

Rangeland Management and the Environment

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Abstract

Management of the rangelands of the world for multiple use is a complicated process. Rangeland productivity can be increased by several means. However, some of these means have undesirable ecological consequences. There is a need for integration of range ecosystems management on a world-wide scale under an ecological framework.

Rangeland uses are multiple, but first among them comes grazing. Recreation is becoming increasingly important also but nearly exclusively in developed countries. Forestry, game production, nature parks, military fields, etc., are other uses.

The utilization of rangeland for any of these purposes can be made with or without control. If the control is a rational plan based on:

- 1) an inventory of the resources,
- 2) the calculation of the productive capacity under various systems of exploitation,
- 3) the regular and sustained harvest of a series of products without overexploitation of the capital assets which is made by the natural resources and the environment,

then it can be called a true "management."

Such true management—which should rather be called *aménagement*, to keep the word created by the French foresters of the XVIIth century, and its meaning (Baumer et Rey 1974)—is environmentally sound. Unfortunately, its application to the immense rangelands of the world is far from being achieved everywhere.

Rangelands are situated for a large part in the developing countries, and some of the less developed countries in the world are entirely made of rangelands or deserts or both.

From what can be seen in the rangelands of developed countries, such as the U.S.A. or Australia, it is obvious that range management specialists know the technical means to make the rangelands productive and to keep them in good condition, whatever their use is. However, not all the rangelands of even these countries are in a good condition, able to give sustained and regular products. In the Third World, most of the rangelands are not managed at all and are freely open to overexploitation. For some countries, for which range resources are the largest source—if not the only one—of internal and external income, this lack of management is a suicide as it leads to greater impoverishment of the already poor populations.

Rangeland Uses

The effects of the lack of management of the rangelands are known. These include soil erosion, salinization, sand dune formation, air pollution by smoke of forest fires, lack of water, pollution of water, quantitative reduction and qualitative degradation of the vegetational cover, including deforestation and degrassing, unbalance between animal species, etc. (Baumer 1978). Let us consider how the environment is variedly affected by the various strategies of rangeland use. Most of these strategies consist either in increasing the yield of the ranges or in improving their productivity.

The simplest way to increase the production of the rangelands is to extend the managed acreage. Range productivity can be increased without modifying the range by enlarging the possibilities of its development by removing the limiting factors which rendered certain areas unusable as rangeland, e.g., by removing stones. On the one hand the absence of the favoured species before the area was open did not allow its specific consumers and decomposers to be present; thus the harmful species will colonize more or less rapidly the new, desired species. As far as the other phytophagous and pathogenic organisms in neighbouring ecosystems are concerned, the change in ecological conditions may result in disturbances that can hardly be foreseen; thus, about 1000 species of Arthropods are estimated to have settled on lucern after its introduction with irrigation in the Central Valley of California (Van den Bosch et Stern 1969). On the other hand, insofar as the full spreading of habitats in the range is accompanied by an intervention into the ecosystem, some detrimental ecological factors may not have completely disappeared. This condition occurs when severe intra-specific competition weakens the newly introduced or favoured species, e.g., when a high density of vegetation does not allow a sufficient water supply to plant individuals.

The increase in production of the rangelands can be obtained by spreading of species in the whole of its potential area. While it colonizes new ecosystems, the introduced element can carry consumers on to its new habitats; at a later stage, the consumers may become so powerful that they attack in force their original range.

A third strategy to extend the managed acreage of rangeland is the introduction of a species by man in new ecosystems where the periodic conditions were not compatible with the evolutionary characteristics of the new species concerned. Usually, the genic pool of the introduced population is so limited that it does not resist attacks by aboriginal consumers and decomposers.

Ecological Management

In addition to increasing production of the rangelands, ecological management will also aim at increasing their capability for productivity.

Let us briefly consider some of these practices and their environmental effects.

First, the lengthening of the time during which a rangeland is used or the shortening of the time necessary to each generation, either of fodder plants or, on the contrary, of grazing animals, affects the environment. For example, fast-growing plants have less elaborate structures, especially protective ones, such as cuticle, or have more rudimentary substances reducing digestibility, which facilitate their consumption by stock or game, and their destruction by enemies: its results in an increased fragility of the system.

Second, increasing the production of useful biomass per acre is commonly obtained by multiplying the strata of useful vegetation in the rangeland: trees over shrubs over grasses as in the "deheisa" system of Portugal and Spain. On the contrary, the reduction of the canopy to a single layer, or further the discontinuity in that single layer, are self developing factors which induce an increasing reduction of the productivity and a consequent impoverishment of

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the environment. For example Lozinskij (1962) noted that colonies of certain destructive caterpillars "appear in areas overgrazed by cattle, an overgrazing which results in the destruction of the undergrowth and herbaceous vegetation, the cracking of soil and the clearing of forest. . . . At the same time, insectivorous birds and entomophagous insects are destroyed".

Third, production of optimum density of population is an other practice to increase productivity of the rangeland. It also induces important environmental effects, of which the most important probably is the homogenization of agrosystem, by elimination or reduction of the interspecific competition: this requires a careful study of the effects upon all the elements of the system and on the downward links in the food chain; for example the protection of pastures against insects is an application of attempts to modify interspecific competition aiming at favouring consumption by cattle; but the use of low specificity chemicals can be harmful to cattle, and via the latter, to man. Consumption or decomposition of biomass is important to man. It has even been considered (Eckardt, 1974) that meadow plants have developed towards a strategy which increases the green biomass produced when they are grazed to allow the maintenance of a sufficient photosynthesis.

Fourth, it is also possible to increase the productivity by improving the species. Species can be improved by increasing the performances of cultivated plants and bred cattle; for example, by selecting high yielding forage plants or by increasing the number of muscular fibres per kilogramme of veal or the protein content of Legumes sprouts. The aim is to increase the biomass of useful products in comparison with the total biomass of the individual. Among the consequences are broader requirements of nutrients and, therefore, an impoverishment of the environment if more inputs, such as fertilizers or irrigation, are not brought into the system; on the contrary, if these inputs are brought into the system, there occurs a risk of pollution of the environment.

Fifth, another way to improve the species is to ameliorate their quality, such as palatability of a forage plant or flavour of meat. Numerous processes aiming at that kind of improvement tend to channel the use of energy and metabolites, for example cutting grass at the stage it is the most nutritious. These processes are producing so-called wastes which, in fact, may become inputs into other systems; for example, the cut horns of a cow becoming crude material for craftsmanship. . . . or for manure.

Environmental Impacts

All these interventions are not without effect on the environment and especially on the sensitiveness of crops and livestock to enemies. They may often result in a greater fragility and thus a lower resistance to parasites, predators, and nuisances. The use of machinery in the ranges causes changes in the relations which should not be overlooked, as Lincoln pointed out (1969). A striking example of sensitization of the environment to nuisances and especially to diseases comes from the homogenization of the biota; each narrowing of a genic pool constitutes a danger. Examples are numerous; thus, since 1955 the number of bovine breeds which are raised in France declined from 30 to a few, and 90% of artificial inseminations are made with the sperm of only five bull breeds.

For An Other Development in a New International Order

These few data underline the extreme complexity of the environ-

mental effects of rangeland uses. They show there exists neither permanent solution nor hierarchy in the values of strategies, nor ideal recipe, nor all-purpose solution. That, a century after Darwin and Haeckel, some people aim at searching for an ideal technique show that mechanism and fixism still left deep impressions, as Labeyrie (1977) reminded recently.

Another conclusion can be drawn, which concerns mainly the developing countries, and therefore should concern all of us: environmentally sound solutions to the problems of the rangeland uses are known, but they are not applicable except in the context of An Other Development, aimed at creating a New International Order.

As Professor Göran Sterky, of the Swedish Agency for Research Cooperation with Developing Countries pointed out in a recent issue of "Development Dialogue" (1978): An Other Development is totally man-centered. As it was defined and elaborated in the 1975 Dag Hammarskjöld Report ("What Now"), An Other Development should be:

<i>need-oriented</i>	being geared to the satisfaction of man's needs, both material and non-material,
<i>endogenous</i>	stemming from the heart of each society, which defines in sovereignty its values and the vision of its future,
<i>self-reliant</i>	relying on the strength and resources of the society which pursues it, rooted at the local level in the practice of each community,
<i>ecologically sound</i>	utilizing rationally available resources in a harmonious relation with the environment,
<i>based on structural transformation</i>	originating in the realization of the conditions for self-management and participation in decision-making by all.

We wish that, taking into consideration the recommendations of many strong voices in the U.N. system and elsewhere, including those of Albert Tévoédjrè (1978), Mostafa K. Tolba, Paul-Mare Henry (1975), and others, there be immediately developed through existing structures such as F.A.O. and the Man and Biosphere project, an intensive effort at the world scale for an ecological management of our only one earth, specially of the rangelands of its poorest parts, the arid and semiarid zones.

It is a matter of justice. It could become a matter of death or life, for all of us.

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