PEOPLE IN RANGELANDS: THEIR ROLE AND INFLUENCE ON RANGELAND UTILIZATION AND SUSTAINABLE MANAGEMENT

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Summary

Most of the problems associated with the management of rangelands and especially those dealing with rangeland degradation are people problems. It is not really possible to manage natural resources without engaging the land users themselves in the process. Most cases of serious land degradation arise from misuse of land by people who are under great pressure from a harsh environment and often tough policy decisions that adversely affect them. Relief from the pressure by such policy instruments as improved legislation, fairer prices for inputs and outputs, income re-distribution and subsidies can make a huge difference to how people behave. The coping strategies of subsistence herders often involve destructive practices and the notion of sustainability is far from their minds as they eke out an existence at the margin of society.

Even under commercial ranching conditions in developed countries the policy environment and market conditions play a major role in how people use the land.

1. Introduction

Rangelands comprise over 40% of the earth's land surface. Rangelands are not suitable

for cultivation because of low and erratic precipitation, rough topography, poor drainage, or cold temperatures. As one of the most prevalent land systems on the planet, rangelands are critical habitats for myriad plant and animal species and form many of the world's watersheds. Rangelands are those parts of the world where pastoral people graze native and domestic animals on native vegetation. But rangelands resources are also utilized by people who harvest products including water, fossil fuels, mineral ores and other saleable commodities as well as "invisible' *ecosystem services* (Table 1).

Provisioning Goods produced or provided by ecosystems • **Food** • **Fresh water** • **Wood fuel** • **Timber** • **Fiber** • **Biochemicals** • **Genetic resources**	**Regulating** Benefits obtained from regulation of ecosystem processes • **Climate regulation** • **Disease regulation** • **Flood regulation** • **Water purification**	**Cultural** Non-material benefits obtained from ecosystems • **Spiritual** • **Inspirational** • **Aesthetic** • **Educational** • **Recreational**
Supporting Services necessary for production of other services ● Soil formation & conservation ● Nutrient cycling ● Primary production ***Supporting biodiversity***		

Table 1. The benefits people derive from ecosystem services fall under three main categories.

Healthy ecosystems provide vital services such as water flows, nutrient cycling and biomass production which underpin rural livelihoods (Table 1). As ecosystems become degraded, their capacities to deliver such services are undermined. Furthermore, healthy ecosystems buffer against extreme weather events such as recurrent droughts and floods. These capabilities are undermined as ecosystems are degraded by land degradation. The relationships between land use and ecosystems are dynamic as usage patterns shift and ecosystems evolve. Every land use option we consider has associated consequences for ecosystems and livelihoods and the resilience of ecosystems has significant bearing on what land uses are viable in the future.

Human security in rural areas is therefore a growing concern due to their vulnerability to ecological changes. However, human security is also impacted by economic changes; increasing commercialization and specialization of agriculture have pointed to concerns that small farmer/herder households may be left out of the growth process unless specifically empowered to effectively participate and benefit from it.

Both human activity and natural events have an impact on the biophysical resources of ecosystems. These activities and events include grazing of livestock, wildlife; seasonal events; wildfires; introduction of exotic plants and animals; land clearing; and changes to land use. It is clear to many, that humans are keystone species within all the world's rangelands. Human (managerial) actions affect the survival probabilities of the key species of an ecological-economic system. In turn, the well-being of these species translates into the well-being or the resilience of the underlying ecological-economic

system. Decisions taken about land use, the number, livestock species to use, season of use and stocking density will have profound and far-reaching effects on the stability, and ultimately, the sustainable use of rangelands.

Realization of the importance of these decisions has led to the concept of "ecological footprints" (Pastore and Giampietro, 2000) that seek to characterize the impact on households, on the local community and the broader region. An amoeba diagram has been used to characterize the ecological footprint of a typical subsistence farming/herding situation (Figure 1).

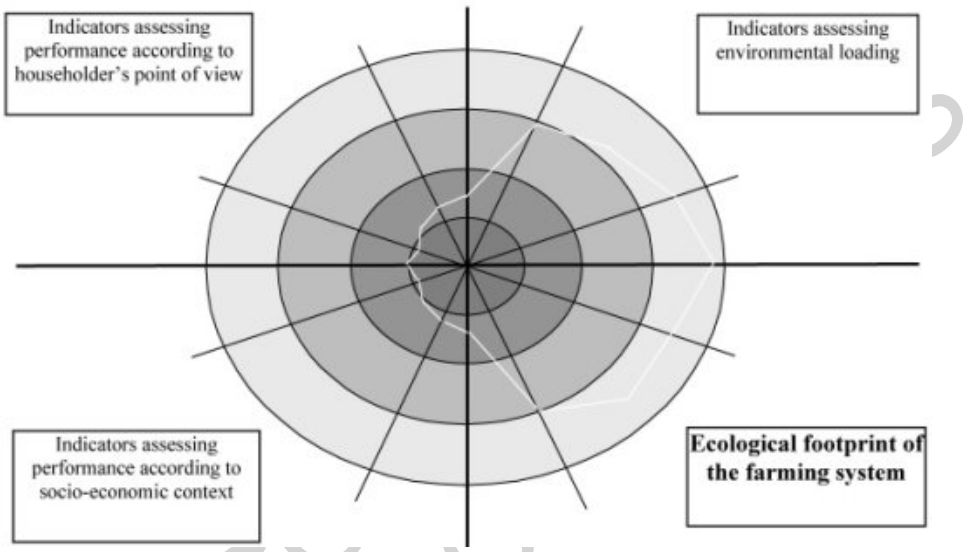

Figure 1. A typical amoeba reading representing a subsistence farming system. Dark (near center) is 'bad' and light (near perimeter) is 'good'. So, this sample system (in white line) has 'soft' ecological footprint but does not do so well for the regional economy nor does it provide a high level of welfare to the household. Of course not all subsistence farming has such a soft ecological footprint.

Enormous varieties of human communities live in and depend directly upon rangelands for their livelihood; many others rely on the rangelands for recreation and for its spiritual values. Today many land use strategies and methods are no longer suitable in the face of economic and political changes and because of population growth and the trend for nomadic pastoralists to become sedentary. Other factors frequently identified as contributing to desertification and preventing sustainable natural resources management are: lack of legal security for land users, land tenure issues, lack of technical expertise, and unfavorable global economic factors (notably world trade conditions).

Wars, political upheaval and other human-induced catastrophes also contribute to processes of land degradation in some countries e.g. Afghanistan and some Central Asian countries. These developments have led *inter alia* to soil exhaustion, overgrazing and deforestation, thus placing in jeopardy the future of the productive natural resources base.

2. The Economics of Common Property Resources

It is important to realize that rangeland resources in developing countries provide more than just forage for livestock. In practice, they provide foods, fuels, medicines and building materials on which poor people depend. Current trends in many areas of the world show that livestock raising is steadily eroding these communal rangelands, "grassland" and "forest" resources to the advantage of richer stock owners, farmers and at the expense of the poorest groups.

The socio-economic changes that profoundly affect herder communities are both effects and causes of the degradation of grasslands (Table 2). The coherence and homogeneity of herder communities have disintegrated as new employment opportunities and production practices widen income differentials between households and disperse economic interests and labor resources among many sectors besides livestock.

Nature of change	**Impacts**
Forced migrations of herders expelled by drought and desertification	Increased risk of land degradation in areas to which they migrate
Increased livestock raising by farmers as there is reduction in traditional exchanges with herders.	Increased risk of over exploitation of grazing lands farmers share with herders
Ecological crises have seen the transfer of livestock ownership to major absentee owners	Increase in the number of paid shepherds who are not motivated to conserve rangeland resources
Shifts in herd composition and choice of species	More goats with higher survival potential and greater stress on forage plants
Traditional knowledge and is being eroded as is the structure of herder communities	Less care taken with rangeland conservation
Change in relations between herders and farmers	Cessation of manuring of farmlands by animals of the herders and the use of crop residues as a fodder supplement
Higher reliance on off-farm employment and the cash economy	Labor shortages for rangeland management, more emphasis on education
Markets for livestock products have altered considerably.	Change in herd composition and age structure

Table 2. Socio-economic changes that affect rangeland in many developing countries

During the second half of the 20th century, several factors have combined to weaken indigenous rangeland management institutions and resource-sharing arrangements, while constraining herd mobility that permitted sustainable livestock production at adequate subsistence levels. Throughout the last half of 20th century, expanding human populations have led to an increase in cropped areas (often new irrigation developments) at the expense of grazing land. Typically the rangelands suffered from increased pressure on grazing and browse together with accelerated degradation and desertification.

In 1954 H. Scott Gordon wrote that " …. most of the problems associated with the words *conservation* or *depletion* or *over exploitation* in the rangelands are, in reality, manifestations of the fact that the natural resources of the rangelands yield little or no economic rent (Economic rent refers to relative value of land closer or further from the urban centre or some other strong economic foci. There is gradient based on the likely economic return from a unit of investment.)."

The simplified version of Ricardian rent gradient model (Figure 2) may be a useful model. It acknowledges that returns per ha of land are highest in the urban areas and least in the desert margins. Where society cannot reap enough rewards there is little or no investment.

Livestock production on rangelands in many parts of the world is an activity on residual lands. Unlike agricultural systems in the wetter regions, pastoral systems are characterized by a true collaboration with nature rather than a control over nature. Raising livestock lies at the outer end (5-6) of the economic rent spectrum; i.e., where the return per ha ($ per ha) is lowest (Figure 2). Within this livestock raising sub-spectrum, commercial ranching more commonly occurs in the moister, more reliable part (4-5). Semi-nomadic, transhumant and other more traditional systems based on migration of livestock and the people who depend on them, occur at the extreme end of this economic rent spectrum in the most marginal areas (5-6). There is a strong correlation between the 'rate of return from each ha of land' and the rainfall regime. Two factors are critical – the actual amount of rainfall and its variability. Generally, the lower the mean annual rainfall, the higher the variability and the greater the risk.

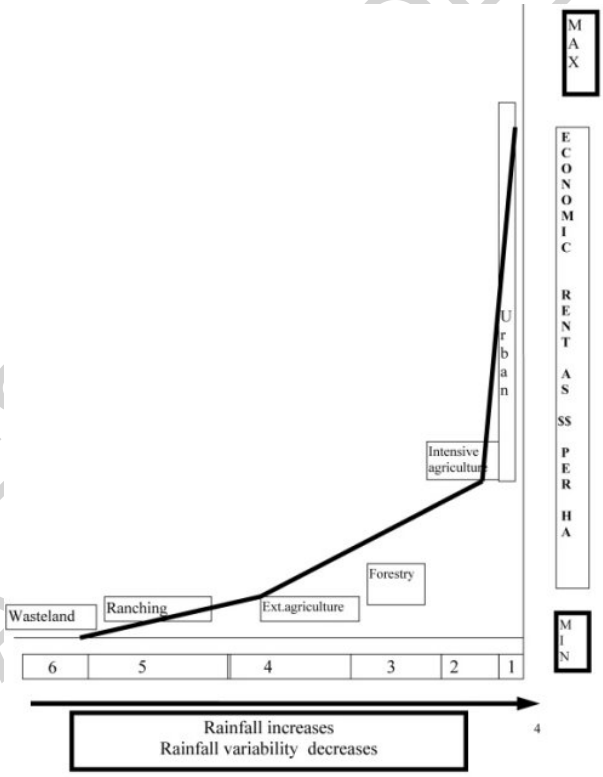

Figure 2. There is a gradient in economic rent from the urban land (far right) through to wasteland. Much traditional pastoralism/herding occupies land in the region of 5 to 6

Starting at the extreme extensive margin (point 6) it can be seen that the economic value of the land and its related natural resources is so low as not to justify any management regime. That is, the per-unit cost exceeds the social value. Such lands and their associated resources would be under a regime of open access (Under common property

regimes usage and access rights accrue to specified groups or communities of people. Non members are excluded. Sets of rules define the rights and duties of members and non-members with regards to access, as well as use and management.). Therefore any use, no matter how destructive, was less harmful than the costs necessary to preclude it. Between points 6 and 5 there would be an open access regime over the land and its related resources. At points 4 to 5 the economic value of the land as evidenced by the rent gradient, is sufficient to warrant some management. Here society develops an institutional structure that is adequate to manage the benefit stream from the land and its related natural resources (See *Range and Animal Sciences and Resources Management*).

One of the wider problems of rangeland development is that insufficient value is attributed to the forage. The removal of vegetation from the ecosystem is likely to reduce its productivity or amenity generally—at a cost to humans. The dramatic increase in dust storms in China, Mongolia and in the Sahel is one such result of over exploitation of rangelands. If land degradation proceeds too far there is little or no forage to be harvested (grazed or browsed). It is axiomatic that the objective of rangeland management should be a "sustainable take" from the stock of resources (See *Range and Animal Sciences and Resources Management*). But, there is need to define sustainable take in the context of rangelands in the highly variable environment of much of Africa, and middle and central Asia.

Two contrasting and partly contradictory influences are at play here. In the commons, it is *competition among herders to maximize their individual share* that leads to over exploitation of rangeland resources. But it is the *individual's personal assessment of the value of resource harvested* now *compared with the value of livestock products that might be produced in* the future *as a result of not taking the forage now,* which results in over exploitation. These financial realities of human behavior are highly significant to the future of most rangelands, and to the instruments we might seek to preserve them. The best way to illustrate this is to analyze a Case study from China.

2.1. Case study The Grassland Law and its Implementation in China

Grassland is term commonly used in China to describe rangelands. Grasslands may in fact be shrub lands or even desert margins. Inflexible, imported notions of 'carrying capacity' and appropriate stocking rates have helped inspire the *Grassland Law*. The *Grassland Law* as formulated in the mid-1980s was based on the assumption that desert grasslands in NW China were deteriorating due to lack of stewardship. Its implementation has been aimed at reducing livestock numbers and constraining herd mobility. Pastures have been allocated to the individual households and large areas were demarcated (sometimes using fences). The purpose was to convert a traditional herder way of life into an "efficient" livestock enterprise. This was based on the assumption that a simple change in land use rights would facilitate a shift from subsistence to market-oriented behavior. However, little effort has been made by government agencies to monitor the impacts of such policies on either the environment or the people affected. The impact of the implementation has been studied and the outcomes have not always been favorable.

There are a number of propositions arise from the implementation of the *Grassland Law*

in N and NW China.

Proposition 1: *Traditional indigenous herding systems were misunderstood.*

Much of the land was grazed as common property. Under common property regimes usage and access rights accrue to specified groups or communities of people. Non members are excluded. Sets of rules define the rights and duties of members and non-members with regards to access, as well as use and management. The common property and access regimes that had previously accompanied wide ranging herd movements, including transhumance, were misinterpreted as destructive, open access situations where no resource management regime applies and no property rights are recognized. Enclosure of the rangeland, restricting herds and their owners to limited areas, was seen as the solution. Typically a residue of 'communal' rangeland remained to carry the livestock not included in such schemes. This residual land suffered extra pressure from grazing and browse, often leading to accelerated degradation. Unfortunately this often reinforced the arguments of those who claimed the communal rangeland management was environmentally destructive.

Proposition 2: *The behavior of herders is rational*

The behavior and rationale of the herders are dictated first and foremost by and awareness of the realities of the marginal landscape in which they live, a landscape that has sustained their way of life for centuries. A rapid conversion to a new mode of thinking and living cannot take place without resulting in substantial socioeconomic and ecological consequences.

Proposition 3: *If regulations change, herders do not change their own behavior in response*.

There is an expectation that introduction of a new regulation to control some aspect of a grazing will have a particular, predictable effect on the behavior of the herders. There is evidence, however, in both commercial and non-commercial (subsistence) herding, that herders change their behavior to minimize the effect of regulations without necessarily acting illegally. This is simply an extension of the cunning applied—in its non-pejorative sense—to the natural factors in herding. It is distinct from known illegal behavior. If, for example, a limit is placed on the number of livestock that might be held by an individual or household; the herders (often the richer ones) simply increased the *number* of herds by notionally assigning livestock to relatives or to paid shepherds, and the overall livestock population can rise. There are other examples of schemes intended to remove "excess" livestock in which total livestock population has increased as a result of changes in the behavior of herders and herding practices.

Proposition 4: *In the long term, a successful livestock industry invites its own destruction.*

The economic rent generated by such herding systems will be viewed as evidence that they can sustain more effort. Policy makers will feel justified in increasing the effort to get more livestock production (and thus dissipating the rent), in the name of economic

development, increasing employment, equity, or some other political or social objective unrelated to the ability of the rangeland to sustain its production and generation of economic rent with increased grazing pressure.

One effect of this kind of management is that, in a relatively short time, the initial temporary permits became permanent entitlements to graze. It then is almost inevitable that they become saleable. This capitalizes economic rent, and is a complication in management. In a few rangelands, such capitalization has damaged cooperative herding arrangements among the license holders and set off competitive harvesting of forage and other resources more like uncontrolled open access rangelands. Only where there are stringent and effective controls on effort and stocking levels have rangelands managed in this way remained more sustainable than most others did.

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Biographical Sketch

Dr Victor Squires is an Australian. His undergraduate studies in Australia were in Botany and Ecology and he has a PhD in Range Science from Utah State University, USA

He is a former foundation Dean of the Faculty of Natural Resources at Adelaide University and the Foundation Director of the National Key Centre for Dryland agriculture and Land Use Systems. He is currently an Adjunct Professor in the University of Arizona, USA.

He has a background in teaching and applied research. As an educator he taught graduate and post graduate students in Australia, and conducted applied research and training programs for institutions and government agencies over the world.

Dr. Squires is an internationally well known dryland management expert. He has worked in many developing countries e.g. China, Mongolia, Thailand, Algeria, Ethiopia, Iraq, and in rural Australia. He has conducted many projects in multiple sectors of environment protection, natural resource and biodiversity conservation, land degradation and desertification control, livestock and rangeland management.

He is the author of over 100 scientific papers, numerous invited book chapters and several books. Dr Squires was the recipient of the Chinese government's 2008 Award for Scientific and Technology Cooperation