

A Story in Two Parts

Advance of the Barren Earth

Ray Anderson

Man and His Livestock

Man learned to domesticate animals to improve the dependability of his food supply long before he learned to gather and plant seeds. This early beginning of a more comfortable life occurred on the grasslands of the Mid-East and North Africa, the cradle of civilization. Man and his animals thrived and multiplied on what was then pasture. Man constructed permanent dwellings at the scattered locations of permanent water, and either killed or frightened the wild game away. Removal of the wild game was accompanied by removal of the harsh numbers control on grazing animals imposed by nature, in the form of occasional drought. Man dug wells to permit year-long grazing where the game had only grazed seasonally. Later, individual herdsman and tribal groups began to compete fiercely for use of the land. Overgrazing began several thousand years ago in these areas of early human history. In time, man was to carry this destructive practice to all of the arid and semiarid regions of the world, or to two thirds of the earth's land surface.

Even on the grasslands of the western United States, which were conquered only a short century ago, serious grazing damage soon occurred. Old comparative photographs of beautiful grassland prove it. The cattle business boomed, personal fortunes were made, and the native bison disappeared. As has been the case everywhere, the primary cause of overgrazing was uncontrolled private competitive use of communal or public land. However, and largely due to ignorance, privately owned land also was overused. The penalty for Americans today is greatly reduced numbers of livestock and rigid government controls on grazing. This is much less serious than the conditions existing in many other countries.

The fragile nature of semiarid grassland and the vital need to manage it carefully were not well understood by man until too late. A major world food resource has been severely depleted, or destroyed forever in some cases, while the human demand on food resources grows rapidly.

Desertification

The earliest evidence of overgrazing is a gradual and largely imperceptible replacement of the big and nutritious perennial grasses by annual grasses. Together with climatic fluctuation, our predecessors were not aware that serious changes were occurring. Then, the annual grasses were gradually replaced by weeds and brush—all of this being the reverse of desirable plant succession. With the single exception of goats, our domestic livestock species will eat these



Livestock waiting their turn to be watered at a communal well in Niger, Africa. The traveler has advance notice of the nearness to a well for the ground is bare up to a kilometer in all directions. It is common to see cattle, sheep, goats, burros, and camels all waiting at one well. The wells are hand dug to a depth of 25-35 meters and the water is pulled up by hand. Fragile grasslands cannot support such an excess of animal life.

invading plants only under the threat of starvation. The total amount of vegetation is also reduced. At that point the economics of raising livestock come under question, for the name of the game is to thrive instead of to survive. As the animal pressure on the fragile land increases still further, the sheep and cattle can no longer survive and only the goats remain. Man's final unthinking attack on the land comes in the form of nomadic populations breaking off the few remaining shrubs for fuel, and their hungry goats eating the few remaining replacement seedlings. This is how productive grassland eventually becomes barren desert, and hence the origin of the term "desertification."

Even a forest is not safe from this destructive conquest by man and his animals. In this case the process begins with lumbering to build human shelter. Whatever remains standing is then consumed at the cooking and heating fire. Again, the ever present goats clean up the straggling seedlings. The next stage is weeds too small for fuel and perhaps some odd grass here and there, with these in turn doomed to disappear in the final phase of the desertification process. An excellent case in point involves a personal experience in Asia Minor (Turkey). While I was viewing an open grass and weed site not far from the capital city of Ankara, on the Anatolian Plateau, it was related that a forest had once flourished here. In fact, the invading Hannibal had concealed his elephant cavalry in that forest just prior to an assault on Ankara.

Economic and Social Consequences

Denuded land has a low water infiltration rate, often as little as one tenth that of grassland. Bare soil sheds water readily since it has developed surface draining patterns and is sealed tightly by raindrops impacting on its surface. The

Mr. Anderson is a private consultant in international range management and livestock affairs. In addition to wide experience in the U.S. ranching industry, he has also worked in Mexico, Venezuela, Brazil, Iran, Turkey, Botswana, Kenya, and Niger.



An example of American foreign aid in Niger. This soybean meal was for human consumption during the five year drought across the African Sahel.

result is water and wind erosion of the thin top soil, and ultimate loss of the irreplaceable soil resource. Instead of becoming soil moisture where it falls, rainwater moves across the land and accumulates into damaging floodwater at lower elevations. But there is one more final outcome of man's misuse of grassland: the destructive floodwater with its cargo of topsoil causes expensive man-made reservoirs to fill with sediment. The big dam that was to be the salvation of the region is destined for a short life.

Grassland is used for grazing because it offers little other economic utilization to man. On a small unit basis it does not offer great benefit to man. But there is also very little economic input, or none at all in many areas where grazing is practiced as an entirely "extractive" industry. However, the sheer vastness of the overall extent of grassland in the world makes the resource of great value to man in terms of meat, dairy products, leather and many other by-products, as well as the means of earning a living for many millions of people. Grassland is the only significant resource that many countries have, especially in Africa, and a primary resource in others that earn income from exporting meat. It is a neglected and forgotten resource in still others where the economy is currently based on oil or some other mineral export. It is important to note here that if properly managed, the grazing resource is self-renewing, while the minerals are not.

The result in human suffering is the loss of a way of life at best and hunger and starvation at worst. The surviving herdsmen migrate to population centers, where there is no

employment for them even if they did have useful skills to offer. During periodic drought, which is a fixed characteristic of grassland climate, these proud and otherwise fiercely independent people must reduce themselves to the social mercy of domestic and foreign disaster assistance. The five-year drought across the African Sahel, which left human deaths in the thousands and livestock mortality in the hundreds of thousands, is well remembered by those of us who tried to cope with the problems.

What Can Be Done?

No one knows how many millions, or billions, of hectares of the earth's grasslands have been damaged or devastated. Climatic fluctuations complicate any attempt at evaluation. We do know that as a result of loss of the thin topsoil that much of this land is beyond reclaim—it can never be restored. We know that virtually all grasslands have been damaged to some extent. But, looking at the other side of the coin, we also know that the condition of most of this remaining land can be improved by changed management, and that much of it can be restored to original productivity by modern revegetation technology and equipment.

Aside from the management option, which involves too many social, cultural and political problems to discuss here, the revegetation option has become more of an economic than a technical question. In some cases the countries that need revegetation most can least afford it, or can't afford it despite an acceptable cost-benefit ratio. The Bureau of Land Management in Arizona states that a cost of \$75 per hectare is too high. However, there are many private ranchers who can face the economics of revegetation, along with a number of countries that can now undertake such programs on their public or communal lands. Examples of these statements are financially comfortable ranchers anywhere, and the oil exporting nations of North Africa and the Mid-East. (We come back to where desertification began). These latter peoples should be turning some of the incoming wealth to their soil and to self-renewing resources. Mexico, too, is now reaching a financial position where it can devote newfound income to improvement of depleted, yet basic, biological resources.

Because the deteriorated condition of grasslands is not well understood, and the existence of the knowledge and equipment to restore them is not widely known, little thought and planning have been devoted to the opportunities available.

Technology for Reversing Desertification

Grassland Resoration

Revegetation is more of an economic than a technical problem. For many years the knowledge, the domestic and exotic seed, and the machines to do the job have been available. Aerial and ground seeding have been tested with and without soil preparation, with and without brush removal, and with a wide variety of expensive machines. Twenty years ago grass and seed fertilizer were tried in pellet form. To destroy brush, heavy marine anchor chains were pulled between two large tractors. Chemical destruction of brush was also tried (now illegal in many countries).

We learned that several operations were necessary for successful revegetation, but also that the combined cost was too high. Where cost has not been a factor, and with the help of normal or higher rainfall, it has been possible to guarantee successful revegetation. However, the land administrator is forced to consider the cost-benefit ratio. The high imbalance of cost has tended to maintain revegetation efforts on more of an experimental than an operational basis, especially in the countries needing it most. High cost has been the economic roadblock and anything less than normal rainfall has meant a high risk of project failure.