

The Environment and Agriculture

THE DYNAMIC ENVIRONMENT

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The environment of the biosphere consists of the atmosphere, the ground and waters, and all living and non-living matter. Matter, in an empirical sense, was considered to be neither creatable from nothing, nor completely destructable leaving nothing behind. The sum total of the contents of the earth, with rare exceptions like incoming meteorites or outgoing man-made space vehicles, would, therefore, seem to be broadly constant in terms of matter. We all know that our planet is full of changes, both visible and invisible. In all such changes there is a shifting of matter from one place, in one form, to another place in another form. If there were mechanisms to replace such shifts of matter with time, then the environment would by and large, remain constant with time, with only transient aberrations during periods when the shift of matter one way or the other is taking place. It is common knowledge that in an infinite number of instances where matter has been changed and/or shifted, there is no mechanism for the reverse process to take place to restore the environment to its original state. There is consequently, an alteration in the environment. This process is going on all the time. In some cases we know it is happening. If we recognize that it is injurious we can try to do something about it. In other instances, we know it is injurious but we do not know what to do about it. In still others, we know what to do about it, but we do nothing because of economic or other considerations. In the remaining instances we neither know it is happening nor do we know what effects these unknown changes would cause.

Matter, left to itself would soon enough be inertialized as it apparently is on the moon. For matter to behave the way it does on our planet it must be 'activated'. This activation requires energy. Our planet's source of energy is the sun. This energy is trapped, stored and used by this planet for all its activities. If there was no mechanism available to trap solar energy, then all life would disappear and the planet would inertialize itself. This is where plants come in. They are trappers, storsers and also, users of energy. If one considers the luxuriance of a tropical forest for example, one may be inclined to believe that plants are efficient trappers of solar energy. This, however, is not quite the case. They trap only about one percent of the radiant energy they receive. Nevertheless, this quantity is not only sufficient for the vital processes of growth and reproduction in order to preserve the species, but it also sustains all other forms of life like animals and humans which are themselves unable to trap solar energy. All the energy used for the vital activities of humans and animals are plant derived.

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The earth has a storehouse of energy in the form of combustible oils, combustible coal deposits and radiation-energy sources. These are being exploited by man to supplement his other sources of energy but not without its consequences. Radiation hazards, for instance, are too well known to recount here. Also, among the world's largest industrial corporations are those which serve to move man and his possessions from one place to another, based on the use of earth's not-inexhaustible reserves of combustible oils. The products of this combustion have to be released somewhere. In effect the high energy oil comes from the bowels of the earth and are used to transport men and materials, leaving the end products in the atmosphere, in water and on the ground surface. This process has been going on in one form or another ever since man discovered the internal combustion engine. How long it can still go on for, remains to be seen.

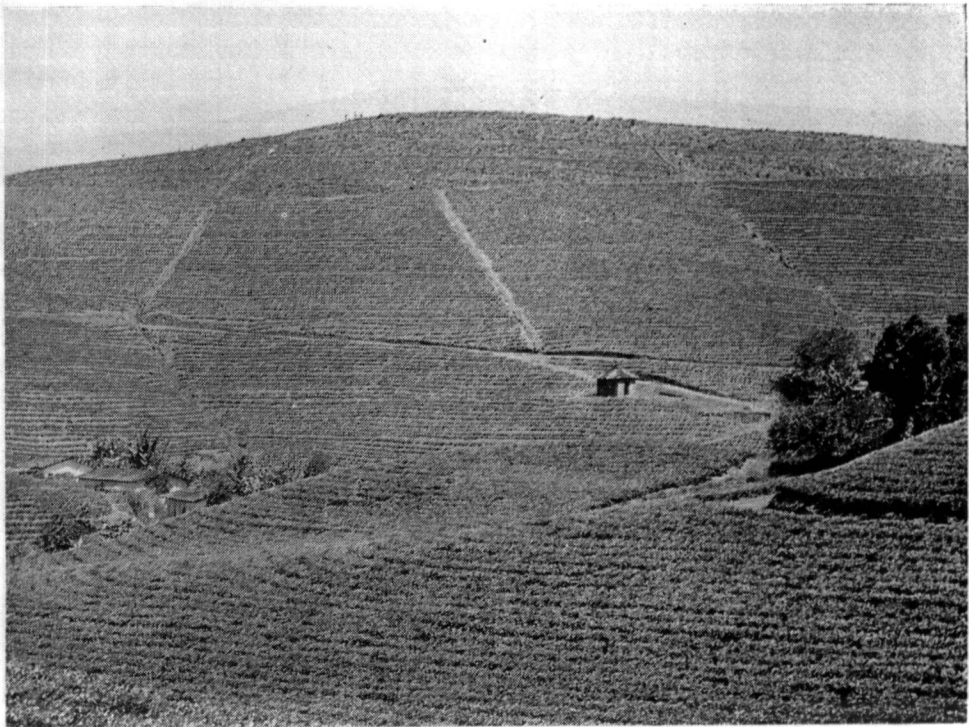
We have mentioned some ways in which man supplements the energy he derives from plants with energy derived from other sources. We must now look more closely at man's association with plants. The primitive human was nomadic and moved about looking for food from plants. When he found it, he consumed it, just as many animals do today. Then came a stage when man made a stupendous discovery. He realized that he could *grow* plants for food instead of moving about looking for plants which grew, apparently haphazardly, in various places which were often inconvenient to locate, and inaccessible when located. This discovery changed our planet significantly. It was the start of Agriculture, and it was also the start of urbanization. If man could grow his food, he would not need to move about looking for it but he could stay in the place where he grew his food. Here began the process of 'civilization'. This was also the beginning of the vast changes that man has brought about in the appearance, functioning, constitution and very existence of the planet Earth. The discovery was, essentially the discovery of Agriculture, from which the other organized activities of man have evolved.

In its early days, Agriculture was an art, a repetitive process, with perhaps much trial-and-error 'experimentation' on a very primitive scale. At first, it would have involved little change in the environment, but as it progressed, so did the changes in the environment. As society became diversified, and man's activities expanded to include activities other than the search for food, a need arose for man to provide food on a larger scale than merely for himself and his family. He had to cater to the food requirements of others, who in turn had to cater to his own non-agricultural needs. This development of society began to change agriculture, and also brought about bigger changes in the environment, ending up with the present situation where vast agriculture, intense urbanization, increased mobility and extensive, competitive exploitation of any and every resource became the order of the day. The competitive element has become so accentuated that man has developed the means to protect himself and the results of his efforts from the rapacious requirements of other men. In doing so, the prime objective is to develop agriculture, industry and technology to preserve himself, his property and his way of life, against the needs of other communities or societies ; but in doing so he changes the environment which sustains *all* life.

The profound influence of agriculture on society is always changing. As populations increase, there is a greater need to grow more food. The land area suitable for growing food continues to increase. As it does so, environmental changes also occur. Man's preference for some types of food results in the cultivation of such types on land areas which are ever-increasing in extent, bringing about greater changes in the environment. The land area available, however, is not inexhaustible and man is compelled to increase the efficiency of his food production without increasing land area, when limits on the latter have been reached.



Man's interference with the natural environment



The natural environment gives way to organized agriculture

This situation compels him to introduce better technology into agriculture. This, in turn, causes further changes in the environment. Improved technology also has its price. The all-important factor of economics has been introduced into agriculture. Man must not merely produce food, he must produce it at a price which is profitable. This forces him to adopt measures against factors which tend to depress his profits. He looks for economic short cuts in order to increase crops, reduce losses and improve the selling power of his products. These short cuts can cause further changes in the environment, which affect not only his own life and his agriculture, but those of all other forms of life with whom he shares this planet.

The economic benefits of improved agricultural technology accrues to the user of such technology, the suppliers of technological equipment, the country in which the product is produced, and possibly to the consumer of the product. Disadvantages of this technology may affect the immediate or distant environment, including people, animals and plants, and in certain instances, the consumer of the product. Persons who are called upon to decide whether innovations in agricultural technology have more benefits than disadvantages are, therefore, placed in a position of particular responsibility. They have to take heed of the extent to which the new innovation will benefit production, the agriculturist's and the particular country's economic position, the economic viability of the crop-producing industry as a whole, including the workers of that industry, the savings in cost of production, the increased output of produce and a host of other factors.

Against these factors they must balance the disadvantages resulting from possible adverse effects on the workers, the economic position of the industry and of the producing country, the immediate and distant environment, and the ill-effects, if any, on the consumer of the produce. In order to make the extremely difficult decision on whether or not the innovation should be implemented it will first be necessary to conduct an intensive investigation of the considerations involved, and obtain the necessary facts and figures, which needless to say, would be helpful only if interpreted correctly. Even if all the available information is at hand, we must remember that there would still be a great deal we would not know, and which is unpredictable, or at most, predictable with rather low degrees of accuracy. The decision, however, has to be made on the basis of the evaluation of known factors and the entrepreneur goes ahead with the project, with the advantages of economic success. Ideally, such projects should be done on miniature scales before extrapolation to vast scales. The results should be carefully watched for signs of trouble and should this prove risky, then the innovation must be suspended, before irreversible damage is done. This of course is ideal, but not always possible. Often, nothing is done even when signs of trouble show up. The results are, of course, catastrophic.

Agriculture is the growing of particular crops to the exclusion of others. It, is an alteration of a natural or balanced environment, however small its scale. More than any other crop in highland Ceylon, tea in monoculture, as did coffee before it, has changed considerably the natural balance extant in the Country's central mountains. Of the 120,000 or so hectares of tea situated over 900 m in elevation in Ceylon, a large proportion consists of estates, adjacent to each other thereby covering a large area of continuous tea land. This land was originally

covered with tropical montane forest, before it was cleared for coffee, cinchona and tea. Under such monocultural conditions, the persistence of unwanted occupants of land becomes even more serious a problem than it would otherwise have been on smaller and discontinuous areas.

Land which has been uninterfered with by man supports life consisting of both fauna and flora in a dynamically balanced association. To satisfy his own ends man interferes with this balance, and constantly endeavours to use land for raising plants and animals suited to his needs, thereby inflicting upon this balance, the consequences of his own selectivity. In this process he has to eliminate forms of life which already had claims to exist on such land. Keeping them out is man's eternal problem. But this is not all. After man has upset the balance, new encroachers, who earlier found no place on the land, now find conditions more amenable. They too stake their claim on the domain man thought was exclusively his, and they in turn must be kept out, if man's objective of raising his selected species is to be fulfilled. Man must, therefore, use his ingenuity and resources to protect his crop from both previous occupants of the land, as well as from new encroachers.

The foregoing account seeks to describe in broad general terms, the nature and dynamism of our environment with special emphasis on agriculture, man's needs and the results of his actions. It is clear that man cannot control the environment to his complete satisfaction without resultant side effects. A major consideration is the immense complexity of the environment and the interaction of each of its constituents with others. Man's knowledge of such interactions is very limited indeed, and his ability to predict changes in the environment with reasonable accuracy is very much more limited, despite his apparent success in isolated instances. As more and more information becomes available, therefore, he must review his earlier predictions and revise them where necessary. In order to understand our environment our thinking must be just as dynamic as the complex subject we are seeking to comprehend.