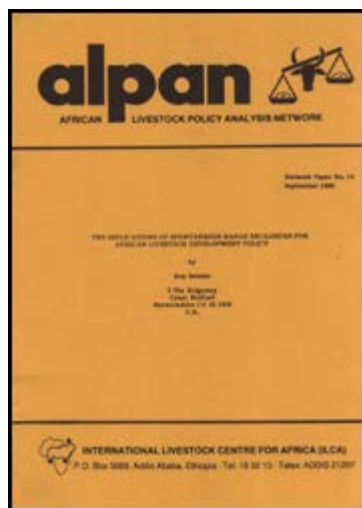


The implications of spontaneous range enclosure for African livestock development policy



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by

Roy Behnke
2 The Ridgeway
Great Wolford
Warwickshire CV 36 5NN
U.K.

INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA (ILCA)

P.O. Box 5689, Addis Ababa, Ethiopia • Tel: 18 32 15 • Telex: ADDIS 21207

ALPAN - African Livestock Policy Analysis Network

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Introduction

1. This paper examines a process - the spontaneous enclosure of the range by livestock owners - which may raise new problems but also permit new approaches to the development of the African livestock industry. In sub-Saharan Africa the unplanned and centrally-unadministered enclosure of arid or semi-arid grazing land by pastoralists is a relatively new phenomenon. Even in those countries where enclosure is occurring, it is localized and, as yet, affects a small proportion of all producers. Range enclosure is not, therefore, an acute administrative problem at this time. Range enclosure movements are significant, however, because they provide an early indication of fundamental changes which are now reshaping the livestock sector.

2. Drawing on case material from Sudan and Somalia, the opening section of the paper will discuss some of the causes of spontaneous range enclosure. It is suggested that the conditions which give rise to enclosure movements - drought, overstocking, water development, the increasing commercial value of livestock production, and the breakdown of collective forms of land management - are factors which are common to much of dry, pastoral Africa. If we can reasonably expect these conditions to persist or become more acute, then we may also expect the fencing of rangeland to become more general.

3. If the fencing of rangeland by livestock owners is likely to become more common, then administrators and policy makers will need to have some idea of the benefits and costs arising out of the shift from open-range to fenced forms of animal husbandry. The case for or against enclosure is not, however, as clear-cut as one might hope. The balance of costs and benefits, and the interest groups likely to be positively or negatively affected, vary according to local conditions, making it unwise to simply endorse or reject enclosure as a matter of general policy. What administrators require is a set of criteria which will assist them in judging the desirability of enclosure or the advisability of intervention under different local circumstances. A brief discussion of the relevant criteria will be provided here.

4. The prospect of extensive range enclosure also raises the issue of the role and effectiveness of livestock policy in influencing voluntary, local-level movements of this kind. To what extent, administrators must ask, can government intervention stop, speed up, or redirect enclosure movements, and how might such interventions be most effectively carried out? Examination of the causes of enclosure will reveal that government agencies can manipulate some, but only some, of the factors which retard or promote enclosure. There is, therefore, a modest role for administrative action in the regulation of enclosure movements.

5. The final issue posed by range enclosure concerns the long-term planning and policy implications of this process. The concluding section of this analysis will argue that range enclosure is producing a new and distinctly African system of livestock management in which animals alternate between both enclosed pastures and the open range. In these cases it would be unrealistic to base development plans on the assumption that we are still dealing with traditional, fully nomadic pastoralists. On the other hand, it would be equally unrealistic for administrators to press for the immediate development of completely self-contained, fenced ranches, on the model of North American or Australian ranches or along the lines of the standard group or individual ranch schemes common in Africa in the 1960s and 1970s. A more reasonable objective would be to devise suitable policy responses to the hybrid form of enclosed and open-range animal management which is now developing, and to sponsor

technical research which will address the characteristic problems of this form of production

6. In sum, the following analysis considers four critical questions regarding range enclosure movements in contemporary Africa, namely:

- (i) Why do range enclosure movements occur?
 - (ii) Under what conditions are they harmful or beneficial?
 - (iii) Can these movements be controlled?
 - (iv) What do these changes imply for the long-term development of the African livestock industry?
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Case studies of range enclosure

7. This section describes four range enclosure movements - two in the South Darfur Province of western Sudan and the other two in the central rangelands of Somalia. While we have no assurance that the factors which encouraged enclosure in these areas will be decisive elsewhere in Africa, both theoretical analysis and historical parallels from the development of livestock keeping in industrial countries suggest that these cases are not a typical (Behnke, 1985b; Demsetz, 1967; Anderson and Hill, 1979).

South Darfur

8. In South Darfur range enclosure is taking place in two distinct but adjacent areas, and different combinations of commercial and ecological factors are responsible for promoting enclosure in these two areas (for details see Behnke, 1985a).

The urban fodder belt

9. One of the zones of enclosure consists of the rural hinterland which supplies the commercial fodder markets for Nyala, South Darfur's largest market town and the terminus of the rail line from Khartoum. The town contains numerous milk cows kept for household milk supplies, horses and donkeys used for the haulage of domestic water or commercial goods from the railhead, and a variable number of animals being held for marketing or shipment to Khartoum. Whether or not a particular farming community produces fodder for the Nyala market is determined by the sale value of the local native fodder species relative to the transport costs of getting it to town. Producers and shippers generally find it profitable to bring fodder to the town from as far away as 100 kilometers, and from greater distances in seasons or years when fodder is scarce and the price is high. The Nyala fodder belt is not, therefore, a natural ecological area, but simply a zone within which a particular kind of commercial agriculture is profitable.

10. The area around Nyala is poorly supplied with permanent water sources and can support very few cattle year-round. Because local cattle are few and a profitable fodder market is close at hand, enclosure in this area is primarily undertaken in order to produce and sell fodder rather than to provide feed for local livestock.

11. Those who enclose fields for the production of fodder range from small-scale farmers to large-scale entrepreneurs small-scale farmers usually sell through middlemen while the large entrepreneurs own their own trucks, produce, haul and market their own fodder. Most of the fodder consists of native grasses which are not cultivated but simply protected from grazing by fences.

The agro-pastoral zone

12. The natural ecology plays a much more important role in defining a second zone of range enclosure lying to the west of the Nyala fodder belt. In this case enclosure affects a region of approximately 20,000 km² lying roughly inside the Rural District Council of Idd el-Ghanam. Several different groups of nomadic graziers and semi-settled agro-pastoralists use pastures in the district. On a pattern common to most of the Sahel and Sudanic zones, the majority of the nomadic herds spend the dry months in the south and west of the district in areas of higher rainfall where dry-season water and grazing are more plentiful. As the rains progress,

however, these wetter areas become uninhabitable due to flooding, mud, biting flies, tsetse and mosquitoes. The Idd el-Ghanam District, characterized by relatively high, well-drained and firm ground, is a wet-season refuge for nomadic stock fleeing from these problems. Nomadic stock are also attracted to the district in the rainy season from about June to September because it offers the highest quality pasture available in that season.

13. Left behind in the district for the remainder of the year are locally owned cattle kept by the mixed crop and livestock farmers who live in the area. Whereas nomadic cattle pull back to southern pastures and water points, many local herds try to make it through the dry season on water from handdug wells in the bottoms of the dry water courses which drain the district. This water is reasonably plentiful, but cattle need fodder as well as water if they are to survive, and herein lies a major conflict of interest between local herd operators and the nomads who seasonally use the district. Under open-range conditions, local residents are forced to permit the wet-season grazing by outsiders of pastures that their own cattle will later need to survive the dry season.

14. The district is therefore under heavy pressure from grazing stock in all seasons. Aggravated by low rainfall between 1982-84, overstocking has undermined the economic welfare of local livestock keepers who face high levels of stock loss at the end of the dry season. Their response has been to enclose a portion of their rangelands for their exclusive use. The range enclosure movement now occurring in the district is therefore based on competition between transient and permanently resident livestock keepers for control of a diminishing range resource. This pattern becomes clear if we compare the regions adjacent to the district which do not support enclosure movements. In these areas either pasture is plentiful and not worth the trouble of enclosing, or there is insufficient dry-season water to sustain large numbers of local stock and thereby to precipitate a conflict of interest between local and transient users.

15. In those communities in which the process of private enclosure is most advanced, it is the larger herd owners with the wealth and social standing to dominate local politics who have erected the largest enclosures. Smaller and less prosperous herd owners do not hold extensive grass enclosures because, at least in part, of the high cost of thorn fencing. Although family labour might be sufficient to enclose a small arable plot, large grass enclosures are commonly built by hired work parties. The cost of maintaining the enclosures is also high since the thorn fences rot after one to three years.

Central rangelands of Somalia

16. The enclosure movements described here are occurring in the vicinity of the market and administrative town of el-Buur which lies on the interior plain of central Somalia in Galgudund Region. The enclosure of grazing land is taking place both on the plain itself and on the neighbouring sand ridges which stand between el-Buur town and the coast. Livestock-keeping is dominant on the interior plateau where soils are thin and rainfall low and irregular, while mixed agro-pastoralism predominates on the coastal dune ridges. Range enclosure has a slightly different history - and slightly different causes - in each of these two ecological zones, and they will be examined separately (for details see Mascott, 1985).

The agro-pastoral zone

17. Range enclosure in the dunes area is an outgrowth of the pre-existing agro pastoral production system. This system had established the principle of private ownership over arable land and the use of thorn fencing to protect crops from livestock. It also created a group of livestock owners with an interest in keeping their herd around the farm in order to use crop residues and to simplify the problems of dividing domestic labour between the farm and the herd.

18. Changes in this form of land use were precipitated by borehole development in the late 1960s and early 1970s. During this period five deep bores with diesel-powered pumps were established in the dune area, a concentration of pumped water unequalled in other parts of the central Somali rangelands. The most attractive farm sites and grazing areas were now located around these wells, and the cluster of wells was compact enough that the normal concentric zones of heavy land-use around individual wells began to overlap, forming a continuous block of densely settled and intensively used land. There was now a land shortage in the vicinity of permanent water, and it was in this area that range enclosure took place.

19. Local herders and farmers asserted that there was still in 1985 sufficient cultivable land to meet everyone's needs. The problem, they maintained, was that everyone had panicked anticipating a land shortage and enclosed huge fallow areas for grazing and future cultivation. But like a run on a bank, the panic was self-fulfilling. Those who did not take the precaution of enclosing surplus land subsequently found that they were hemmed in on all sides by other people's fences, and that it was impossible to expand their farms or find good grazing for their animals. No one planned to enclose the entire area, residents said; it just happened, the unintended result of each individual protecting his own interests.

20. Commercial herd operators and livestock traders have also been instrumental in furthering enclosure. Because they can pay for labour, these entrepreneurs have enclosed far larger areas than poorer households which were solely dependent on domestic labour or work parties to construct and maintain fences. Commercial producers also use their enclosures for intensive sheep fattening, and option not open to small-scale producers.

21. Finally, the decline of the traditional rural political system has made an important contribution to encouraging range enclosure. In the el-Buur area, the late 1960s were an unsettled period during which different local groups struggled against each other to control the land. From 1969 onwards, however, the national government outlawed the old system of clanship, raiding, and collective responsibility for homicide. By the early 1970s the disputes in the el-Burr area had been suppressed, and security had improved to the point where herders could occasionally turn their camels loose and unherded without fear of theft. Thus, the decline of the clan system and improved levels of personal security coincided in time with new initiatives to control land through private enclosure rather than collective military action.

22. In sum, it is clear that enclosure in the agro-pastoral areas has been caused by a combination of factors. Initially it was triggered by intensive water development in an area where fencing of arable land was already accepted and herders welcomed this new opportunity to keep their animals close to the farm. The initial pressures towards enclosure were then exacerbated by the self-fulfilling logic of an enclosure movement. Once the movement had gained momentum, even individuals who did not want to enclose were forced to do so in order to prevent others from expropriating all the communal land. Finally, the enclosure movement has been sustained by the growth of commercial interests and the decline of old forms of collective political organization based on the joint defense of common landed resources.

The nomadic zone

23. A combination of four factors had encouraged range enclosure in the nomadic areas of the interior plateau around el-Buur town.

(i) drought. The current enclosure movement began in 1975 at the height of the great Somali drought, the Dhaba Dhere, as a response to the exceptional scarcity of good grazing during the drought.

(ii) government policy. The spread of enclosure was abetted, according to local

government officials, by a national policy during the drought to promote agricultural production by clearing new farm areas. Individuals came forward saying that they wanted to farm, and were allocated land on that basis; their real intention however, was to gain control of pasture by fencing it.

(iii) commercial profitability. Not all local livestock owners - either pastoralists or townsmen with a few milch cows - have been able to obtain enclosure. By eliminating the most productive areas of the open range, enclosure inevitably increases the demand for and the price of fodder offered to these people for sale, making further enclosure even more attractive.

(iv) local political factors. The pastoralists who use the el-Buur area for dry-season water are affiliated with descent groups different from the local el-Buur residents who have enclosed the area. The pastoralists come from nearby, open-range grazing areas which provide excellent wet-season pastures and numerous temporary water sources, but no permanent water. These pastoralists have instead established rights of access to water points and dry-season grazing controlled by other groups located on the periphery of their home territory. By enclosing the best grazing land, the el-Buur population has partially opted out of this system of shared access. The pastoralists still use el-Buur water, but enclosure has denied them good grazing in the vicinity of that water.

24. Thus, enclosure has been encouraged by communal rivalries based on old patterns of land holding, coupled with the weakening of the communal institutions which had previously channeled these rivalries. Whereas disputes over land would previously have involved collective group action on each side, the initiative has now passed to individuals who fence private holdings.

Summary of the causes of enclosure

25. In the preceding examples range enclosure was caused by different combinations of seven factors. These seven factors were:

- (i) the growth of commercial markets for fodder
- (ii) the development of commercially-oriented forms of animal husbandry
- (iii) drought
- (iv) heavy stocking of pastures
- (v) borehole development
- (vi) the breakdown of traditional rural institutions which formerly managed and defended common landed resources
- (vii) government tenure policies

26. While this list is certainly not exhaustive, the factors cited above are indicative of the range of conditions which promote and sustain enclosure movements. The list suggests that, in general, individuals fence common rangeland whenever they judge enclosure to be both practical and profitable. The role of profitability is immediately clear with respect to commercial fodder and livestock production, points (i) and (ii) above. As the value of rangeland production goes up, there is a corresponding tendency by individuals to attempt to acquire private control over the sources of that production.

27. However, land may also acquire a scarcity value which is independent of, or even

inversely correlated with, the value of its current output. Borehole development, overstocking, and drought (points iii. - v.) may destroy the productivity of rangelands, but by reducing the total supply of available fodder they increase the value of any good grazing which may remain. Factors which lead to the degradation of rangeland may, therefore, intensify the struggle by individuals to control that range. Alternatively, borehole development may create an artificial land scarcity by making the surrounding area particularly valuable. In this case the pressure for enclosure will be similar to that which occurs in a severe drought or under conditions of continuous overstocking, but it will occur in a limited geographical area.

28. Whether or not individuals respond to commercial incentives or scarcity by fencing the range also depends on the liabilities resulting from this course of action, represented in the preceding list by points (vi) and (vii). National policies and local political conditions can make it either more or less difficult for individuals or groups to defy the customary understandings which govern the ownership of scarce resources, or to violate existing land laws. At a more prosaic level, the "cost" of fencing for individuals may be affected by government policies to subsidize fencing or the purchase of fencing materials, for example, or to tax enclosures.

29. In sum, the seven causal factors underlying range enclosure, described above, can be reduced to three principles:

- (i) increases in the commercial value of range or livestock production;
 - (ii) a decline in the supply and a corresponding increase in the scarcity value of grazing land;
 - (iii) decreases in the costs of enclosure costs in this case including social and political as well as monetary considerations.
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The consequences of range enclosure

30. The economic, social, and biological consequences of range enclosure vary significantly, depending on local conditions. What administrators require is not a general policy for or against enclosure but rather some understanding of the variable effects of enclosure under different circumstances. Eventually, researchers may be able to present policy-makers with a typology of different kinds of enclosure movements, and with a systematic discussion of the probable outcome of each kind of movement. There does not yet exist, however, sufficient case material to undertake a rigorous analysis of this kind.

31. It is, nonetheless, possible to present the major issues which administrators or researchers will need to examine in order to provide an accurate estimation of the costs and benefits of individual enclosure movements. At least three areas of concern deserve attention: questions of technical efficiency and productivity; problems of range conservation; and the related issues of economic equity and economic growth. Each of these topics is discussed below.

The effect of enclosure on livestock and range productivity

32. In the pastoral areas of dry Africa enclosed pastures are frequently used for annual deferred grazing.¹ That is, herds are held on the open range during the rainy season, which is also the season of vegetative growth, and they then fall back on enclosed areas as a dry-season fodder reserve. There are, however, certain biological inefficiencies inherent in this pattern of use. African grasslands are at their most nutritious and digestible stage (measured in terms of nitrogen or crude protein and mineral concentrations) when they are growing. Ungrazed pastures which are permitted to flower and reach senescence may produce a considerable mass of vegetation, but this vegetation will be high in undigestible fibre and low in crude protein and mineral concentrations and therefore low in both feed value and palatability to livestock. Unused pastures will continue to deteriorate in quality if they are allowed to remain in place as standing hay. The tropical sun will volatilize valuable constituents of the fodder, while wind, unseasonal rainstorms, termites and ants will remove the more nutritious leaves, until a standing crop of hay has been reduced to a standing crop of relatively useless stems (Breman et al, 1980; Penning de Vries, 1983). Enclosure may therefore result in very dramatic and visible increases in the mass of forage production with no improvement and even a possible decline in the capacity of a pasture to support grazing stock.

¹ The principal exception to this pattern are pastures which are handcut and the fodder commercially sold.

33. Given the importance of timing in the optimal use of pastures, enclosure may have a very different impact on total livestock production depending on the area where enclosure occurs and the kind of livestock management system it displaces. Enclosure will always tend to alter the distribution of control over pasture resources within and between pastoral communities, and therefore have a dramatic effect on the performance of individual herds. By capturing a greater share of the resource base, herds with access to enclosures will tend to prosper and herds which are excluded will suffer. But enclosure is unlikely to have a negative impact on regional livestock production levels in areas where the herds are already stationary and use the same kinds of pasture year-round. Protection of pastures during the vegetative and seeding phases may even lead to improvements in fodder and total livestock yields.

34. On the other hand, the factors which precipitate range enclosure suggest that such enclosure may be accompanied by a decline in regional herd performance in nomadic systems. In general, pastoralists will bother to enclose pastures only when heavy grazing or commercial considerations transform good rangeland into a scarce and valuable commodity. In a nomadic production system, however, heavy grazing in a particular zone would indicate that the vegetation in that zone is already a critical bottleneck, possibly the limiting resource in the regional production system. Enclosure and expropriation of this resource by a few producers may disrupt the entire regional system of production. In the extreme case, removal of one grazing zone from an integrated migratory system will make it impossible to sustain throughout the year a regional herd which is large enough

to efficiently exploit the remaining grazing zones.

35. If the migratory cycle of herd movements also provided for the cropping of natural pastures at their nutritional peak, it is doubtful if increases in sedentary livestock production will offset declines in nomadic output. To reserve standing crop of stems for private use may be attractive from the point of view of the herd owner who has an enclosure, and yet be detrimental to regional livestock production. Initial declines in regional livestock productivity may therefore be a common feature of the shift from open to enclosed systems of range ownership in nomadic areas.

36. Policy-makers must therefore exercise caution in evaluating the apparently positive results of range enclosure in nomadic areas, for the drawbacks are not always immediately visible. For example, visiting delegations can walk through impressive enclosures of standing hay which is low in feed value and therefore contributes less to overall regional livestock production than the denuded pastures outside the enclosure. At a more sophisticated level, measures of improved herd performance can be deceptive unless the productivity gains of herds using enclosures are matched against the declining performance of excluded stock.

Range conservation

37. Overgrazing has long been viewed by range ecologists as an unalloyed disaster, precisely the disaster that range projects and government programmes were designed to forestall. It can be argued, however, that overgrazing is merely a symptom of more fundamental demographic and economic problems which currently beset pastoral communities. To focus all of our attention of alleviating a symptom may not be the best way to address these problems or to protect the range.

38. In this context, the prospect of substantial private range enclosure undermines and complicates the conventional wisdoms which have thus far guided African rangeland conservation policies. The case material presented in this paper certainly underlines the negative impact of overgrazing on the interests of livestock producers. But these cases also suggest that overgrazing may have a critical role to play in restructuring the African livestock industry since it can serve as a catalyst to the eventual creation of enclosed, more intensive systems of stock and pasture management. Spontaneous range enclosure thereby calls into question the objective of almost all current African range development projects - the control of livestock numbers on the common range.

39. While range enclosure may provide a long-term remedy to the overstocking problem, it must also be emphasized that it provides little hope for any immediate improvement. At present enclosed ranges in Africa are grazed on a seasonal basis, with herds spending most of the year outside the fences on the open range. Under these circumstances, private range tenure provides no necessary check on herd growth because herders are able to adjust either the number of animals or the period of time they spend inside the fenced area. Nor does the improved condition of the range inside the fences insure an overall improvement in range quality throughout a region, for stock excluded from private holdings will be dumped on the common range.

40. In terms of range monitoring, balanced assessment of the impact of enclosure must therefore take into account conditions both inside and outside of the fences. In terms of development policies, the immediate conservation benefits arising from spontaneous enclosure do not pertain to the control of stock numbers, but rather to the possibility that herders will use improved fodder production and range management techniques inside their enclosures. This possibility is discussed in the closing section of the paper.

Issues of economic equity and economic growth

41. Inequality and economic growth are closely linked in the commercialisation of pastoral economies. Because labour is displaced by capital and because commercially viable units of production tend to be larger than viable subsistence operations, the commercialization of a livestock industry may entail the exclusion of large numbers of former pastoralists. This exclusion can be achieved in two different ways: either through rural-urban migration and/or through the dispossession and impoverishment of the mass of pastoral producers (Behnke, 1983; Toulmin, 1983). In either case large numbers of pastoralists will lose their traditional rights to land.

42. It would therefore be inadequate for policy-makers to evaluate the desirability or undesirability of an enclosure movement by examining only the movement itself. If research attention focuses exclusively on the enclosures and those who operate them, then enclosure will, almost invariably, appear in a favourable light. To reverse this assessment, one need only shift attention to those who have no enclosures and whose traditional livelihood is threatened by their declining access to the range. In order to mediate between these conflicting points of view, objective evaluations of enclosure movements must estimate the costs and benefits of enclosure to the overall economy of which the pastoral sector forms one part. If the national or regional economy is buoyant, it may absorb displaced pastoral labour with an increase in the overall productivity of the economy and at no economic loss to individual migrants. If the local economy is stagnant or if opportunities for productive employment do not exist elsewhere, the pastoral sector may grow and modernize, and individual pastoralists may become wealthy, at the expense of both their neighbours and the national economy. In this case, the potential for individual hardship, increased income mal distribution, and reduced opportunity for economic growth are obvious.

43. Information on human migration, rural and urban incomes and employment opportunities are, therefore, essential for any impartial evaluation of the economic impact of range enclosure. Guidelines for the design of applied research programmes on human migration and agricultural and pastoral development are provided in Kerven (1983 and 1986).

The management of enclosure movements

44. Spontaneous range enclosure movements reverse the usual relationship between government planners and the pastoral populations which are the targets of their planning. Planners and project designers generally assume that pastoralists must be instructed, coerced or inticed through appropriate incentives to respond to government development efforts. With spontaneous range enclosure, however, the impetus for change comes from below, from the livestock-keepers themselves, and while final costs and benefits may be difficult to predict, it is clear that these local-level initiatives will produce fundamental social, technical and economic changes. In these cases it is the local communities which have taken the initiative, and planners, administrators and technicians must respond appropriately to changes they have not initiated, and processes which they do not fully control.

45. Policy responses to range enclosure can take three different forms:

(i) Because of their negative backwash effects on non-participants, enclosure movements tend to polarize public opinion. In this environment one of the most useful functions administrators can perform is to arbitrate between those who favour and those who oppose enclosure. Aside from their coercive power, which will be discussed below, the authority of administrators as arbitrators rests on their ability to argue persuasively based on reliable information and a clear understanding of the issues. The preceding discussion has outlined the questions which applied research would have to answer in order to sustain the credibility of administrators as impartial arbitrators.

(ii) Administrators may also attempt to control enclosure by suppressing, encouraging or simply regularizing the process. In this case emphasis will lie on routine administrative action designed to establish a degree of central control over local-level events. The following discussion examines the possibilities and problems of regulating enclosure through the direct exercise of administrative authority.

(iii) Finally, government intervention may be directed at both ameliorating the negative effects and exploiting the potential benefits of enclosure. In this instance emphasis will shift from government regulation to the provision of inputs, services or improved agricultural techniques which will encourage voluntary compliance with government's development objectives. The final section of the paper will suggest ways that enclosure movements can be indirectly managed through the provision of critical inputs.

The limits of regulation

46. The ability of government agencies to regulate range enclosure directly depends on their capacity to manipulate the factors which cause enclosure, as illustrated by the Sudanese and Somali cases. Unfortunately, the demonstrated capacity of administrators to control events in extensive pastoral areas is, and usually has been, limited, whether the setting be contemporary Africa or historical periods of ranch development in industrial nations. The limits to administrative control arise, in part, from the nature of the pastoral populations which administrators confront, populations which are often mobile, self-reliant and locally organized. The financial limits of realistic administrative initiative may also be set by the low productivity

and revenue generating potential of dry pastoral areas. Faced with comparatively low tax revenues relative to the high costs of governance, administrators may be forced to limit their activities to those interventions which have the highest chance of success. There follows here a point-by-point examination of the extent to which administrators can expect to control the different factors which cause enclosure.

Commercial fodder and livestock production

47. African governments are committed to increasing all kinds of commercial agricultural production. Given this consistent policy, administrators are in a position to indirectly encourage fencing by encouraging the growth of commercial agriculture and business interests at the local level. Attempts to retard or suppress enclosure will, however, run counter to the stimuli provided by general government policy and long-term economic pressures, and it is doubtful whether such policies would eventually prevail.

Overstocking and drought

48. The failure of two decades of range management projects has demonstrated the administrators have little ability to control stocking rates in order to dampen the effects of periodic drought. Overstocking on common ranges and drought are therefore likely to recur and to continue to provide incentives for enclosure in many areas.

49. One of the possibilities raised by range enclosure is that it will induce herd owners to control their own herd sizes in order to conserve their own rangeland. However, herd owners will only be inclined to limit their herd sizes when most of the range around them has already been subdivided and appropriated by others. In the short term, range enclosure will exacerbate the problem of overstocking on the open range by withdrawing parts of the range from communal use, and by forcing more livestock into the remaining area. The pressure for further enclosure will therefore increase as individuals watch the commonage shrink and attempt to grab their piece of it before it is too late. In this way enclosure movements build within themselves pressures for their own expansion, pressures which administrators may find very difficult to effectively counteract.

Borehole development

50. Technicians and planners have often drawn up water development guidelines which prevent the clustering of boreholes. Nevertheless, in few areas of tropical dry Africa has it been possible to implement these comprehensive plans consistently. Part of the problem is attributable to the scarcity of suitable drilling sites and the irregular distribution of these potential sites. Political and business interests also routinely influence the number and locations of new bores. Because of the difficulties of implementing water development plans, the irregular maintenance of existing wells has often an important part in preventing overgrazing by reducing the total number of functioning wells (Sandford, 1983). Improved servicing of wells could exacerbate the overgrazing situation and create further pressure for enclosure. Thus, while water management and planning cannot be ruled out in theory as a means of regulating enclosure, practical impediments will likely limit the effectiveness of this means of control.

Local political institutions

51. Many independent African governments have been hostile to tribal political organizations in pastoral areas because of the threat these organizations pose to central authority and national unity. Attempts to replace indigenous groups with government - sponsored organizations such as group ranches have not proved notably successful (Oxby, 1981). Administrators responsible for range and livestock development may therefore be in a position to encourage enclosure by discouraging traditional forms of competition over the use and

ownership of the range. They are much less likely to be able to discourage enclosure by promoting effective local institutions which are capable of owning, managing, and defending group interests in communal land.

Land law and taxation

52. Perhaps the greatest opportunity for government control lies in its ability to manipulate the social, legal and financial costs associated with enclosure. Even here, however, the room for manoeuvre would appear to be limited. The enclosure movements discussed in this paper were all technically illegal in terms of their respective national land laws, as these laws were interpreted by local administrators. Administrators may have the capacity to encourage enclosure through new legislation, or by failing to enforce existing legislation, but anti-enclosure land laws alone do not appear to be a sufficient deterrent to fencing, if other factors encourage it and if officials are unwilling or unable to use force. Official recognition of enclosures and their taxation may prove more effective.

53. The preceding discussion suggests that administrators have at their disposal the means to encourage the fencing of rangeland, but that they have little capacity to oppose fencing effectively, should they want to do so. It would appear that spontaneous enclosure movements are generated by forces which planners only marginally control, and that these movements possess a momentum of their own. The management of enclosure movements should not, therefore, be restricted to attempts to regulate and control them. Administrators should also consider how best to exploit the development potential of these movements which are likely to persist whether or not they are officially condoned.

The development potential of range enclosure

54. The development potential of range enclosure depends on the productivity of fenced production versus open-range pastoral nomadism. The preceding discussion argued that the shift from open to fenced animal husbandry was likely to cause an immediate drop in herd performance in nomadic areas. This final section of the analysis examines the reasons for this decline, and reviews some of the steps that may be taken to counteract it.

55. The importance of herd mobility in African systems of livestock production becomes clear if we examine the problems of localized livestock management. If a herd is confined to one place, both livestock numbers and viability are limited by the scarcest resource in the most difficult season in that place. With the help of industrial inputs and commercial marketing channels modern ranchers have developed techniques to circumvent these seasonal environmental limitations. Surplus forage production during peak seasons can be harvested, stored, and fed to livestock during seasons of scarcity. Capital investments in fencing, water development, or bush control, for example, can help to stabilize the productivity of an area throughout the year. Seasonal stock sales, typical of cow-calf operations, can be used to bring stocking rates into line with regular variations in pasture carrying capacities. Finally, even in commercial ranching systems, sometimes the most profitable way to handle seasonal scarcity is to simply walk away from it, i.e., to nomadise. For African pastoralists with limited access to industrial inputs, herd migration has been one of the most effective adaptations to seasonal resource fluctuations.

56. Nomadism is a viable option, however, only under certain regional ecological conditions. Ideally, what nomads or mobile ranchers need is a series of environmental zones each of which reaches peak carrying capacity in a different season. Mobile herds can then move from peak to peak, consistently avoiding the difficult months in each zone that they visit. In this way mobile livestock producers can maintain in a wide geographic region a total livestock population in excess of that which could be sustained, ceteris paribus, by several smaller herds each confined to its own locality.

57. The long-term policy implications of range enclosure hinge on the preceding ceteris paribus, they hinge, that is, on whether or not everything else is held constant in the shift from open to fenced ranges. Recent ecological research in the Sudanic and Sahelian zones has demonstrated the precision with which nomadic herds crop the best pastures at their seasonal peak (Breman and de Wit, 1983). The botanical principles involved suggest that a high level of efficiency is characteristic of most nomadic regimes, and that from the point of view of the nutritional status of grazing stock, it would be difficult under existing conditions to conceive of higher yielding patterns of herd mobility than those currently employed by many nomadic groups. Interference in this pattern of herd mobility will necessarily produce a decline in herd performance, unless restrictions on mobility are offset by the availability of new inputs.

58. Enclosure therefore poses a clear alternative to policy-makers. If fencing takes place without additional inputs or management innovations, it will precipitate a decline in herd performance. The picture is quite different, however, if new materials and techniques are available to herd operators. Nomadism is adjusted to the exigencies of the natural environment, but it rests on a strategy whereby herders physically avoid rather than confront production problems whenever possible. Regardless of the theoretical development potential of nomadism, a production strategy based on mobility discourages heavy investments in fixed

assets which are a prerequisite of modern ranching. Thus, while enclosure poses short-run problems in terms of diminished productivity, it may nonetheless open the way for sustained commercial and industrial livestock development in the longer term.

59. The question remains as to how policy-makers might most effectively respond to this possibility. Part of the answer lies in a recognition of how enclosure actually happens in dry Africa, as distinct from how project papers and professional range managers say it ought to happen. The implicit model behind the typical range management project has been the Australian - American family or company ranch, with land held on a freehold or leasehold basis and ranch stock confined on this land. The explicit reason usually given for this kind of project was the impossibility of instituting modern range management practices without first establishing control over both the number and movement of animals in a given area.

60. More realistic project designs would require abandoning the model of the self-contained Texas or Australian ranch. In contemporary Africa we are dealing with relatively small private enclosures which can potentially be managed more intensively than large ranches. But these enclosed pastures will, at least in the foreseeable future, be used in conjunction with a vast "residue" of unenclosed range which is exploited extensively on a shared basis. If industrial ranching models are helpful, the closest parallel to the emerging African situation may be the small freehold farms and ranches of the arid American West. Many of these private holdings are too small to maintain an average family were it not possible for their owners to lease grazing rights on adjacent, unenclosed state-owned land. For ranching operations of this kind, effective management and development is a two-fold process. It implies, first, the disciplined management of state land to insure sustained yields. Secondly, it requires intensive production techniques, usually involving mixed farming and livestock husbandry, suitable to small private holdings.

61. An examination of the administrative and technical requisites of mixed private and public-land ranching lies beyond the scope of this paper. It should be noted, however, that the principal technical constraint to production on African enclosures is the sharp drop, in the dry season, of the nutritive value of standing hay. More effective hay-making techniques or equipment would undoubtedly help to alleviate this constraint, as would the introduction of high-yielding fodder crops which would improve the incentive for hay-making. Alternatively, many trees retain their value as dry-season browse better than unharvested grasses. Review of the possibilities of sylvo-pastoralism, and a summary of the research done on this topic, is provided by Payne (1984).

62. In many parts of dry Africa, current land tenure practices are conducive to private fodder production, hay-making and mixed livestock and tree-crop production. In these cases, it is not a matter of technicians or planners struggling to convince pastoralists to do what is best for themselves and for the range. The onus instead lies on government agencies and the livestock research establishment to deliver the resources which will permit the continued evolution of this new form of animal husbandry on partially enclosed range.

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