



**Agricultural
Administration
Unit**

Overseas Development Institute
10-11 Percy Street London W1P 0JB
Telephone 01-580 7683

PASTORAL DEVELOPMENT NETWORK

Paper 20f
August 1985

OPEN-RANGE MANAGEMENT AND PROPERTY RIGHTS IN PASTORAL AFRICA~ A CASE OF
SPONTANEOUS RANGE ENCLOSURE IN SOUTH DARFUR, SUDAN

by

Roy H Behnke, Jr

Field work in the Sudan was carried out in association with Mokoro Ltd and Hunting Technical Services and an earlier version of this paper was commissioned by the Overseas Development Institute. James Morton suggested that I look at the overgrazing problem in light of the economic literature on externalities. Michael Hubbard and Philip Lister commented on the manuscript; Clare Oxby and Carol Kerven provided extensive editorial contributions. I am solely responsible for the views expressed here.

THE CONVENTIONAL MODEL OF COMMUNAL RANGELAND MISMANAGEMENT

1. The enclosure of open rangeland and its allocation to individuals or groups is a component of many African livestock development projects. In project after project, however, pastoralists have declined to fence or reallocate ownership of their land according to project specifications (Oxby 1981; Horowitz 1979; USAID 1980; Teitelbaum 1980). It would now appear that the promise of a more efficient system of livestock production and range management is not, in itself, sufficient to induce pastoralists to adopt a fenced system of ranching. The present paper therefore examines some of the economic, social and legal factors which may discourage or encourage pastoralists to enclose common rangeland.
2. Current theories of the management of African rangeland owe much to the work of Garrett Hardin (1969). Hardin identified a potential contradiction between group interests and individual interests whenever rangeland was commonly owned and animals privately owned. Given this combination of public and private property, he argued that individuals who increased the size of their herds reaped all the benefits of those increases while they passed most of the costs on to their neighbours in the form of overstocking and declining herd performance.
3. Subsequent theoretical analyses have accepted the premises (if not the conclusions) of Hardin's argument. That is, they have assumed that African rangelands are owned in common and that herd owners exploit this situation by manipulating the size of their herds. The literature on why herd owners retain or dispose of animals now evidences a degree of sophistication and precision far beyond that achieved by Hardin (Jarvis 1974; 1980; Stryker 1984; Shapiro and Ariza-Nino 1984; Meadows and White 1979). Nonetheless, these analytical refinements have generated no new approaches to the problem of dealing with overgrazing on African rangelands. Indeed, in the estimation of a recent, comprehensive review of the literature, the problem now looks more complex and intractable than ever (Jarvis 1984).

4. Much less theoretical attention has been given to reports by anthropologists and other field workers on the nature of pastoral forms of land ownership in arid Africa. The reluctance to directly address the topic of land tenure may spring from the apparent particularity of individual tenure systems, and from an inability to incorporate specific cases into a wider model which will provide a basis for policy prescriptions. In any case, systematic model building continues to be based on typological categories like open access, communal and private tenure, rather than on a close examination of the rules and processes which actually govern access to land in different cases (Runge 1981; Ciriacy-Wantrup and Bishop 1975; Picardi and Seifert 1976; Guttman 1982; Palmquist and Pasour 1982).

5. Herein lies one of the principle paradoxes, and deficiencies, of the analytical tradition which has developed in response to Hardin's work. For while Hardin, and those who accept his problem focus, purport to be concerned with the management of common resources, their attention is largely restricted to the analysis of the economic factors which influence the growth of herds, which are private property. This paper will shift the focus of theoretical attention back to Hardin's explicit but neglected problem: the ownership and management of the range itself.

6. This shift of the analytic framework may yield significant benefits in terms of more realistic development policies relating to African rangeland and the overgrazing problem. The examination of real tenure systems demonstrates that many African systems of pastoral land tenure recognise exclusive rights to restricted categories of land, and communal access to other categories of land. Faced with increases in numbers of livestock and increasing pressures on landed resources, individual pastoralists may attempt to redefine the customary system so as to extend their private control over rangeland. Thus, the overgrazing that Hardin predicted may not, as he suggested, inevitably lead to the

impoverishment and destruction of the resource base; it may instead precipitate a change in the terms under which the resource is held and used, ie. a shift from open-range systems of livestock production to enclosed systems of private land ownership.

7. In many parts of pastoral Africa, therefore, the most pressing social and economic issues may concern neither the management of communal land, nor the correct design of centrally-administered projects to privatise that land. In these instances, realistic policy-related research will instead involve devising appropriate responses to spontaneous enclosure movements. To comprehend these movements we require a systematic theory of the nature and evolution of property rights. A body of economic theory known as property rights analysis addresses precisely these issues, and the opening section of this paper examines the property rights literature and assesses its applicability to the specific problem of range enclosure.
8. The theory is then applied to the analysis of a range enclosure movement in South Darfur, Sudan. The indigenous tenure system in South Darfur recognises different degrees of open access versus private control depending on the kind of landed property in question. The variability and ambiguities within the customary system provide the entrepreneurially-minded pastoralist with ample opportunity to reorganise the existing land-holding system. This reorganisation is taking place in those parts of South Darfur where ecological pressures and economic incentives are sufficient to sustain an enclosure movement.
9. The closing section of the paper will discuss the implications of both property rights theory and spontaneous range enclosure movements for the design of future livestock development projects and policy.

PROPERTY RIGHTS ANALYSIS

The Hypothesis and its Foundations in Economic Theory

10. Ownership or property rights may in the broadest sense be thought of as a series of rules stating how a thing may be legitimately used. If this much is admitted, then it is also clear that private property is not defined by exclusive physical possession of things by individuals, but by the extent to which owners are entitled to use their property solely in the light of their own self interest:

Property rights do not refer to relations between man and things, but, rather, to the sanctioned behavioural relations among men that arise from the existence of things and pertain to their use. Property rights assignments specify the norms of behaviour with respect to things that each and every person must observe in his interactions with other persons, or bear the cost for non-observance (Furobotn and Pejovich 1972: 1139).

11. In other words, it is insufficient to think of ownership as the simple physical possession of things. It follows that private property is itself a matter of degree as defined by prevailing laws and customs which state how an owner may use that property. In certain instances owners may be permitted to use their property in ways which inconvenience others. These wider costs which property owners or actors need not take into consideration are technically termed "externalities. Conditions may change, however, and force actors to take responsibility for what were once the side effects of their behaviour. When the scope of responsibility is broadened in this way, economic actors will be forced to take new kinds of costs into account in computing the costs of using their "own" property. In the jargon of economics, they will be forced to internalise externalities.
12. Overgrazing on communal land, as described by Hardin (1969), is a classic instance of an externality since the private

herd owners may choose to ignore the contribution which their cattle make to the degradation of the common range. The switch to private range tenure would then involve internalisation since it would force individual herd owners to live with the results of their own overstocking. Our problem is to specify the range of factors which would precipitate this shift.

13. A school of economic analysis known as property rights analysis is devoted to the examination of precisely this kind of problem involving the interplay of economic and legal forces. One of the most succinct statements of the relationship between property rights and economic factors has been give by Demsetz, as follows:

Property rights develop to internalise externalities when the gains of internalisation become larger than the cost of internalisation. Increased internalisation, in the main, results from changes in economic values, changes which stem from the development of new technology and the opening of new markets, changes to which old property rights are poorly attuned (1967: 350).

14. Demsetz uses several concrete examples to give substance to this abstract framework. The best developed of these examples pertains to the classic works by Speck and Leacock on the fur trade and Indian hunting territories in the Labrador Peninsular (Leacock; Speck 1915). This historical case involves the shift from communal to private hunting territories in response to the development of the commercial fur trade. In Demsetz's terms, this shift hinges on an externality - the over-hunting of game under a system of communal land ownership:

Because of the lack of control over hunting by others, it is in no persons interest to invest in increasing or maintaining the stock of game.

Overly intensive hunting takes place. Thus a successful hunt is viewed as imposing external costs on subsequent hunters – costs that are not taken into account fully in the determination of the extent of hunting and of animal husbandry (351).

15. Up to this point Demsetz's argument parallels Hardin's account of the causes of overgrazing on common rangeland, but Demsetz recognises a series of economic and legal responses to this dilemma which Hardin never envisaged. Prior to the fur trade, Demsetz reasons, the possibility of overhunting existed, but the problem was not significant and it was not in the interests of the Indians to correct the situation. This was the case because fur-bearing animals had a relatively low commercial value prior to the fur trade. There was, therefore, both a minimal incentive to overhunt them and a minimal incentive to control any overhunting as might exist. Communal hunting territories were an 'economical' legal response to this situation. As the price of fur animals rose, however, both the costs of overhunting and the incentives for overhunting were increased, as were the financial rewards to successful animal conservation. The incentives now existed for the Indians to evolve a form of property that would allow them to handle (or 'internalise') the overhunting problem. Following Leacock, Demsetz shows that the development of private hunting territories – which discouraged collective overhunting and encouraged individual long-term conservation of the animal population – coincided geographically and temporally with the spread of the commercial fur trade.

16. In his analysis of the Labrador material Demsetz distinguished between two analytically separable sets of factors which determined the shift to more exclusive forms of property control. On the one hand, there was the value of the commodity which people were attempting to control, fur in the Labrador case. As the price of the commodity went up, so did the economic rewards to controlling it. On

the other hand, there was the cost of "policing" any system of privately allocating control over a scarce commodity. To demonstrate the effect of policing costs Demsetz compared the property systems of different American Indian groups, in particular the northern hunters of fur-bearing animals and American Plains Indians who hunted migratory grazing animals. Individual hunting territories did not evolve on the plains, Demsetz contends, because of the wandering habits of the animals themselves and the consequent costs of controlling them:

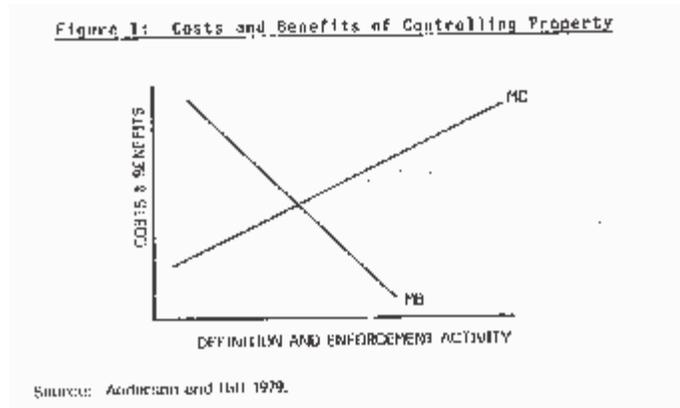
The value of establishing boundaries to private hunting territories (in the Great Plains) is thus reduced by the relatively high cost of preventing the animals from moving to adjacent parcels '(1967: 353).

17. Demsetz's twofold distinction - between the costs of policing and benefits to control - has been formalised and schematically presented by Anderson and Hill (1975). Consistent with Demsetz's position, they argue that:

Establishing and protecting rights is very much a productive activity to which resources can be devoted. But like any other activity, the amount of investment will depend upon the marginal benefits and costs to investors of allocating resources to these endeavours (202).

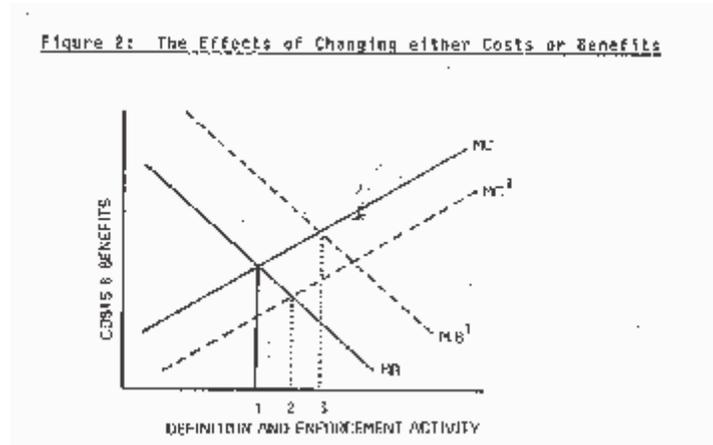
3. This argument is presented graphically in Figure 1, where the vertical axis represents the level of costs and benefits which arise from attempts to control a resource, while a rightward movement on the horizontal axis denotes an increasing level of activity devoted to the definition and enforcement of property rights (what Demsetz called 'policing'). As enforcement activity increases, they argue, marginal benefits will tend to fall while marginal costs will tend to increase, giving the slope on the benefit and cost curves in Figure 1. They also argue, following stan-

standard assumptions, that the level of enforcement or policing activity in any given situation will be determined at the point where the marginal cost and benefit curves intersect. Any factors which change this point of intersection will tend to generate new levels of enforcement.



19. Two general kinds of changes will, of course, promote a change in the level of property rights enforcement: a change in the marginal cost or the marginal benefit curve. As a hypothetical example, we may cite Demsetz's case of the Labrador fur trade and the accompanying rise in the market prices for furs. Commercial developments of this kind would tend to increase the returns to successfully obtaining pelts, and consequently shift the marginal benefit curve from MB to MB1, shifting the level of "enforcement activity" from point 1 to point 3 in Figure 2. A similar effect would be produced by any change which would lower the costs of enforcing private property rights. Anderson and Hill provide an appropriate historical example of such a shift: the introduction of cheap barbed wire into the open-range

ranching areas of the American Great Plains, where fencing material had previously been scarce and expensive. Graphically, such a change would be represented by moving the cost curve from MC to MC1 in Figure 2, thereby promoting (even at stable market prices) an increase in enforcement activity from point 1 to point 2.



From communal rights to private property: legitimising technical and economic change

20. It behoves us to keep clearly in mind the kinds of relations which are being graphically displayed in Especially critical in this regard is the label we the horizontal axis, what Demsetz calls 'policing" Anderson and Hill term 'definition and enforcement activity". Despite the appearance of objectivity, these labels may in fact obscure a number of critical issues.
21. Displayed in Figure 2 are the economic considerations - the marginal costs and benefits - which sustain different levels

of coercive activity with regard to the control of scarce resources. It is also possible, however, to read Figure 2 as a graphic presentation of the economic foundations which sustain different legal systems of property allocation. To establish the connection between law, economics and coercion, let us assume that there is a change in economic conditions which encourages individuals to assert an increasing level of exclusive control over a valuable resource. Let us take, for instance, a case in which the formal property rights system is 'set at point 1, but economic forces encourage individuals to struggle to maintain a higher level of exclusive control.

22. Let us also assume, however, that these attempts at exclusive control are eventually successful and that this success is reflected, in the long run, by changes in the formal system of property allocation. But the formal system of property allocation is nothing more, as we have seen, than a codification of the steps that individuals or groups may legitimately take to exploit or control scarce resources. If the new legal tenure system is set at point 3 on the horizontal scale, a level of coercive activity appropriate to this level of private control will, accordingly, be legal. At this point it will be appropriate to label this activity as policing or enforcement behaviour, for it will represent the legitimate expression of individual interests with regard to property. Until these legal changes come about, however, the assertion by individuals of exclusive rights can hardly be deemed 'policing', for it will be at best outside the legal framework and at worst an outright violation in terms of the pre-existing property rights system. A more appropriate label might, in fact, be extortion, fraud or robbery - from the point of view of the old communal system. The legal ambiguities and the associated suggestions of expropriation outlined here are likely to recur whenever a system of more open legal access to property is converted under pressure of economic and technical change into a system of more exclusive access.

23. Well-documented cases of range enclosure - English Parliamentary Enclosure (1790-1850), the Highland Clearances of Scotland (1780-1855), the fencing of the open range in North America (1870-1890), and the expropriation of village commonages in contemporary India - all conform to the general pattern presented here (Dahlman 1980; Hammond and Hammond 1965; Mingay 1968; Yelling 1977; Richards 1982; Osgood 1970; Webb 1931; Joda 1983, 1984). In all these cases changes in the system of land allocation were initiated by commercial and technical forces, and these changes were only subsequently ratified by political and legal means. This cause and effect sequence implies that movements to restrict access to resources may be initiated by forces which planners only marginally control, and that these movements may possess a momentum of their own. This possibility - and its implications for the design of effective livestock development policies - are examined in the following analysis of a contemporary range enclosure movement in South Darfur, Sudan.

A RANGE ENCLOSURE MOVEMENT: THE CASE OF SOUTH DARFUR, SUDAN

24. In most areas of arid pastoral Africa access to grazing land was traditionally relatively open. In South Darfur, however, this situation is being altered by a range enclosure movement. Protagonists of this movement do not directly challenge the customary tenure system. Rather, they reinterpret that system by selectively suppressing or emphasising elements in it. This reinterpretation hinges on the fact that the old Darfur system recognised restricted access to certain categories of arable land and water. What the proponents of enclosure have tried to do - by rhetorical, legal and political means - is extend the principles of exclusive access to cover rangeland.
25. In pastoral Africa, this process of extension has usually proceeded along two different lines. On the one hand, the

proponents of restricting access to rangeland can build upon the principle of restricted access to water. By controlling water they then control the range around it, a tactic which is particularly effective in very dry areas. This technique of range control has been employed to good effect in pastoral areas as diverse as the Kalahari of Botswana (Hitchcock 1980), Ethiopia (Cossins 1971), and Somalia (Holtzman 1982; Reusse 1982; Box 1982). Another way of controlling range is to manage it as if it were arable land. This approach is often the only practical alternative in grazing areas where water is commonly available and monopolising it is not an option. This is the case in South Darfur where enclosure is taking place on pastures which are used during the rainy season when standing water is readily available for stock.

26. The following analysis of range enclosure in Darfur firstly describes the existing tenure system and the way that system is being manipulated by certain pastoralists to justify range enclosure. We then examine the reasons why enclosure is taking place in certain parts of the province but not in others. The chapter concludes with a discussion of the role in the enclosure movement of a donor-sponsored rural development project.

Changing patterns of land control

27. The principles which organise the customary land tenure system in South Darfur conform to what we would expect on the basis of property rights theory. Valuable types of land are tightly controlled by the local authorities, the community or individuals. Relatively valueless land is loosely managed and "owned" in common. Between these two extremes there exist a number of transitional tenure and use arrangements which reflect the intermediate economic status of the land type under consideration.
28. In very general terms, the category of land which is most valuable and productive per hectare is flooded land suitable

for cultivation, followed in order of descending value by rainfed arable land, grazing rights to harvested or fallowed field sites, and, finally, grazing rights on unimproved range. The rules which govern access to each category of land reflect this gradation in value. Flooded arable land may be bought and sold, contrary it would seem to a strict interpretation of current Sudanese land law. The next most valuable class of land – rainfed interfluvial field sites on mixed clay and sand soils – cannot be inherited. Private ownership over these sites when they are fallowed for long periods of time is recognised and cultivation need not be continuous in order for the user to maintain a claim to the site. In contrast, the less productive category of rainfed field sites located on sandy soil must be regularly cultivated in order for the user to retain undisputed claim to the site. Thus, the claims that individuals have to exclusive control of cultivable fields becomes more attenuated as the productivity and value of the fields declines.

29. Much the same pattern emerges if we examine the allocation of rights to graze animals on the agricultural residues left behind in harvested fields. The customary practice was to open the fields to common use by all livestock owners, a practice which still obtains in those areas where crop residues are not a particularly valuable resource. However, in areas where it is clear to livestock owners that there are more cattle than the natural range can conveniently carry, local community norms permit farmers to restrict access to their fields.

30. Customarily, zariibas or thorn-hush fences provided a physical barrier to prevent livestock from trespassing on cultivated fields. In communities where grazing pressure is low farmers may still fence fields only on their exposed sides, and the fence does not alter the conditions under which an individual owns or manages the land. Anyone can hand-cut grass on an enclosed field, and any herd of cattle can graze the field after harvest.

31. The situation is more complicated in villages which lie in areas of heavy overgrazing and where fencing serves both to exclude livestock and to demarcate claims to fallow land, harvest residues, and natural rangeland. It is the use of fencing in these areas which most concerns us here, for it indicates a shift - however tentative - to a new system of rangeland tenure and management.

32. In practice, the distinction between an arable and a grazing enclosure is often anything but clear. It is acceptable (under the present rules) for farmers to enclose a certain amount of uncultivated land around the margins of their fields, thereby providing room for the later expansion of the cultivated area. Thus, farmers may not cultivate all of an enclosure, but the cost of fencing - which is an expensive and laborious process - will prevent them from enclosing vast unproductive areas.

33. Widespread enclosure becomes more attractive, however, should farmers ever establish control over their fields during the post-harvest period. Once this right is established, farmers have the option of maintaining a quasi-legal year-round claim to any fenced area which also contains a patch of cultivation. When natural grazing becomes a scarce and valuable commodity in an area, the interests of some farmers in enclosure shifts from protecting crops to using cropping as an excuse to control rangeland for their own livestock or to sell pasture rights. The result in some areas of South Darfur was a two-tiered pattern of field enclosures in which large fields (of 10 ha or more) tended to be cultivated over no more than 10% of their area, and served primarily as grazing enclosures, while small fields (of 1-3 ha) were much more extensively cultivated and constituted genuine arable field sites.

34. Whether the grass enclosures were legal or illegal depended on whom one asked, and how the question was phrased. If asked directly about zariiba sakit or zariiba al-hawa

("empty" or "air" enclosures) both herders and farmers agreed that such enclosures were illegal. Those who build pasture enclosures were also likely to add that no such enclosures existed in their community, although they were common enough in surrounding communities. Similarly, neither the traditional tribal authorities nor district-level administrators officially sanctioned range enclosure. The effective legality of range enclosure was more evident, however, if one examined the rulings of local courts in areas where enclosures were common. These courts were dominated by and represented the interests of the local farmers and livestock keepers who erected the enclosures, and the courts routinely enforced fines against nomadic livestock owners whose stock grazed either crops or enclosed rangeland.

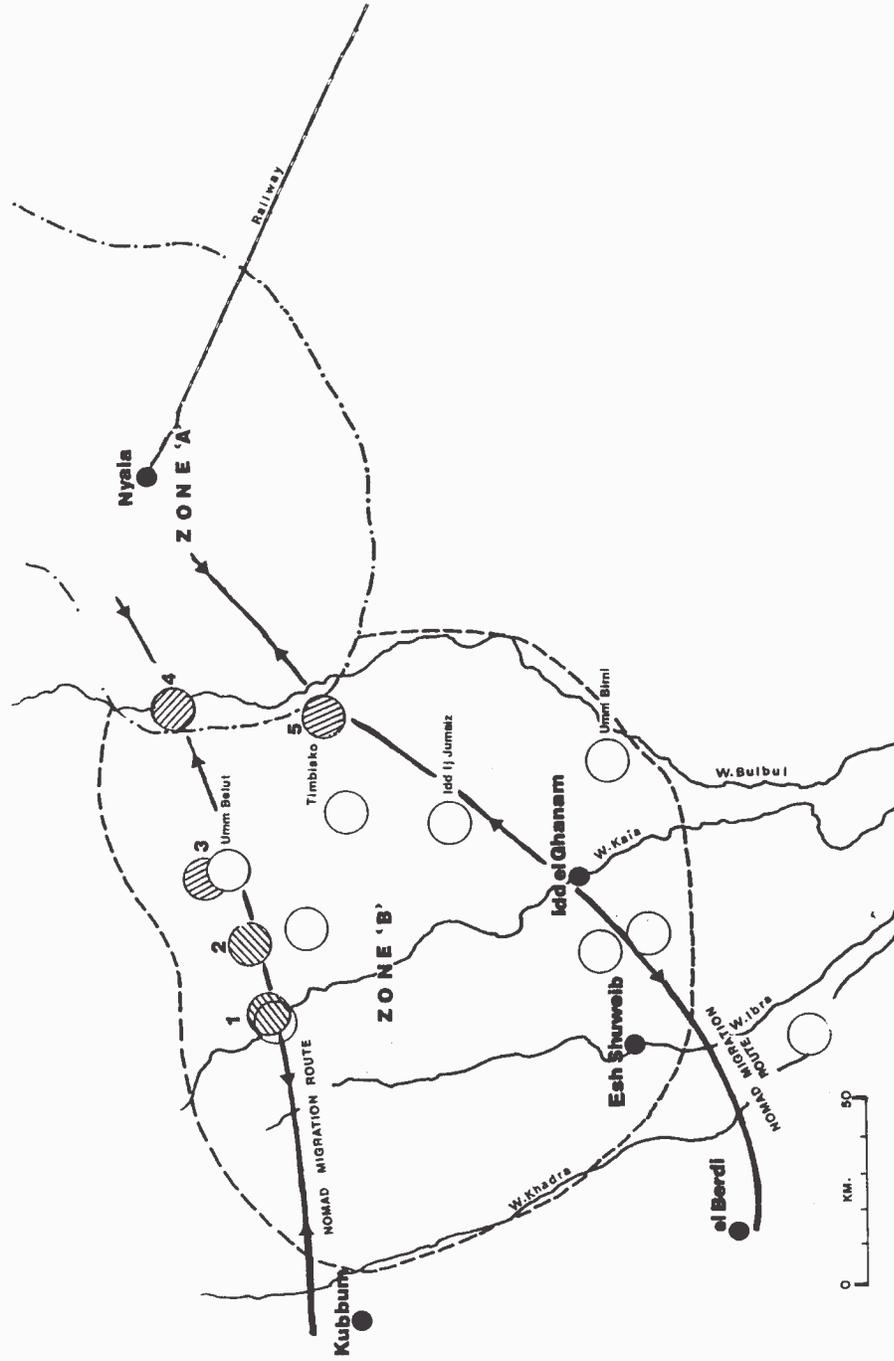
The geographical limits of the enclosure movement

35. In South Darfur range enclosure was taking place on an extensive basis in two distinct areas, market Zone A and II in Map 1. Different combinations of commercial and ecological factors were responsible for promoting enclosure in these two areas.

35. Zone A might be called the urban fodder belt, and consisted of the nearby rural areas which supplied the commercial fodder markets for Nyala, a major provincial market town and railhead. The city of Nyala contained numerous milch cows kept for household milk supplies, horses and donkeys used for water transport or the haulage of goods from the railhead, and a variable number of animals being held for marketing or shipment to Omdurman. Whether or not a particular farming community produced fodder for the Nyala market was determined by the sale value of the fodder species relative to the transport cost of getting it to Nyala.

¹ Since these factors fluctuated seasonally and annually, the precise distance that it was economically attractive to transport fodder was variable. Shown in Map 1 is the core area of intensive fodder production for the city.

Map 1



As long as this ratio was favourable, fodder for the Nyala market could be produced on different soil types and involved different grass species of various nutritive and commercial values. The Nyala fodder belt was not, therefore, a natural ecological area, but simply a zone within which a particular kind of commercial agriculture was profitable. Those who enclosed fields for the production of fodder ranged from small-scale farmers who sold through middlemen to large-scale entrepreneurs owning their own trucks, who produced directly for the urban market. Range enclosures in Zone A were primarily undertaken in order to sell fodder rather than to provide feed for local livestock.

37. The natural ecology played a much more important role in defining the second zone of range enclosure lying to the west of Nyala, Zone B on Map From the point of view of both nomadic and settled livestock producers this area was a particularly favoured region. Nomads used the zone for only part of the year from approximately June to September during the height of the rains. The majority of the nomadic herds spent the dry months to the south and west of Zone B in areas of higher rainfall where dry-season water for stock was more plentiful. As the rains progressed, these wetter areas became uninhabitable due to flooding, mud, biting flies, tsetse and mosquitoes. Zone B, characterised by relatively high, well-drained and firm ground, was a wet season refuge area for nomadic stock fleeing from these problems. Nomadic stock were also attracted to Zone B in the rainy season because it offered the highest quality pasture available in that season.
38. Left behind in Zone B for the remainder of the year were locally-owned cattle kept by the mixed crop and livestock farmers who lived in the area. Whereas nomadic cattle pulled back to the southern pastures and water points at the beginning of the dry season, many local herds tried to make

it through the dry season on water from hand-dug wells in the bottoms of the major wadis (dry sand rivers) which drained Zone B. But cattle need fodder as well as water if they are to survive, and herein lay a major conflict of interest between local herd operators and the nomads who seasonally used Zone B; for under open-range conditions, local residents were forced to permit the wet-season grazing by outsiders of fodder that their own cattle would later need to survive the dry season.

39. Zone B is therefore under heavy pressure from grazing stock in all seasons. Aggravated by periodic drought, this overgrazing 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. In those communities in which the process of private enclosure was most advanced, it was the larger herd owners with the wealth and social standing to dominate local politics who had erected the largest enclosures. Smaller and less prosperous herd owners did 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 field, large grass enclosures were commonly built by hired work parties. Cost of maintenance of the enclosure was also high since the thorn fences rotted after one to three years, depending on the particular thorn species used.

40. The range enclosure movement now occurring in Zone B is therefore based on competition between transient and permanently resident livestock-keepers for control of a diminishing range resource. Customary users of formerly unenclosed range repudiate the legitimacy of new enclosures though they have yet to formally challenge the principle of range enclosure. The pattern becomes clear by comparing the regions adjacent to Zone B 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 precipitate a conflict of interest between local and transient users.

41. Thus, the enclosure movement in Zone B reflects the area's extraordinary Importance in the regional system of livestock movement. While proponents and opponents of enclosure can be identified with particular tribal and land-owning groups, the impetus for enclosure is provided by the scarcity and therefore the increasing value of grazing in a limited area. The enclosure movement cannot be understood, as might be the case in the west African Sahel, in terms of an inter-ethnic or pastoralist-farmer conflict.

Enclosure and the role of development projects

42. Since at least the 1960s and 1970s donor assistance for livestock development in Africa has focused on the problem of overgrazing as a critical element in the supposedly low productivity of traditional pastoral systems. One of the common solutions offered to this problem, following Hardin, was to promote a shift from open-range to enclosed ranching, that is, from communal tenure to private land ownership. The projects which attempted to engineer this shift were, by and large, notorious failures. By providing an instance of spontaneous enclosure, the preceding case raises the prospect that we will be able to understand the conditions under which livestock-keepers will voluntarily change their tenure system, or conversely, reject outside attempts to institute such changes.
43. The factors which encouraged range enclosure in Zone A and Zone B were different, but they were in each case consistent with the theory of the development of property rights stated in Section I. In Zone A, the Nyala fodder belt, the high commercial value of fodder conferred a high value on the land which produced the fodder. It was therefore economical

for individuals to fence this land, and to devote their resources to meeting the social, legal and political costs that such enclosure entailed. While this enclosure was contrary to the existing tenure rules, it was entirely consistent with the underlying principle that valuable types of agricultural land were tightly controlled, even under the customary tenure system. The only novel element in this case was provided by the fact that the value of the land was not irrevocably determined by ecological factors, but had been altered by proximity to markets.

44. On the other hand, in Zone B the detrimental economic effect of overstocking was the factor which encouraged enclosure. In this case the productivity of the range was declining, and it was the increasing disparity between current and potential levels of production that induced local livestock keepers to act. Overgrazing had become, in Demsetz's terminology, an externality that local herders could no longer afford to ignore.

45. Both the Sudanese case material and the property rights theory emphasise that enclosure will occur only when certain objective economic conditions can be met. The preceding analysis thereby implies that formal development projects are not in a position to dictate when or where enclosure will take place. This conclusion is borne out if we examine the history of a rural development project designed to improve, among other things, the existing system of range management in South Darfur. One of the pilot programmes under this project was the creation of village-managed grazing reserves to be closed during the wet season and opened during the dry season when fodder was scarce. Unlike spontaneous private or communal enclosures, the project sponsored enclosures were formally legalised and endorsed by the regional political authorities. The project also arranged for the deployment of armed, mounted police to patrol the enclosure and to ensure observance of the rules regarding restricted access to it. Finally, the legitimacy

of the enclosure was buttressed by a steady stream of government officials and visiting foreign delegations who come to appraise or assist in its progress. The effect of these activities was to shift part of the costs of "policing" and "enforcement" off the local community and onto the project or the regional government, thereby rendering enclosure a more attractive option for participating communities.

46. The limitations inherent in this approach are illustrated by Map 1 which shows the locations of existing project-sponsored enclosures, and villages which had requested project assistance in establishing enclosures as of January 1985. All existing, proposed, or requested enclosures lay in or near Zone B, and most lay along major nomadic trek routes where grazing pressure was at its highest. Thus the project-sponsored enclosure programme had developed a clientele only in areas where pre-existing economic pressures favoured spontaneous enclosure. It achieved success in this limited geographical area because its activities were consistent with the needs of a certain group of producers whose home territories were under pressure from seasonal transient users.
47. These producers and project personnel were able to cooperate to further the enclosure movement, but they did not necessarily share the same objectives. As far as project personnel were concerned, the enclosures were technical interventions designed to improve the quality of rangeland in those areas where pressure was greatest. Whether particular types of users gained or lost as a result of enclosures was of less immediate concern to the project. The local communities in the area of heaviest grazing, on the other hand, supported enclosure because it gave them exclusive control over what had traditionally been a resource shared with nomadic users.

48. A brief review of the few partially successful range enclosure projects in Africa suggests that this is a general pattern (Behnke 1984: 273-279). Range enclosures are justified before donor agencies on technical grounds - that they will help to protect degraded rangeland, control overstocking, increase livestock production, etc. To the extent that they are accepted, however, the enclosures are used by certain pastoralists as a ploy in the struggle to control scarce resources. When these pastoralists respond to project initiatives, therefore, their response is usually selective, and the components of the official project which are neglected are precisely those which would entail a change in the system of herd management or a limit to herd growth, the very components which were often initially used to justify the project.
49. The repeated failure of enclosure or ranching projects in Africa is largely attributable to this difference in perspective between planners and their pastoral clients. These projects are often proposed for technical reasons in areas where enclosure serves no economic or political purpose for any interest group, and therefore receives no indigenous support. At the very least, property rights analysis should help to clarify why programmes of range tenure reform have succeeded or failed among different groups of pastoralists in the past, and where and with whom such programmes will be likely to succeed in the future.

CONCLUSIONS AND POLICY IMPLICATIONS

50. This paper has presented a theory of property rights which purports to account for the way in which land tenure systems change over time and in response to new technical and commercial factors. Extending or maintaining property rights, it has been argued, is a productive activity akin to other kinds of economically-rewarding behaviour and is therefore subject to general considerations of costs versus benefits.

The propensity of individuals to devote their resources to establishing property rights depends on the benefits which they expect to accrue from ownership, relative to the costs of defending that ownership. The shift from open-range to enclosed systems of land tenure is simply a particular instance of this more general phenomenon.

51. Three sorts of factors would radically alter the balance of costs and benefits derived from the maintenance of property rights in a pastoral economy. First, increasing levels of overstocking may render unattractive what had once been a relatively cost-free system of open access to rangeland. Secondly, the value of pastoral produce may increase, indirectly increasing the commercial value of the land which sustains this production. Lastly, technical or legal changes may reduce the costs of maintaining property rights, thereby making the maintenance of such rights more "affordable" even at stable levels of stocking or under stable market conditions.
52. In sum, property rights analysis has the potential to provide an explanation of how these systems change over time in response to commercial, technical and ecological pressures. If applied, the analysis would therefore provide an overview of a large and complex body of data which, at present, is only intelligible on a case-by-case basis. This line of analysis is particularly attractive in that it does not require abstraction from the details of individual cases to construct ideal types of tenure systems. Rather, property rights theory allows us to account for an ordered pattern of variability by specifying the limited set of causal factors which give rise to these patterns.
53. Contrary to the tone of numerous livestock project papers, the case study and analysis presented here suggests that range enclosure is not an antiseptic, purely technical undertaking, but, rather, an eminently political process of ambiguous legality. If processes of this kind arise spon-

taneously, then it would seem imperative for policy makers to develop criteria to judge the desirability of these movements and the advisability of intervening in them. At least three areas of concern deserve attention: questions of technical efficiency, the problems of resource conservation, and the related issues of economic equity and economic growth potential. In brief these issues are:

54. i) Technical efficiency: the shift from unenclosed to enclosed forms of livestock production may change technical or biological efficiency. The immediate factors which precipitate range enclosure suggest that such enclosure may often be accompanied by a decline in herd performance. In general, pastoralists will bother to enclose pastures only when overgrazing transforms good rangeland into a scarce and valuable commodity. In a nomadic pastoral economy, however, the very fact of overgrazing would indicate that the vegetation in the area being enclosed is in a critical bottleneck in the regional production system. Enclosing this area is likely to constrict the bottleneck even further and to cause disruption throughout the wider system. Short-term 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.

55. Questions of the comparative long-term efficiency of open-range pastoralism and enclosed ranching are difficult to answer. Recent research has shown that increases in productivity on a per hectare or per animal basis associated with commercial enclosed ranching are by no means as great as was once thought (Penning de Vries and Djiteye 1982). In livestock production systems using natural rangeland, as in some other agricultural systems, biological processes set fairly rigid limits on the marginal returns to increased inputs of labour or capital. While the incommensurability of commercial and subsistence systems makes comparison difficult, it would now appear that the substitution of capital for labour, and not higher absolute levels of production, is

the primary difference between modern ranching and traditional pastoralism. Questions of livestock development policy therefore hinge on the availability and cost of various inputs in different situations, rather than on the clear-cut advantages of either system.

56. ii) Resource conservation: overgrazing has long been viewed by most livestock development specialists as an unalloyed disaster, in fact, precisely the disaster that the projects were designed to forestall. The Sudanese case presented here certainly underlies the negative impact of overgrazing on the immediate interests of livestock producers. But this case also suggests that overgrazing has a critical role to play in restructuring the African livestock industry since it may, under certain conditions, serve as a catalyst to the eventual creation of enclosed, more intensive systems of stock and range management.
57. What needs to be investigated are the conditions under which projects should - or should not - supply inputs which will increase the value of livestock produce, indirectly increase the value of the range which supplies this produce, and thereby create pressures for the expropriation and private management of the range. There may be problems with such an approach in extremely arid areas where per hectare range productivity is very low, and pastoralists prefer to "mine" a region and then move on. The history of livestock development in arid areas of Australia implies that over-exploitation may occur irrespective of the tenure system if pastoral land holdings are too small to sustain a family, or if the returns to capital in non-pastoral sectors of the economy are better (for Australia see Young 1979 and Heathcote 1965; for the ranching areas of North America see Bennett 1969). In both situations pastoralists will be tempted to realize large but unsustainable profits from their pastoral enterprises, and then shift their money or labour to other more remunerative sectors of the economy. Extreme caution must therefore be exercised before

encouraging growth beyond ecological limits on the assumption that the system will ultimately be self-regulating, and livestock policies designed to promote sustained production must necessarily take into account the interplay between economic and ecological factors on a case-by-case basis.

58. iii) Issues of economic equity and economic growth are closely linked with respect to 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 commercialisation 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). In either case large numbers of pastoralists will lose their traditional rights to land.
59. Whether this expropriation is accompanied by actual hardship or by greater income maldistribution depends on the state of 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 modernise by displacing its redundant population at the expense of the overall economy. In this case the potential for individual hardship and the lack of opportunity for economic growth are obvious.

REFERENCES

Anderson, I and Hill, P (1979), 'From Free Grass to Fences: Transforming the Commons of the American West', in G. Hardin

- and J. Baden (eds.), Managing The Commons, W H Freeman and Co, San Francisco.
- Ariza-Nino, F. and Shapiro, K.H. (1984), 'Cattle as Capital, Consumables and Cash: Modelling Age-of-Sale Decisions in African Pastoral Production', in J.R. Simpson and P. Evangelou (eds.), Livestock Development in Sub-Saharan Africa, Westview Press, Boulder, Colorado.
- Behnke, R.H, (1983), Production Rationales: The Commercialisation of Subsistence Pastoralism, Nomadic Peoples 14: 1-34.
- Behnke, R.H. (1984), Fenced and Open-Range Ranching: The Commercialisation of Pastoral Land and Livestock in Africa, in J.R. Simpson and P. Evangelou (eds.), Livestock Development in Sub-Saharan Africa, Westview Press, Boulder, Colorado.
- Bennett, J. (1969), Northern Plainsmen, AHM Publishing Corporation, Arlington Heights, Illinois.
- Box, T. (1982), Central Rangelands Development Project, Somalia: Consultant Report, Louis Bergerinternational, Mogadishu.
- Ciriacy-Wantrup, S.U. and Bishop, R.C. (1975), 'Common Property as a Concept in Natural Resource Policy', Natural Resource Journal 15: 713-727.
- Cossins, N. (1971), Pastoralism under Pressure: A Study of the Somali Clans of the Jijigga Area of Ethiopia, mimeo).
- Oahlman, C.J. (1980), The Open Field System and Beyond Cambridge University Press, Cambridge.
- Demsetz, H. (1967), 'Toward a Theory of Property', American Economic Review 57: 347-59.
- Furobotn, E. and Pejovich, S. (1972), 'Property Rights and Economic Theory: A Survey of Recent Literature', Journal of Economic Literature 10(4): 1137-1163.
- Guttman, J. (1982), 'Common Property Externalities: Isolation, Assurance and Resource Depletion in a Traditional Grazing Context: Comment', American Journal of Agricultural Economics 63: 781-782.
- Hammond, J.L. and Hammond, B. (1965), The Village Labourer, New York.
- Hardin, G. (1968), 'The Tragedy of the Commons, Science 162: 1234-1248.
- Heathcote, R.L. (1965), Back of Bourke: A Study of Land Appraisal and Settlement in semi-Arid Australia, Melbourne University Press, Melbourne.

- Hitchcock, R.K. (1980), 'Tradition, Social Justice and land Reform in Central Botswana', Journal of African Law 24: 1-34.
- Holtzman, J. (1982), The Economics of Improving Animal Health and Livestock Marketing in Somalia, USAID, Mogadishu.
- Horowitz, N. (1979), The Sociology of Pastoralism and African Livestock Projects, USAID, Washington.
- Jarvis, L. (1974), 'Cattle as Capital Goods and Ranchers as Portfolio Managers: An Application to the Argentine Cattle Sector', Journal of Political Economy 82: 489-520.
- Jarvis, L. (1984), 'Overgrazing and Range Degradation: The Need and the Scope of Government Policy to Control Livestock Numbers', Conference on Livestock Policy Issues in Africa, ILCA, Addis Ababa.
- Joda, N.S. (1983), Market Forces and Erosion of Common Property Resources, ICRISAT Center, Patancheru, Andhra Pradesh.
- Joda, N.S. (1984), Causes and Consequences of Decline of Common Property Resources In the Arid Region of Rajasthan, ICRISAT, Patancheru, Andhra Pradesh.
- Leacock, E., 'The Montagnais Hunting Territory and the Fur Trade', American Anthropology 56(5).
- Meadows, S. and White, J. (1979), 'Structure of the Herd and Determinants of Offtake Rates in Kajiado District In Kenya, 1962-1977', Pastoral Network Paper 7d, 001, London.
- Mingay, G.E. (1968), Enclosure and the Small Farmer in the Age of Industrial Revolution, MacMillan Press, London.
- Osgood, E. (1970), The Day of the Cattleman, University of Chicago Press, Chicago.
- Oxby, C. (1981), Group Ranches in Africa, FAO W/P 3698, Rome.
- Palmquist, R. and Pasour, E. (1982), 'Common Property Externalities: Isolation, Assurance and Resource Depletion in a Traditional Grazing Context: Comment', American Journal of Agricultural Economics 63: 783-784.
- Penning deVries, F. and Djiteye, N. (1982), La Productivite des Paturages Saheliens, Centre for Agricultural Publishing, Wageningen.
- Picardi, A.C. and Seifert, W. (1976), 'A Tragedy of the Commons in the Sahel', Technical Review 78: 52-51.
- Reusse, E. (1982), 'Somalia's Nomadic Livestock Economy: Its Response to Profitable Export Opportunity', World Animal Review, 2-11.

- Richards, E. (1982), A History of the Highland Clearances, Croom Helm, London and Canberra.
- Runge, C.F. (1981), 'Common Property Externalities: Isolation, Assurance and Resource Depletion in a Traditional Grazing Context', American Journal of Agricultural Economics 62: 595-606.
- Speck, F. (1915), 'The Basis of American Indian Ownership of Land', Old Penn Weekly Review, University of Pennsylvania: 491-495.
- Stryker, D.J. (1984), 'Land Use Development in the Pastoral Zone of West Africa', in J.R. Simpson and P. Evangelou (eds.), livestock Development in Sub-Saharan Africa, Westview Press, Boulder, Colorado.
- Teitelbaum, J.M. (1980), Nutritional Impacts of Livestock Development Schemes among Pastoral Peoples, USAID, Washington.
- USAID (1980), 'The Workshop on Pastoralism and African Livestock Projects', USAID Program Evaluation Report No.4, Washington.
- Webb, W.P. (1931), The Great Plains, Blaisdell Publishing Co., Waltham, Mass.
- Yelling, J.A. (1977), Common Field and Enclosure in England 1450-1850, London.
- Young, M.D. (1979), 'Influencing Land Use In Pastoral Australia', Journal of Arid Environments 2: 279-288.
- Young, M.D. (1979), 'Differences Between States in Arid land Administration', Commonwealth Scientific and Industrial Research Organisation, Australia.