those of provision of summer shade and amenity, and with the warning that unless they are handled and maintained in accordance with the highest standards of sanitary horticulture they constitute the gravest of all menaces to the forest hygiene of the country. Of this subject of forest hygiene, I shall have more to say later in this talk. It is sufficient at this stage to note that the enthusiastic but unskilled tree planter frequently overlooks it, and his proposals fill the sober forester with the gravest misgivings for the future.

Limitations on Use of Forests as a Protective Measure.

These misgivings arise from the forester's realisation of the fact that forests cannot be grown everywhere. There are limitations imposed by nature on tree growth and on forest growth, and it is the forester's profession and *duty* to recognise these limitations, and not to transgress them. There is a school of thought—or perhaps, it were better described as a school of unthinking belief—which expects that the skill of the forester can force trees to grow where no tree grew before, and that it can turn, as it were overnight, natural grassland or heathland into good forest land. This is to fly in the face of nature, and on foresters as on aviators who attempt this, nature will always have her revenge.

What then are these limitations that nature imposes on the man who wishes to grow forests for his own purposes? Volumes could be and have been written of them. Knowledge of them and respect for them constitute the science and the art of silviculture. But to put it very briefly they are the limitations imposed by the complex composed of the climate and the soil of the locality on the one hand, and the inherent characteristics and responses to handling of the plant species concerned on the other. *Within certain narrow limits*, deficiencies in one of these factors can be offset by adjustment of the others, but the limits are very narrow indeed, and it is failure to recognise their narrowness which has given rise to what I have just

stigmatised as the "school of unthinking belief" that some sort of forest can be devised to suit every locality. As has been said already, this is quite incorrect. There are absolute limits imposed by soil and climate in every country, which no amount of plasticity, of adaptability, of tolerance in trees will overcome. In New Zealand, the two most easily recognisable of these climatic limits are the altitudinal line of 3,500 feet (lower in the South Island), and the rainfall limit of 30 inches per annum. These are absolute forest limits for the Dominion and its particular climate; and no amount of juggling with tree species or adjusting of methods of planting and culture will enable one to create forests successfully above the altitude or below the average rainfall stated. It is of no use to point out that forest growth reaches the 8,000 feet line in the Rocky Mountains, or the 6,000 feet line in certain aspects of the Swiss Alps, nor is it anything but a travesty of science to advocate introductory trials of species growing in such altitudes and localities. The cold facts of science are that the tree as a life form, the forest as a vegetative association are inhibited in the New Zealand climate at an altitude of about 3,000 feet, and any attempt to overcome this barrier is based merely on wishful thinking, not on knowledge or on science. So too with attempts to create forests in the more arid and naturally treeless areas where the average rainfall is less than about 30 inches, and the minimum down as low as 15 or 18 inches.

Forest Health and Hygiene.

I have spoken of nature's revenge on those people who trespass beyond these limits that she imposes. It is not always swift, but it is always sure. It is often subtle rather than dramatic. If the transgression is flagrant—if, for example, a coastal species is carelessly planted near the snow line—then the revenge is swift and decisive. The trees die, the effort is wasted, the money is lost. You will doubtless accuse me of paradox, if I say that the forester will think you have got out of it cheaply. The first loss will have been the last loss, if the planter has wisdom to profit by experience. More usual will be the case where the transgression of the natural limits has been less flagrant, and the retribution in consequence less striking, less sudden, but just as sure and much more to be feared because it is less obvious. For small deviations from safe practice in forestry do not usually result in death of the complete stand, or even in immediate death of most of the individual trees that are planted. The process is a long drawn out one, the trees live on and grow slowly and unhealthily with numerous malformations, and with a gradually increasing crop of tree diseases both insect and fungal. Always there is the hope—nearly always a vain hope—that the stand will "grow out of it," as the phrase goes. Finally it may be that a year of climatic extremes puts an end to the sickly life of the unsightly stand. Throughout the more arid districts of the Dominion there are many scores of such sickly stands of pines on light shingle soils. The long

dry spell of the summer before the last put an end to many that had just held on to an unhealthy life for the past fifteen years or more. Winds of more than normal violence will periodically rase to the ground others of this precarious type, which have been planted in defiance of nature's limitations. The real danger, and the real retribution lies, however, not in the financial loss incurred by the over-venturesome originators of such faulty stands, but in the parasitic population either of insects or of fungi (or of both) that is bred upon them during their long period of lingering death. I am no alarmist pathologist, and I do not wish to imply that every sickly stand gives rise to epidemics of blights, but the danger is always there, and occasionally nature exacts the full penalty—a parasitic disease breeds up to epidemic proportions in unsanitary, impoverished stands planted outside the permissible limits of tree growth, or by methods inimical to tree health, and from the poor stands it then spreads to previously healthy stands, so that whilst it runs its epidemic course, these too are devastated and it may be that the possibility of future cultivation of a valuable and useful tree species is lost to the country. The history of forest pathology is full of instances of this nature—chestnut culture ruined in America by a fungus, in Italy by the so-called "ink-disease" of the 1930's: larch canker in Great Britain in the early part of this century. Nor need we go beyond New Zealand to find instances. Spruce which grew well in the South from about 1860, gradually, in the over dry, unsuitable sites of Canterbury, bred up an insect population which by 1920 virtually exterminated all spruces in the Dominion, and they passed, unnoticed by most people, from our list of forest trees. So with many species of eucalypt: so with wattles, which an unsightly gall-forming fungus is weakening until their culture is no longer desirable. Even more significant and perhaps less generally known is the fact that many of the large but moribund veteran macrocarpa cypresses which are a feature of old farmsteads in parts of the Dominion are heavily infested with the two-tooth longhorn beetle, which is so destructive a boring pest in buildings. Insanitary retention of such veteran trees has undoubtedly been a significant factor in the increase of this beetle. This is not the place to go further into details of plant diseases. The point to be made clear here is that epidemic diseases and bad forest hygiene, all arise in the first instance from faulty silviculture—not necessarily, or even usually, from spectacular faults, but from small infringements of nature's laws and limits, and these small infringements are often made with the best of intentions by those who wish the forest or the tree to do just a little more than nature intended it to do. Is it not obvious that the soil conservationist, with his eye focussed principally on soil improvements must be particularly prone to this fault, particularly prone to ask the forester to risk just a little more than it is safe to risk in extending the range of his forests, or in altering the methods of his forest establishment and maintenance? Is it then any wonder that the forester confesses to experiencing some

misgivings when he hears, and is even asked to countenance and recommend experiments and methods that are fraught with the gravest risks to forest health? The forester knows that poplar culture is one of the most intensive types of forest culture, that carefully rooted cuttings, well grown and tended for some eight years with almost vineyard standard of attention are the only way to secure quality poplar timber. He knows the poplar cankers and poplar blights that infest untended stands abroad, and he daily shudders at the sight of old poplar pollards, which are ready hosts and vectors of these blights. Yet he hears of the distribution and planting on a large scale, not merely of unrooted cuttings, but of bare rods and poles of poplar up to 10 feet in length and 5 inches diameter! The immediate objective of course is to get quick coverage and quick fixation of a moving soil. Undoubtedly, this objective can be achieved by this unorthodox method, yet the forester, when he views the successful achievement, can view it only with distaste and misgiving. The result is not a tree, but an uncomely pollard, and the test is not the present result, but the result twenty or even forty years hence, when the catalogue of the fungal flora and the insect fauna of the pollards is drawn up!

Even worse than this are the feelings engendered by reading recent newspaper reports that farming interests are actively recommending artificial dissemination of a fungous disease which has recently become lethal on common manuka in parts of the South Island. Surely such proposals must be repugnant to the soil conservationist, as well as to the forester pure and simple. Manuka is the cheapest and best natural forest pioneer species on much of the degraded land of the Dominion. It is surely misfortune enough to have a malignant disease occurring naturally on it in some few localities, without deliberately attempting to propagate it and accelerate its spread! In saying this I am well aware that the pastoralist on much of our hilly country has his manuka problem, but I trust that if he has endured this talk so far he will forgive me for expressing the opinion that deliberate spreading of an endemic disease is a remedy fraught with many risks.

Conclusion.

It will now, I hope, be clear that when I said earlier in this talk that the forester viewed with serious misgiving some of the current proposals for soil fixation and counter-erosion forestry, I was talking not lightly nor without due appreciation of the urgent need for speed in a soil reclamation programme. I would, however, be failing in a forester's duty, if I did not counsel caution as well as speed: for the forester must take and must preach the long view, and it is the condition of the land and of its forests half-a-century or even a century hence which is the forester's concern. If I may briefly sum up the gist of this talk, I would say that I have tried to bring home to you that the forester is concerned with much more than trees and tree

species. He has come to be, as it were, the trustee of the residual estate in that land which is not desired by his colleague the agriculturalist, and if he is to exercise his function as trustee, he must be allowed to exercise it unhampered by restrictions other than those imposed by nature. He does not and should not try indiscriminately to translate grassland or heath land into forest land, but sometimes nature is doing so, and it is his job then to assist nature if he can; to protect her always, if he cannot help her; and to thwart her never, or she will retaliate in the long run. To assist her, his device is silviculture, and it is of great use as a counter-erosion measure. Closely allied to silviculture is arboriculture, which is comely and useful in many ways, but is of little use for soil improvement or fixation. If land has deteriorated to such an extent that a tree remedy is necessary, then silviculture and conservative silviculture only can be depended upon. Arboriculture, being an art of infinite variety, and of but few constant principles, is not to be depended upon as a remedy for anything except correction of very local over-exposure to sun and wind, and faulty arboriculture, like faulty silviculture, is fraught with many dangers to the health and the well-being of all the forests of the country. The keynote for safety in forestry is caution and orthodoxy, with a full appreciation of remote as well as of immediate possibilities.
