

FORESTS AND EROSION

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I have chosen for my Presidential Address the subject of "Forests and Erosion," not because I have any patent formula which will solve all our troubles, but because I think it is time foresters had an exchange of views on the subject. In particular it seems to me desirable, when so many Institute members are serving on Catchment Boards, that the basic principles of the relationship of forests to erosion control should be discussed and, having due regard to differing local conditions, that foresters should attempt to work along more or less the same lines.

It is well known to you all that under normal conditions of geological erosion and without any interference by man, a very delicate balance is struck between the formation of soil due to rock-disintegration and the losses of soil due to wash, wind and other agencies. By far the most important single factor which is responsible for maintaining this balance is the mantle of natural vegetation, whether it be tussock grassland, scrub, high forest or any intermediate type. Accelerated or Soil Erosion is caused by upsetting the balance to such an extent that soil formation cannot keep pace with soil loss and this in turn is caused by some radical disturbance of the protective vegetative cover. Such disturbances can, I think, be classified broadly as follows:—

- (a) Over-grazing, over-burning and general bad husbandry of grass lands.
- (b) Deforestation of unstable hill country lands for settlement, uncontrolled logging of steep country, and destruction of virgin forest by fire, introduced animals and mining activities.

Any or all of these, singly or in combination, may be responsible for initiating the various types of erosion found in New Zealand to-day.

Let us consider in what way foresters are responsible for any of these causes and in what way they can assist in repairing the damage once it is done.

As a body we cannot be blamed for over-stocking, over-burning and bad husbandry; these abuses must be laid at the door of the people responsible for land settlement. They are due probably, in the case of Crown Lands, to lack of enforcement of Section 259 of the Land Act, and where freehold land is concerned, to the lack of any previous authority for controlling burning. With the passing of the Soil Conservation and Rivers Control Act of 1941 there is now statutory authority to prohibit the lighting of fires in any Catchment District, Soil Conservation District or Soil Conservation Reserve

except under certain prescribed conditions. This power of controlling indiscriminate burning has been sadly lacking in the past, and it is to be hoped that it will now be rigidly enforced.

On well established grasslands there is very little erosion problem, and the forester does not come into the picture except in the rare cases when he is asked to take measures to control some noxious weed. It is the marginal hill country lands where the forester becomes directly concerned. On these, the grazier as often as not is fighting a losing battle with invading fern and scrub, and has to resort to periodic burning in order to get sufficient grass for economical farming. There are widely differing practices on the treatment of such land. Some farmers will burn lightly, at the right season and without allowing the fires to spread. They are not deliberate "miner" farmers, and the damage they do in the repeated weakening of soil stability, is so gradual that the results do not become apparent for many years; and it is not then in every case serious. At the other extreme there are the farmers with a large proportion of scrub interspersed with a little grass who burn spring, summer and autumn, and rely for their grazing on the intermittent and temporary pastures following a burn, rather than on a good permanent sward of grass. Their practices lead to rapid soil deterioration with, first, loss of the top soil and then gulying. They are the worst type of "match farmers" and they are dissipating a national asset.

A further problem exists when the hill country farms adjoin and merge into protection forests. Many people contend, and with some truth, that a high forest bush edge is the safest firebreak a forester can obtain. Controlled burning, they say, will ensure an abrupt change from low fern to high forest and will reduce the fire hazard. Certainly a belt of unburned high scrub creates a most difficult fire protection problem. On the other hand an abrupt bush edge will never remain stable but will be gradually whittled away. The suggestion is sometimes made that the whole scrub belt should be planted up with exotics bringing the plantations right down to the edge of permanent grass where an adequate firebreak would be easy to construct and to maintain. Some authorities are considering this as a practical measure—the forester obviously is very directly concerned with their decisions.

In general there is an urgent need for classification of all hill country farms into those which can be economically farmed without practices leading to soil deterioration and those where the mining habit is already causing loss of top soil and which, therefore, should be allowed to revert to some more efficient form of vegetative cover. In the latter category is much former forest land which never should have been cleared. The forester is asked to repair the damage by replacing some form of vegetative cover.

The question of what type of vegetation should be introduced is a crucial one. The popular cry is for afforestation, preferably with *Pinus* species. The advocates of this policy give no thought to soil

or climatic requirements, to fire protection, or to subsequent utilisation problems. Afforestation in some form is perhaps the cure but the task will be very difficult and is one which should not be undertaken as long as there is any possibility of the area coming back of its own accord into native forest. If plantations are formed it will be necessary to protect them from fire and stock; a similar measure of protection, however, is generally all that is required to permit native species to re-establish themselves, particularly in the high rainfall districts. Protection without planting should perhaps be the slogan.

When erosion is already well under way and has exposed an impoverished and impervious subsoil, then only the hardiest vegetation will be able to grow. Valuable forest trees are out of the question. On such areas it will probably be necessary in the first place to establish quick growing species which do not demand much of the soil and only at a later date to introduce species of economic value. Some shrub species will act as soil binders but will do little to improve it. Manuka (*Leptospermum*) comes into this category and, although not a soil-improver, should be seriously considered in many districts since it acts as a nurse crop for volunteer native growth. Other shrubs, such as gorse, broom, *Acacia* and *Albizia*, will improve soil fertility and at the same time arrest erosion. They also are to be considered as a suitable intermediate crop. The cardinal principle to be followed is that if the farmer cannot produce grass and the forester cannot grow trees, then any plant cover which can be kept in bounds is better than none. The soil must not be left bare.

On the steeper slopes and particularly in areas of high rainfall, I am personally convinced that the best protective cover is the original plant association. On such areas this will be high forest. As a vegetation type it is the natural or climatic climax, and provided fire and stock are kept out, it is the association to which all others will develop. The numerous and inter-related protective functions of a high forest are too well known to foresters for me to expand on them here. It should be stressed, however, that New Zealand rain forests with their various tiers of trees, their dense undergrowth and their abundance of mosses and ferns, are perfectly adapted to perform all the protective and regulatory functions essential to the efficient conservation of soil and water. Nature has done a much better job than man can ever hope to do.

It is the removal of this high forest cover on steep and unstable slopes that has been the most serious factor causing erosion in the past and without doubt it must not be repeated in the future. Has deforestation already been stopped? During the last few years there has been little sign of recent deforestation by farmers. Perhaps they have learnt their lesson and see now that the early fertility following felling and burning will not last and that much land cleared for settlement is now a liability rather than an asset. Eroding and unprofitable hill country should revert to the State and be encouraged by the quickest possible means to grow an adequate protective cover,

whether this has commercial value or not. As well as deforested land, however, there is still a large area of privately owned upland country still carrying bush whose destruction should not be allowed to take place. At present the opportunity is there for the settler to clear if he so desires; the temptation should be removed. It is in the national interest that these lands also should come under the control of the State and should be permanently dedicated to protection forest. There is a soil conservation job waiting to be done here. Once the necessary machinery has been evolved, for compensation in the case of private owners and reduction in rent in the case of Crown tenants, it should not be difficult to arrange for tens of thousands of acres of the finest protection forest in the country to be put into its correct classification. I am convinced that this is one of the most important practical steps which foresters should advocate and that its immediate prosecution will be a major contribution to the country's soil erosion problem.

I would like now to discuss the various agencies, other than clearing for settlement, which may still be active in weakening or destroying the remaining native forests. Fire must be mentioned first. As was seen last year, under exceptional climatic conditions, podocarp forests will burn standing. I am inclined to the view, however, that a healthy, well-cared for podocarp stand is as nearly fire-proof as any forest can be. It is the dead snags in virgin forest and the dry debris and snags in old workings which create most of the fire hazard. Properly managed forests, with the dead and inflammable trees removed and access roads provided, could be protected with a minimum of effort and cost. Kauri forests are more inflammable than podocarps on account of the gum in the trees and in the soil. But experience in Auckland over the last 20 years shows that with even a modicum of protection they can be maintained intact. The beech forests, unfortunately, present a very different picture. Occurring as they often do in areas of lesser rainfall and being without the dense moist undergrowth, they constitute a much greater fire risk, and even in quite recent years large tracts have been destroyed by fire. They do have recuperative powers, however, if subsequent fires are prevented. Protection from fire for all types of forest as well as for the marginal fern and scrub areas, must constitute one of the most important problems the forester has to face.

Logging and milling activities must be discussed next. Generally speaking, the valuable merchantable forests occur on the lower levels where no great erosion problem exists. This is a fortunate thing, for it means that sawmillers are not interested in pressing for rights on the higher and steeper slopes which are so crucial from a protection point of view. Nevertheless, much of the low altitude merchantable forest occurs on hilly country and the forester must consider to what extent logging practices are responsible for inducing accelerated erosion. That some loss of soil occurs cannot be denied. Ground snagging, whether by hauler or tractor, will tend to form water courses

and these in times of heavy rainfall will cause undue and excessive run-off. Possible means of alleviating this type of damage are to place tractor roads along contour lines and at intervals to bulldoze "turn-offs" so that the water is by-passed into gulleys before it reaches the volume and velocity necessary for scouring. More important still, however, is to protect old workings from fire and stock. The rush of second growth following logging is most likely as efficient a protective cover as was the original forest association.

The third and perhaps most important agency at work on forest destruction is introduced animal life. Again in the low-lying forests the problem is not so acute, although here often cattle and goats are active in retarding the development of any regeneration. In the protection forests, deer are the most serious enemy and without doubt, if uncontrolled would cause a down-grading and eventual destruction of the forest. Their extermination, or at least, their reduction to insignificant numbers is an urgent necessity without which the perpetuation of protection forests cannot be assured. Of no less importance is the damage caused by grazing animals, deer, chamois and thar, in the sub-alpine zone above the upper limits of the forest. This is particularly difficult to deal with since the effects of the damage, in the form of moving shingle slides, are felt in the forest itself but the damage starts in areas which are sometimes out of the forester's control. As in all other matters connected with wild life, there is an urgent need for unification of control and better co-ordination of extermination measures. The wild life problem has many ramifications and not the least important is the effect of introduced vermin on our native bird life. Without doubt, such animals as cats, rats, stoats and weasels are taking a heavy toll of native birds. When one realises the dependence of so many native species on bird life for the dispersal of seeds, it is evident that bird protection is an integral part of forest protection and hence erosion control.

The forester then is concerned not only with the forest proper but also with the subalpine zone above it and certain fern and scrub areas below it. His interest must cease at the river bank whose protection becomes the job of the engineer. I would like finally to stress that river-bank control, necessary though it may be, does not tackle the root cause of the trouble. There is a definite engineering bias to soil conservation in New Zealand to-day—the bias should be ecological rather than engineering, and should have reference, above all, to the watersheds of the rivers where the real causes of erosion are to be found.

As foresters I feel we should give a lead in these matters. I would like to see a greater exchange of views and an attempt to formulate a policy which represents the considered opinion of all foresters who have to deal with erosion problems. It is to be hoped that this paper will be of assistance in focussing attention on to what is a matter of great national importance and that it may help to clarify some of the many complicated issues which are involved.