ISSN 0951 1911
Paper 27a
March 1989

A SOLUTION TO DESERTIFICATION: HOLISTIC RESOURCE MANAGEMENT[1]

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[1] This paper is reprinted in abridged form from 'A Solution to Desertification: and Associated Threats to Wildlife and Man', Transactions of the 51st North American Wildlife & Natural Resources Conference, pp116-124, Reno, 1986.

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The Problem

Land deterioration, or 'desertification' as it is called in its extreme, is the most serious problem facing the world today. Disappearing wildlife and plant populations are some of the earliest signs of desertification. Unfortunately, most people do not heed these signs until those farming and ranching the land disappear and eventually the villages, towns and cities they support.

Because mankind has not yet understood the desertification process and its causes, many tragic mistakes have been made and continue to be made, exacerbating the situation. The early civilisations in the arid and semiarid areas that today lie under desert sands are testimony to the past mistakes. In Africa, the looming environmental disaster indicates that mistakes continue to be made, while in China and many other parts of the world deserts continue to expand at an alarming rate. In America, the same mistakes are leading to tragic results. In central New Mexico, there is a large basin drained by the Rio Puerco which, as recently as the turn of the century, was known as the 'bread basket' of New Mexico (Sheridan 1981). Today, it is a desolate valley, slashed with gullies, deserted villages and irrigation works.

Before any problem can be solved, it must first be recognised. Following recognition, it is then most helpful to learn what the causes of the problem are. However, in the world's developed countries, there is little acknowledgement that desertification is a serious problem outside the Third World, despite evidence the contrary (Sheridan 1981). There is a widespread belief in the developed countries, including America, that we have solutions for desertification in the Third World (and for declining land productivity in the United States) if only people would apply them.

An inspection of the many hundreds of reports and papers dealing with the massive environmental disaster building up in Africa will indicate that the causes are 'well-known'. Timberlake (1985) outlined and summarised many of these 'known' causes. In Table 1, I have listed the major known causes for Africa's deteriorating environment. Alongside these, I have given the comparable situation in the State of Texas. I use Texas as my American example since its environment is not as harsh as much of Africa, it does not have the poverty or high population and, for the most part, the land is privately owned. Almost any American state west of the Mississippi could have been selected.

Table 1: Major causes for desertification in Africa compared to the present situation in the State of Texas

Africa	Texas
High rural populations	Very low rural population
Overstocking	Little or no overstocking
Too much tree cutting	Relatively little tree cutting
Bad run of droughts	No run of droughts
Cultivating unsuitable soils (steep slopes, etc)	No necessity to cultivate steep slopes, etc
Low general education of farmers	Thousands of graduates owning and operating land
Poverty	Extreme wealth
Communal tenure of land	Private tenure of land
Shifting agriculture	Stable agriculture
Insufficient fertilisers, herbicides, machinery, etc	Massive availability of fertilisers, herbicides, machinery, etc

Poor and somewhat corrupt administrations	Large bureaucracy with low level of corruption
No extension service	Large universities and extension services

When seen in this manner, the two situations reflect as opposites. What we see as causing desertification in Africa does not appear to exist in Texas. From this, then, it is logical to reason that desertification is not a problem in Texas. Unfortunately, this is not the case. In 1977, the western half of Texas was already being described as suffering from moderate to severe desertification (Dregne 1977). In 1985, approximately 100 farming families a week were leaving the land. On August 15, 1985, the Austin American Statesman carried five different articles connected to serious environmental degradation in the state and the proliferation of ghost towns. Since 1900, stocking rates have dropped an average of 1.5 animal units per section per year (Bently 1902, Merrill 1959).

Clearly, we do not understand what is causing desertification and the consequent loss of plant and animal life. It is no surprise that our costly and well-meaning efforts to halt it are consistently failing. In 1985, a significant statement was issued at the end of an International Arid Lands Conference sponsored by the University of Arizona, UNESCO, the US Agency for International Development and the American Association for the Advancement of Science, among others. The statement (Stiles 1985) read in part: "An International committee of 13 arid lands scientists from nine nations have urged their colleagues to determine why years of effort to improve life in the world's dry regions have failed. Scientists must clearly tell global political leaders why those efforts failed, they said ... It has become gravely evident that with a few exceptions, the welfare of the people occupying many of the arid lands and the health of the underlying resources of air, water, soil and biota are continuing to degrade ... It is not a simple matter of additional funds or of new technology or of further research along conventional lines. The central challenge is to translate our accumulated experience into approaches that see people in their environment whole, and to embody that view pervasively in new activity and policy."

A SOLUTION TO DESERTIFICATION

A potential solution to this worldwide problem originated in work begun in Africa 30 years ago - to halt the decline of large wildlife populations. Known as Holistic Resource Management (HRM) today, the work has been refined into a planning and management model that incorporates a holistic view of human, financial and biological resources. The HRM model is used by resource managers (including farmers and ranchers) to guide them in their management to ensure that it is economically and ecologically sound.

The first step in using the model is to decide on a goal. The ecosystem is then evaluated to see how it must function to achieve that goal. Next, the model is used to decide which of the tools available to mankind should be applied toward achieving that goal. And finally, a number of guidelines in the model help the manager determine how best to use those tools to achieve his goal in the most economically, socially and ecologically sound manner.

The Goal

Unlike resource management to date, HRM cannot be applied without a clear goal. The goal is always expressed in three parts. First, there is the ’quality of life’ sought by the people from the environment under management. This is followed by the ’production’ desired from the ecosystem to attain that quality of life. This takes many forms - profit from crops, timber, livestock, wildlife or recreation, as well as less tangible forms of production dealing with aesthetics, culture, educational and scientific endeavour. Finally, there is the ’landscape description’, which is a futuristic description of the ecosystem that will produce and sustain that production.

The Ecosystem

Anywhere in the world, a goal defined as indicated will rest on the ecosystem. The ecosystem is conceptualised as four foundation blocks which are: water cycle, mineral cycle, succession, and energy flow. Although they are, in reality, one entity - the ecosystem - they are broken out in this manner to aid in the practical application of the tools that will be used to take us to the required landscape goal.

The Tools

Three broad categories of tools are available to mankind to manipulate the ecosystem foundation blocks to the desired goal. These are: 'money and man-hours of labour'; a group of tools that are applied directly to the ecosystem through money and/or man-hours of labour - 'fire, rest, grazing, animal impact, wildlife and technology'; and finally, human creativity. No other tools are available to mankind.

The Guidelines

We can have the finest tools in the world, but without an understanding of how to use them we are prone to drastic mistakes. The guidelines are a fast-developing part of the model that guide us on the application of any of the tools to the ecosystem blocks.

Once the goal is established, the resources involved (biological, financial and human) are continuously monitored. A control process is linked to this to ensure that no major deviation takes place except through natural catastrophe or human error, in which case a replan procedure is initiated.

THE MISSING KEYS

Although the process of applying the HRM model has proven successful in practice, it has generated considerable controversy. This reception is understandable because some of the knowledge on which the model is based goes against long-held beliefs. Historically, acceptance of new knowledge has been particularly difficult when the new knowledge has conflicted with what people 'knew' to be true and not merely what they 'thought' was true (Beveridge 1957, Boorstin 1983).

There were four major discoveries that had to be made in connection with environmental deterioration and with resource management before the desertification problem could be understood and before the HRM model could be devised. We refer to these four discoveries, made over the last 60 years, as the four 'missing keys'.

Holism

The concept of holism was first expounded by Jan Smuts 60 years ago (Smuts 1973). Although Smuts provided the basic ideas, it has taken us a long time to absorb the knowledge and realise its importance in practical application. Elsewhere (Savory 1985a, 1985b, 1986a), I have given explanations of Holistic Resource Management and spelled out how very different it is from interdisciplinary management. For many years, I made the mistake of using the two terms interchangeably, thinking they were but two faces of one coin. I now realise that they are totally different concepts.

Basically, many people had appreciated that the single-discipline approach to resource management was not succeeding. Advances to the integrated approach - the multidisciplinary approach and then the interdisciplinary approach - were little more successful (Naveh 1983). In all of these approaches to resource management, we essentially looked at the management of total resources from the points of view of our various specialities. However, where the whole was made up of interrelationships greater than the sum of the parts, we only studied perceived parts in all of our disciplines and never the whole from which the disciplines were derived.

We use the HRM model to look at the knowledge available in all of our disciplines from a 'holistic point of view'. We subject the knowledge to testing through the model and then apply the knowledge as long as it passes the tests and leads us towards achievement of our goal. This application of knowledge is then 'holistically sound', to the best of our current knowledge.

It is apparent that the most difficult aspect of HRM, based on my own experience and that of other scientists, is the transition from interdisciplinary thinking to holistic thinking, which involves a complete paradigm shift.

Brittle and Nonbrittle Environments

The next essential discovery was that we have two broadly distinct terrestrial environments that are not distinguished by the amount of rainfall they receive. We had always known that we had jungles, forests, savannas, grasslands and true deserts, depending on rainfall. We had always known that the areas that were arid and semiarid were desertifying worst. We had always known that if we rested any of these environments from overuse in any form they would 'improve'. If an overgrazed grassland was rested, it would again have vitality - a complexity of species and stability. Our first inkling that this was not the case in all environments occurred in Zimbabwe in the early 1960s, when livestock there was almost totally removed from deteriorating national land, followed by 50,000 or so head of game dying of malnutrition and related factors. The area, contrary to all beliefs at the time, did not 'recover' with the removal of the animals as it was supposed to do (Savory 1969).

The things that we 'knew' did not explain situations such as the lack of anticipated recovery mentioned above. More generally:

1 Many of the areas of the world desertifying seriously were high rainfall areas with 50 or more inches of rain. Other areas not desertifying badly after hundreds of years of 'abuse' were only 20-inch rainfall areas.

2 All of our many efforts at reclamation were consistently failing, no matter how many millions of dollars we spent on stock reductions,

wildlife culling, reseeding, brush clearing, soil contouring, etc. All of these measures should have contributed to improvement and success according to our knowledge and research, but they did not. This is now starting to be acknowledged publicly for the first time (Stiles 1985).

3 Many of our 'wild' areas and national parks were developing obvious management problems when 'left to nature'. Where we had 'culled' game populations to reduce riparian damage, such damage persisted.

We have had to introduce new terms to explain the new discovery: 'nonbrittle environment' and 'brittle environment' (not to be confused with fragile environment - a fragile environment can be either brittle or nonbrittle).

The degree of 'brittleness' of an environment runs on a continuum from very brittle to completely nonbrittle. The more brittle the environment, the greater the speed of the desertification process under current agricultural, wildlife and range management practices.

In Table 2, I have taken the two extremes of very brittle and nonbrittle environment and listed the major differences discovered to date. In this, a grassland is used as the example, since grasses provide most of the soil-stabilising influence in arid areas where problems are greatest.

The Role of the Herding Ungulate in Brittle Environments

The third of the discoveries is closely linked to the one just covered, but it was actually discovered before the different forms of environment were clearly observed and understood. It has to do with the physical impact (trampling, dunging, urinating, rubbing, etc) of large herbivores in the ecosystem. This is more than the mere trampling, etc, and involves the behaviour of the animals and their relationship to their predators as well as their home range or territorial movement and the evolution of whole communities of soil, animal and plant life.

We have now been able to link this with brittle environments and finally understand the essential connection between the animal impact and behaviour now lacking in the worst of the desertifying lands. We can now see how some of our early civilisations initiated the destruction of the agricultural base they depended on by their mere presence disturbing the habitual movement patterns of the wildlife populations on the water catchments controlling their fate. When these civilisations introduced livestock to these same areas, they did not replicate the effects of the wildlife populations.

Table 2: Differences between nonbrittle and brittle grasslands

Grassland Characteristics	
Nonbrittle	Brittle
Reliable precipitation	Unreliable precipitation
Reliable growing seasons	Unreliable growing seasons
Erect-type grasses of unclumped form	Erect grasses of a strongly clumped nature
Plants closely spaced as a function of the climate	Plant spacings tend to be wide and more a function of large animal numbers and behaviour than climate
Decay of old material rapid and largely biological	Decay of old material slow and largely chemical (oxidation)
Breakdown of old material starts near the base of leaves and stems and takes place largely on the ground	Breakdown of old material largely a weathering process starting at the unprotected grass tips
Old plant material held by close plant spacing regardless of the presence of animals	Old plant material easily eroded as animal impact decreases and plant spacing increases
If rested from any form of physical disturbance, can develop great species diversity and stability	If rested from any form of physical disturbance, species diversity and stability decreases
Dependent on climate for diversity and stability	Dependent on disturbance for diversity and stability

Heavy overgrazing produces tight plant cover in a near monoculture (small bare areas may develop near points of extreme concentration)	Heavy overgrazing produces bare ground between plants, but plant spacing is controlled mainly by animal impact rather than overgrazing

What took us a long time to discover, even after we understood the importance of animal impact in brittle environments, was that inadequate animal impact combined with overgrazing has a very adverse effect on the ecosystem - much more adverse, in fact, than does overgrazing on its own. Animal impact tends to offset to a high degree the adverse effects of any overgrazing taking place at the same time. We have on file photographs which show the effects of 50 years of severe overgrazing alongside 50 years of nondisturbance in a brittle grassland area of New Mexico. Fifty years of heavy overgrazing combined with adequate animal impact has led to a living grassland of small, closely spaced young plants. The average space between grass plants is about one to two inches. Just across the fence, one finds that 50 years of no grazing at all on Chaco Canyon National Monument land has led to serious destruction of the grassland, with very large spaces between old remnant grass plants. I’m not praising the results of 50 years of overgrazing, I’m merely here trying to point out the far greater damage from 50 years of nondisturbance in a brittle environment. This discovery, which caused such controversy in the 1960s that no reputable journal would publish the findings, has now been supported by some excellent work done in East Africa (McNaughton 1984).

Overgrazing Related to Time Not Numbers

The fourth of the discoveries required to solve the problem of desertification was provided by the French scientist, Andre Voisin (1961), who discovered that ’overgrazing’ by livestock was a function of ’time’ and not ’numbers’.

Controlling ’time’ is easy with livestock, since we can herd them, fence them in and move them at will, to control the amount of time plants are exposed to them. More complex is controlling time with wildlife species that are not self-regulating and are dependent on predation and natural catastrophe to control numbers. We are in our infancy learning how best to regulate 'time' in wildlife management, but at least we now know what we have to achieve. We also know that it cannot be achieved by controlling numbers alone (Savory 1986b).

Whenever animals are on the land, whether by design or accident, there is always a 'time dimension' involved. This time dimension affects both the overgrazing of plants and the animals' physical impact on the plants and soils. The very worst combination for most brittle environment grasslands is to subject them to overgrazing of the plants simultaneously with low animal impact as mentioned above. Unfortunately, this was by accident the very underlying basis of most of our modern range management - we reduced livestock numbers and scattered them thinly on the land in our efforts to avoid overgrazing and overtrampling, but in fact continued to overgraze and overtrample because we did not control the time. Most importantly, we deprived the land of the beneficial form of animal impact that was necessary to sustain its health. This, at last, begins to account for how we have managed to cause more damage to our brittle environment rangelands in a century than nomadic people had done in a few millennia (Savory 1985a).

CONCLUSION

It is clear from the failure of our efforts in many countries to halt the desertification process - deserts are now advancing at a rate of nearly 15,000,000 acres a year worldwide (Worrall 1984) - that something was missing in our knowledge of the problem. Four discoveries have been made that enabled us to design a simple holistic model to manage resources successfully in a sustained and economic manner. Excellent results have now been achieved in many situations, and we have witnessed positive grassland improvement, even in a severe drought and under increased livestock stocking rates while protected plots in the same seasons have deteriorated (Cardon 1983, Savory 1984).

HRM offers great hope for all resource management situations. The Center for Holistic Resource Management, a nonprofit membership organisation located in Albuquerque, New Mexico, was formed by a group of resource managers, researchers, ranchers, farmers and environmentalists, to provide training and dissemination of knowledge on HRM. Working in an international collaborative effort, the Center now also acts as a focal point for the rapid increase in knowledge that is taking place through practical application of the HRM Model.[1]

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References Cited

Bently, H L (1902) 'Experiments in range improvements in central Texas', USDA Bur. of Plant Indust. Bull. 13, 72p

Beveridge, W I B (1957) 'Difficulties', pp142-154 in The art of scientific investigation at Random House, New York, 239p

Boorstin, D (1983) The discoverers, Random House, New York, 745p

Cardon, B P (1983) 'Range management: the past and the opportunities for the future', Rangelands 5(6):266

Dregne, H (1977) 'Desertification of arid lands', Economic Geography 53(4):325

McNaughton, S J (1984) 'Grazing lawns: animals in herds, plant form, d coevolution', American Naturalist, 124:863-886

Merrill, L (1959) 'Heavy grazing lowers range carrying capacity', Texas Agricultural Progress 5(2):18

Naveh, Z, and Lieberman, A (1983), p56, in Landscape ecology: theory and application, Springer-Verlag, New York, 322p

Savory, A (1969) 'Crisis in Rhodesia', Oryx X (1):25-30

Savory, A (1984) 'Barlite ranch progress astounding despite drought', pp1-5 in The Savory Letter, No 5, Center for Holistic Resource Management, Albuquerque, NM

Savory, A (1985a) 'Savory comment', pp 1-5, in The Savory letter, No 7, Center for Holistic Resource Management, Albuquerque, NM

Savory, A (1985b) 'Holistic resource management', in Holistic Ranch Management Workshop Proceedings, J Powell, ed., May 1985, Casper, Wyo., Wyoming Ag. Ext. Serv.

Savory, A (1986a) 'Savory comment', pp1-5, in The Savory Letter, No 12, Center for Holistic Resource Management, Albuquerque, NM

Savory, A (1986b) 'The time dimension in wildlife management', The Savory Letter, No 12, pp12-13, Center for Holistic Resource Management, Albuquerque, NM

Sheridan, D (1981) p14, in Desertification of the United States: report of the Council on Environmental Quality 1981, US Gov. Print. Off., Washington, DC

Smuts, J C (1973) Holism and evolution, Greenwood Press, Westport Co, 361p

Stiles, L (1985) 'Pros ask validity of dry land measures', Lo que pasa 9(11):2, University of Arizona, Tucson

Timberlake, L (1985) 'Africa in Crisis: the causes, the cures of environmental bankruptcy', International Institute for Environment and Development (Earthscan), Washington, DC

Voisin, A (1961) Grass Productivity, Crosby Lockwood & Son, Ltd, London, 371p

Worrall, J (1984) 'Lip service paid to halt desert', in the Calgary Herald, Calgary, Alberta, Canada