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ECOLOGY AND THE ADMINISTRATOR

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For the sheer purpose of surviving, primitive man had to possess a great deal of empirical knowledge about the animals and plants which surrounded him. He was, for a long period, a small, and often he must have been an insignificant, part of his surroundings. He would have had to develop a deep knowledge of both the individual and the social lives of other animals occupying the same habitat as himself. Much of this knowledge would have become instinct.

As time went on his learning increased, and he mastered knowledge about some plants and animals to such an extent that he began to manipulate them for his own use. This allowed him to increase productivity and so the basis was laid for building concentrated populations of human beings. Today, all of us have some knowledge of how the very large concentrated human populations are organised and succoured. Scientific advances in animal husbandry, in crop and food technology and in other fields are providing the basis for greater and greater increases of these insofar as food provides a basis for increase. Although a plentiful supply of food does not always mean an increase in population, there is no doubt that under certain conditions it does, just as it must have been the main stimulus to population increases during primitive man's early struggles for existence.

In spite of his knowledge of natural things, it seems that early man sometimes destroyed his habitats, and certainly as he began to aggregate into dense communities he did this. No doubt the cause was misuse of natural things through ignorance; primitive man must have had to struggle so hard for survival that it seems most unlikely he would have deliberately destroyed a habitat.

However, as sections of a community came to have less and less to do with land and the winning or production of food, the community as a whole began to lose both

the knowledge of and instinct for ecology which was an essential part of primitive man's equipment. The greater the concentration of people into towns and cities the greater the loss. There is no doubt that this loss also led to the wholesale destruction of habitats, for we have examples within historical times in Mediterranean and many other countries. There are even more notable examples, and less excusable ones, in recent historical times accompanying the European occupation of the so called "New World". This pattern is familiar to ecologists. It has been vividly described by such writers as Jacks and Whyte in *The Rape of the Earth*. These authors ascribe the rise and fall of civilisations to their mastery, or the loss of it, over soil. Their book commences: "To gain control over the soil is the greatest achievement of which mankind is capable. The organisation of civilised societies is founded upon measures taken to wrest control of the soil from wild nature and not until complete control has passed into human hands can a stable superstructure of what we call civilisation be erected on the land". They say further: "Soil erosion has made a knowledge of the underlying principle of human ecology — the art of living together with animals, insects and plants — one of the most urgent needs of mankind, . . ."

The most recent trend in this field — and it is a strongly developing trend — is the growth of national and international consciousness for the need to save or to improve man's habitat. This growth manifests itself in many ways. "Conservation", the catch-word to the movement, has come to be a bye-word — its meaning usually implying, "the wise use of natural resources". Conservation is the subject of national and international organisations and of many conferences. People use it when speaking of the use of renewable natural resources. Vari-

ations of the word are being coined, "Multiple use" of forest land has been the subject of a recent World Forestry Conference, though most foresters would maintain that they mostly use the land under their charge in this way. As you all know there is under consideration in this country a Bill setting up a Nature Conservation Council.

There are centuries of evolution between modern conservation and primitive man's instinct for ecology. The latter must have been acquired almost entirely because of the need to win supplies of food. Conservation still means principally this, of course, but it has also come to mean many things in addition, including the use of the habitat for recreation, an increasingly important aspect as population concentrations grow.

One might conjecture that much greater progress could be made in conservation, so far as the improvement of the whole human habitat is concerned, if human beings could return to that universal knowledge of ecology, but with a modern basis, possessed by primitive man.

The principles are simple. Animals live in populations which conform to patterns of some sort or other. A knowledge of these is necessary if we are to know anything about the animals at all. Plants have community structures and they pass through successional changes. Habitats can be analysed according to factors well known to students of ecology. Can these things be taught like multiplication tables and their importance grasped? Because they are, to human populations, quite fundamental. I quote, "It is a truism that every society must adapt itself to its environment to survive". This remains as true today as it ever was even though there are other quite different things that also now threaten society.

A few examples will serve to jolt us back to a realisation of how basic ecological concepts are in our everyday lives. But unfortunately, few recognise the ecological content of many problems that face them.

One that immediately springs to mind in this country is the control of rabbits. This introduced animal found the country as congenial as the European settlers did, and com-

peted with what success we all know, for the natural resource, grazing plants. The basis of the successful control that eventually came with the passing of the Rabbit Act was both political and administrative in its nature. Bold measures achieved a remarkable and, one might maintain, an unpredictable result. Recovery of over-grazed vegetation soon showed how devastating rabbits had become and that the result of their control can undoubtedly be calculated, over a period of time, in many, many millions of pounds in value of increased agriculture production.

Having achieved this result an ecologist would probably say: "Well, now we can control this animal when we want to. Let us therefore live with those that are left because this will be much cheaper. We can deal with outbreaks of populations when need be". Subconsciously this is probably the thinking by the owners of land still lying outside Rabbit Board organisation. In general, it is land that has always carried low rabbit numbers. But the policy is one of extermination, and one could maintain that in the absence of an ecological outlook generally it is the only safe one. An ecologist would maintain that the extermination of a wild, or naturalised animal throughout a country of the size and variation of New Zealand is not possible. Therefore, much unnecessary money will be spent in attempting to exterminate the last animal or even in keeping populations at an unnecessarily low level. But if extermination is not to be the policy, then some form of control must replace it; *and who decides at what level of infestation control operates?* Perhaps if everybody was ecologically equipped, politicians, administrators and farmers, the right stage might be agreed upon. In its absence, no agreement would appear possible.

It would seem that there is scope here for some politicians and administrators earning their keep by having a good working knowledge of ecology.

The same argument arises, much more vociferously, as you all well know, in connection with the introduced large game animals. I will not dwell on this problem for various reasons, but just remind you

that the argument about these animals rages around the theme extermination or control. Extermination is Government policy. If it were not then it would be control. And who would determine the level of control? Every State in America where deer hunting is carried on wages incessant war about this. Could sportsmen and land holders agree about animals on occupied country in New Zealand? There seems little likelihood of this if past results are any guide. In protection forest the problems are even more difficult and many of them puzzle even the best ecologists in this country today. Nevertheless, in the absence of extermination — which at present one has to admit seems remote — ecologists will be turned to for answers, and the administrator who can best translate those answers into policy will obviously be doing the most good.

The degree of control of game animal populations is a problem that concerns almost all countries that possess natural or naturalised sporting animals. Even in European countries, where the numbers of these animals is comparatively small and there is a great deal of accumulated knowledge about them, much money is spent both in administration and in ecological study to arrive at solutions that will satisfy opposing interests. Foresters, unfortunately, usually come in for special censure for the way in which they generally oppose the presence of large populations. However, these animals are not tolerated to any extent on agricultural land. The forest is, therefore, looked upon as their habitat. But the more intensive forest management becomes, and this is happening constantly throughout the world and especially so in New Zealand, the less tolerable animals become.

Turning to quite a different theme, and probably a safer one, that of land development companies that were rife during the period 1925–35. The unsound nature of many of these became so apparent that Government finally had to step in and amend Company Law to prevent matters going from bad to worse. They were essentially land companies buying cheap land, which at that time was still available in New Zealand, putting a crop on it and selling it and the crop at a greatly enhanced price.

Fruit trees, pine trees, tung oil trees, tobacco, *Phormium tenax* and possibly other plants were the crops. There were large investments and there were signal failures of crops. There was undoubtedly much shady business. Prospectuses for tung oil companies said that here was a tree yielding valuable oil, that could be grown on the poorest soils. They did not say that the tree had never before been tried in New Zealand. Today, there is no tung oil crop in New Zealand. Things might have been set to rights much sooner than they were, and thus considerable wasted capital investment turned in other directions if more people concerned with these schemes had possessed enough ecological sense to have known what was going on. As it was, one only of the promoters was tried at law, and that for financial malpractices. One could imagine a Utopia in which offenders misusing the habitat in such a way would be tried by a learned judge possessing a degree in ecology and passing sentence for sinning against ecological principles. This might have given more satisfaction to the investors than knowing that they had not one single pint of tung oil for all their investments and no redress.

We are all familiar with widespread weeds such as gorse and blackberry. We have been compelled to learn to live with both these and with many others. By and large intensive farming controls them. On unploughable country, however, a weed such as gorse sometimes becomes so dense, through a succession of fires, that trees are finally resorted to for control. A more recent weed arrival in our midst is *Nassella tussock*. It seems to have commenced its naturalisation about the beginning of the century. By the time concerted action to control the weed commenced it had spread over an estimated area of nearly 400,000 acres in different degrees of density. This action was greater than had been taken against any weed up to then. It amounted to the introduction of special legislation, the setting up of two boards under it and the carrying out of heavily subsidised control. These control measures are increasing in tempo. For a number of years it was thought that *Nassella* was confined to parts of Marlborough, with a heavy infestation in the Wrekin, and a more ex-

tensive area in North Canterbury with several centres of dense infestation. In the past year or so, however, the grass has been reported from a few other centres and reports continue to come in.

In relation to the amount spent on control, a very modest amount indeed has been spent on the study of the plant, including its botany and ecology. Yet these studies are essential if a prediction is to be made as to what is likely to happen to the plant in the long run. It will certainly not remain static as administrators might hope. Nor has it yielded particularly successfully to the controls so far applied. It is likely to be reported from many places yet. Can anybody define what New Zealand habitats it could occupy and what is to prevent it from occupying these in the course of time? If we could be like Rip Van Winkle and sleep for one hundred years, when we woke up the odds are that we would find *Nassella* over large areas of the eastern part of the South Island and possibly the North as well, but that we had learned to live with the plant just as we have learned to live with gorse and blackberry.

Phormium tenax is a plant for which the Maoris found a wide range of uses and it is one of the few plants they cultivated. Europeans followed up one of these uses, fibre, and quickly established a valuable overseas trade, that assisted materially with the economy during the colony's early years. The rise and fall of this trade has been well documented, and its relationship to the inducement of stands of *Phormium* in large swamps that were being drained. The disappearance of these stands came rapidly. Few realised that *Phormium*, being a swamp plant, required fine control of the water table both for the health of the plant itself and for the control of competing plants. Thus an industry based on a natural plant has almost died. It has been rescued in one or two areas only where leaf is harvested and stripped to provide fibre for New Zealand woolpacks, matting and rope.

But *Phormium* is a highly variable plant in many of its characters, including its physiology and the amount and quality of the fibre in the leaves. The Maoris had succeeded

in selecting high quality fibre varieties that would grow on dry land. This feat has never been accomplished by Europeans in spite of a certain amount of study of the plant. Nevertheless, Europeans only had to take the Maori selected material and experiment more widely with it, and they would, in all probability, have paved the way to success in keeping the industry going. The plant offers many opportunities of diversified methods of growing and harvesting. A great deal more has been done with a much less promising plant, sisal, which yields a hard fibre of a somewhat similar nature to that of *Phormium*. It is possible that in other parts of the world the growing of *Phormium* and investigations carried out on it will pave the way to establishing the fibre in world markets. It is now grown as a commercial crop in various places. One of the most unexpected is South Africa on poorish soils at an elevation of 4000 ft. and a rainfall of 25 in. The fibre is to provide the basis for some African industry.

Phormium is a plant that is to be found growing widely in horticulture throughout the world. It would be surprising if, in the course of time, it did not find its way equally widely into commercial cultivation. Some understanding, at higher administrative levels at the appropriate time, of the plant and its potential might easily have resulted in a New Zealand industry a good deal more substantial than it is today.

I could not, of course, leave this theme without saying something about the practice of forestry. Cultivators of plants or users of growing plants are, to some extent, practical ecologists unless they are the most advanced cultivators dealing with hydroponics or the culture of bacteria; they might then be chemists. Foresters, who are at the primitive end of the civilisation scale, so to speak, must be closely associated with ecology.

In a somewhat remarkable analysis of phases of cultivation, C. M. Smith gave the opinion that man's first efforts at cultivation constituted the release of plants from their natural surroundings (Dominion Over the Plants. *N.Z. Sci. Rev.* 9: 60-64). Foresters, in treating natural forests, are still groping with this method. Throughout tropical forest workings it is almost the only method

used, even though it might be hedged about with tools much more advanced than those used by primitive man; even chain-saws, and modern arboricides. Much ecological incantation precedes, accompanies or follows the treatments. Nevertheless, I used the word "groping" purposely, because the structure and composition of a mixed tropical forest is so complex, and the ecological knowledge so incomplete, that both methods applied and results are still largely guesswork; this in spite of a seemingly large amount of ecological study going on in these forests.

In natural forests of simpler structure, the beech, oak and coniferous forests of the Northern Hemisphere, the problems of management, so far as they concern regeneration and growth of the crop — release of trees at various stages — have been largely solved. The problem that remains in these forests is one of increasing production by manipulating release.

Within comparatively recent times man learned to cultivate trees in orchards and plantations. This method gave the forester mastery over his plant selection and the siting of plantations, and, if need be, he can manipulate the soil. He quickly grasped the great advantages these conferred upon him, and within recent times plantation culture has become one of the really vigorous developments in the world of forestry. It has played, and will, of course, continue to play, a foremost role in New Zealand. Throughout the world searches are being conducted for new forest tree species. The relatively unknown pines of Mexico have been objects of pilgrimage by foresters from several countries. Of the trees already introduced and showing promise, searches go on for better provenances and strains. Tree breeding work, both on natural and introduced trees, is increasing in tempo in many countries.

There have been outstanding achievements in plantation culture. There have also been notable failures. Those in New Zealand plantations have been extensive and costly. It is as well that they should be remembered. C. M. Smith expresses the situation as follows: "He grew so expert, so ambitious in this particular form of manipulating plants and their products, and the social forces mentioned exerted such economic

pressure, that the landowner over-reached himself in many ways and many of the greatest disasters of plant and land misuse and money loss occurred with these two forms of plant culture."

In order to bring the greatest success possible to plantations one must apply all plant knowledge, especially ecological knowledge, available. Although most of it must be discovered empirically, some of it can be applied in theory from knowledge that is already known. Once successfully established, the manipulation of a stand of trees is intricate. It rests upon the characteristics and response of individual trees and of the whole stand of which they are components. Again, I quote from Smith because I believe he stated the case with an understanding possessed by few: "These two cultures are similarly closely allied, and differ from the two previously described in that they are both based on complete removal of all wild (and therefore seemingly useless) plants and on a certain amelioration of the soil factors affecting the cultivated crop. The natural plant community is disregarded and wholly replaced. The land is deliberately induced to carry and to feed far more plants than it would naturally carry; and even, so far as the value of the crop plant will permit, the climatic factors are modified at crucial stages in the life cycle."

For all these reasons I would consider that, other things being equal, it would be a material advantage for forest administrators at all levels to possess at least an understanding of ecology.

The examples given here, rabbit control, the growing of *Phormium tenax*, forest practice and so forth, are but a few of hundreds that could be cited. In a country in which a large part of industry, and hence the daily lives of people depend upon biology, a knowledge of ecology, or rather of its principles, is of the greatest importance. At no level is it more important than at the top, but to get it at the top we must start at the bottom. I know school curricula provide for the teaching of some ecology at certain levels. But are these prescriptions the right ones and how are they interpreted? I suspect that there are few teachers who understand the principles of ecology. It may even be that a name other than "ecology" is needed before the science is readily accepted.