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A CRITIQUE OF «ECOLOGICAL» MODELS OF PASTORAL LAND USE¹

by

Anders Hjort

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In discussions on land use and development in rural areas, one can essentially have two kinds of perspectives on relations between people and land. One is to look at the productive potentials of land and account for various constraints on this (including the activities of human beings). The other is to concentrate on human communities and ask what natural resources people have available for making an income. These two approaches can also be found in the study of pastoralism, as the bibliography of this article illustrates. A title like «Pastoralism in Crisis: The Dassanetch and their Ethiopian Lands» suggests that the essence of the problem studied lies in people's land rights and the difficulties encountered when a local community is integrated into a national political system. On the other hand titles such as «A Review of Desertization in Africa -- Water, Vegetation, and Man», imply a view of people as one of three major technical factors to be considered in the plans for rational land use in the arid zone. The two perspectives of course reflect different academical traditions focussing on different aspects of a study problem. Exaggerating their consequences, we see that proponents of the first approach tend to emphasize social and ideological systems as a primary study object, whereas the other approach tends to emphasize environmental conditions and production systems. Proponents of this latter ecologically inclined approach frequently see the people now living in and exploiting the arid areas as more or less disturbances in the system.

Of these two approaches the second is undoubtedly and unfortunately the one which has had most impact both on policy making and on public opinion (as represented by Western press). Social scientists, naturally, tend to advocate the first approach. At the same time they rarely take the trouble to venture into direct debate with the representatives of natural or technical sciences on the homeground of the latter. Many perhaps feel dismayed at the standard generalizations about pastoral irrationality so frequently found in technical reports or at the lack of awareness of political implications of the results of technical research, and so shy away from a dialogue, perhaps feeling that something is fundamentally wrong but that prospects for communication are hopeless. Others acknowledge a necessity for integration but feel that there are inadequacies in their own education and so fear critically reviewing the merits and limitations of ecological research. Hence, unfortunately, when ecology makes its way into social science, it is rarely through intensive research cooperation between anthropologists or sociologists on one hand and the new generation of serious «field ecologists» on the other. More frequently, it is by social science paying uncritical respect to «applied», ecology.

In this article I shall touch upon some of the basic problems of generalizing from ecological models and using them for the study of pastoral societies and production systems. I shall here try to show some of the inherent limitations of traditional ecological models, but also how, by the way they have been used, they tend to fill a political role, identifying

symptoms while avoiding the more controversial issue of real causes, such as regional inequalities in political control over land rights.

The model set-up: people, land and domestic herds

Let us start off by presenting the parameters of an ecological pastoral model. In a contribution, nowadays often referred to in the anthropological literature on pastoralism, Paine (1972:78) notes that «a prerequisite of successful herd management is the possession of three variables in commensurate proportions: herd, personnel and pasture». Similarly, Dyson-Hudson (1972: 19) suggests that the simplest necessary model of a pastoral system would be that of «coincident populations (human/livestock) surviving by balanced response to a natural environment in which grazing, water and disease vectors are the prominent features...». These quotations may at first sound somewhat trivial; people, animals and «land» in a wide sense (including water, minerals and vegetation) must be fundamental elements to a model of pastoral production. Nevertheless, the actual construction of such a model seems to be a rather difficult task which so far nobody has mastered.

Paine uses the triad of factors in his analysis of the different decision-fields into which individual Sami herdowners are drawn. However, when the analysis leaves the individual household level as practiced by Paine, and instead deals with larger populations and regional systems of pastoralism, there are complications. Consequently, Dyson-Hudson, in the text quoted, quickly adds reservations for the case where two or more sets of coincident populations compete with or react to each other in the same general environment, or even exploit it in different ways. In fact, when we approach this aggregate level, few attempts of model-building seriously take account of all of the relations which are involved, that is between people and land, land and herds, and herds and people. Most attempts concentrate upon two of the elements. Since the most common theme is the relation between animal numbers and grazing resources, I shall dwell at some length at this particular approach.

Animals, land and the «carrying capacity» concept

In the land/herds model, balance between pastures and domestic herds is represented by the notion of «carrying capacity». This is a widely used concept which represents the relations herds/land in terms which closely parallel the Lotka-Volterra model of predator/prey relations, a classic within the ecological discipline. In the 1920s the two authors Lotka and Volterra, independently of each other, arrived at an ecological model, summarized by Ingold (1980: 38) in the following words:

«Two species, one of which feeds on the other, must undergo perpetual and undamped oscillations in numbers. The predators usually increase to a point of overloading their food supply, then decline again through malnutrition, giving the prey a chance to increase, consequently allowing the predator to increase, causing the prey to decline and so on...».

In analyses of pastoral systems, livestock are usually put in the position of the predator and grass in the position of prey. Animal numbers rise to a limit determined by the «carrying capacity»; then the animals

die in large numbers due to inadequate grazing; the grazing can then recover and allow for a new boom of animals. The simple «Lotka-Volterra model» for animals and grazing can be summarized in the form of the following graph, used by Haaland (1975: 27):

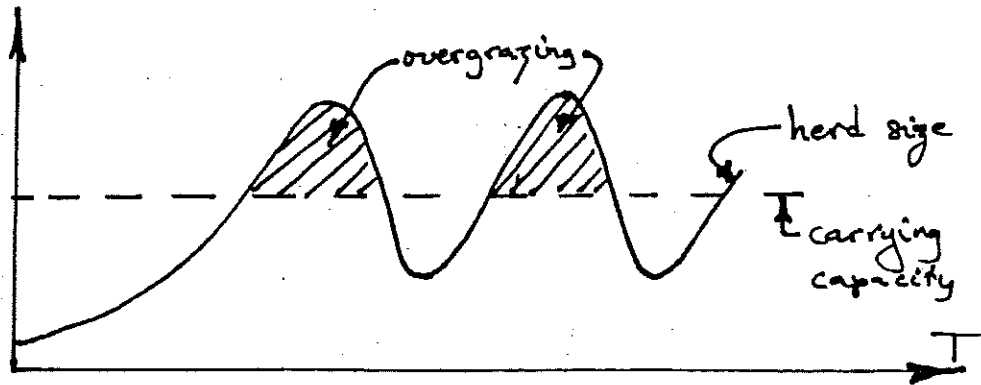


Figure 1: A constant carrying capacity regulating stock numbers

The graph above assumes that pastures recover after overgrazing. A more pessimistic view leads to the following presentation (Cf. Haaland 1975:28):

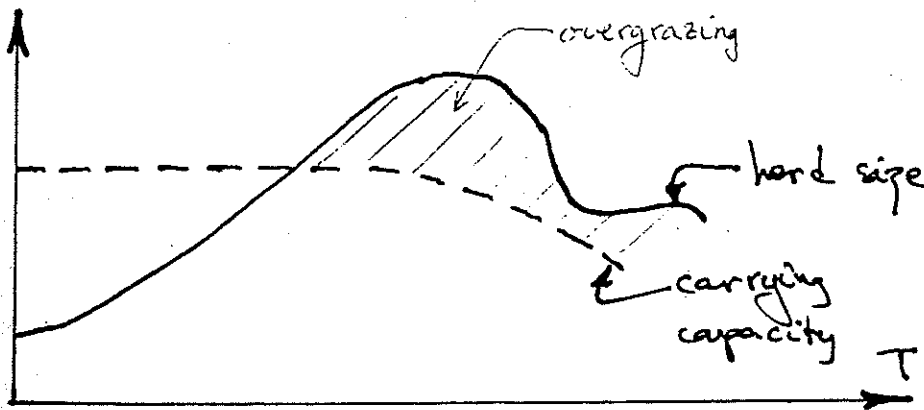


Figure 2: Deteriorating carrying capacity due to overstocking

Figure 2 suggests a deteriorating carrying capacity as a function of overgrazing. If one instead looks at herd size as a function of a varying carrying capacity, pictures like the following emerge:

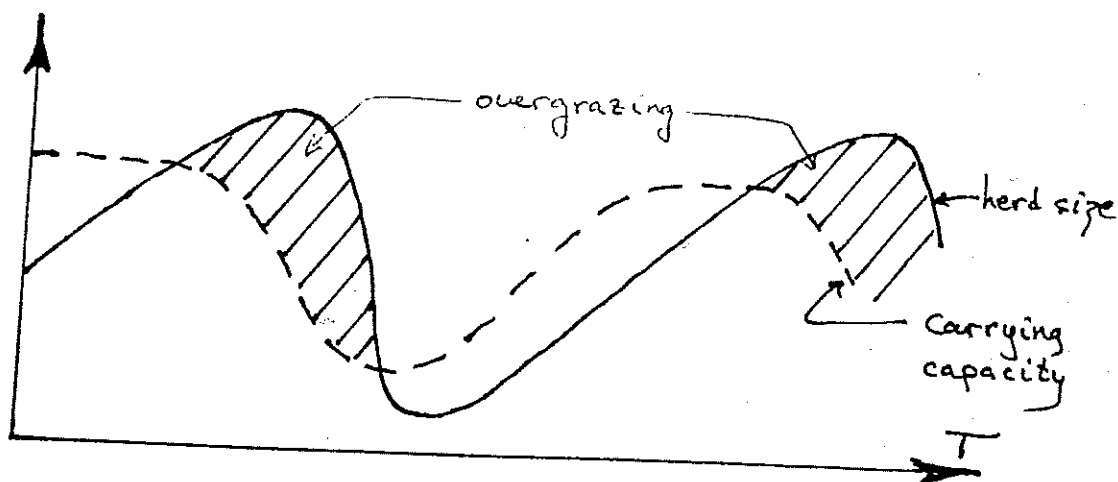


Figure 3: Stock numbers and reversible degradation of pasture
(Cf. Rapp 1974:23 after Swift 1974)

The first general form of graph is used by authors who assume grazing to cause a quantitative depletion of fodder only. The second graph postulates an irreversible process. Haaland's (1975) argument refers to the agropastoral land use as contrasted with pastoralism, but it aptly also summarizes one major school of thought on the effects of pastoralism. The graph contains no longer any suggestion of an undamped oscillation; in the long-term relation between pasture and livestock numbers, land is seen as irreversibly destroyed.

The third graph is used by those who assume a degree of reversible qualitative degeneration of the grazing grounds. Relieving the grazing pressure is thought to allow the plants, the composition of the vegetation or the soil to recover².

The concept of carrying capacity is usually expressed in terms of liveweight-based standard stock units of about 450 kg with the implicit assumption that camels, cattle and small stock can be compared on the basis of their consumption needs. A certain area which exhibits the carrying capacity of, say, 15 Standard Stock Units (SSU) will then appear to harbour equally well 15 camels, 106 goats or 106 sheep. However, as Pratt and Gwynne (1977: 279) point out, these animals have different feeding habits and do not directly compete with each other. If one uses several types of animals the number of SSU that can be kept in an area increases.

Ideally, one also ought to take account of the purpose of pastoral production and the standard of livestock maintenance that is accepted. As is clear from FAO in 1972 (see Pratt and Gwynne 1977: *ibid*) - but rarely done - the ideal Stock Unit system should take into consideration that barely keeping animals alive, obtaining an acceptable milk yield, or fattening animals imply different grazing requirements.

The importance of this point is that in terms of household economy, food production is not necessarily a direct function of the average liveweight

or fodder intake of the individual animal. It is inadequate to use Standard Stock Units to define, for example, the minimal herd size needed for a household (Cf. Dahl and Hjort 1976: 224FF). Comparisons between stocking rates per area or per household can be done in terms of SSU only if one is concerned solely with one species of animal, and if the purpose of production and standard of maintenance is unambiguous. As soon as the attention is shifted to consumption aspects, we need distinctly different sets of stock units, one representing the carrying capacity of the land (for livestock) and one representing the carrying capacity of domestic herds (for people)³.

Another criticism which can be raised against the concept of carrying capacity, or perhaps rather against the way it is commonly used, relates to the limitations in a temporal dimension. At any particular point in time, one could possibly find a maximum number of animals which could be sustained on an area without actually depleting or destroying the grazing basis. However, one characteristic of the zone where specialized pastoralism is practiced is the very drastic seasonal and yearly fluctuations in vegetation, with constant intermittent periods of abundance or scarcity. Hence, the actual carrying capacity will vary from season to season and even week to week; nevertheless the concept is used normally without any temporal specification. «Average carrying capacity» is a notion of little utility, since the «normal state of affairs» is more or less anomalous in pastoral eco-systems. Seasonal variability may under these circumstances also overshadow the fluctuations which are created through grazing pressure⁴. In pastoral societies such fluctuations bring great changes in the utilization of manpower and food production. One has to conceptualize seasonal variations in the model as rapid changes in the relationships between people, animals and land.

Also, it is not always clear whether the critical limit of carrying capacity is defined by the occasion when the environment is destroyed or damaged, or by the time when the animals suffer enough to starve (or stop lactating). Pratt and Gwynne (1977: 36) emphatically state that «... the animals destroy or damage the environment before they die of starvation...» while Haaland (1975: 25), for example, maintains that «... when the number of animals approach this limit (i.e. where the environment is destroyed), starvation occurs and the animal population is regulated by reduced reproduction rate increased death rate...». Haaland's model furthermore presupposes that the human population always hits the starvation limit before the animals do; the predicament of the hungry pastoralists do not allow them to let animals reach the starvation stage but will force pastoralists to cull their herds before that.

The degree of grazing that is to be classified as «overgrazing» is not an unproblematic issue. Recent research in Kenya suggests that semi-arid areas require quite a high grazing pressure for a maximum nutritional benefit for livestock. This decreases the relative intake of crude dry matter to protein⁵ and increases the efficiency of grazing, since a proper protein intake from fresh shoots increases the capability to digest low-nutritional dry matters which frequently dominate the undergrazed vegetation. Also, recent research trends in the micro-ecology of arid grass lands tend to put much more emphasis on the impact of qualitative differences in grazing patterns between various livestock and game species, and on the implications of

species interaction. The way in which an area is grazed may be more important than by how many animals⁶. Noting this, one can only comment that more pasture research is needed into aspects of overgrazing. Presently, it is wise to be cautious about generalizations as to the effects and causes of overgrazing.

People as consumers and labour

The most common way of treating the relation between the two parameters man and land is to regard it as a reflection of the relation between herds and land. One illustration of this, and of the difficulties met when trying to enter «people» into the «Lotka-Volterra» kind of model can be provided by Haaland's (1975) analysis of the differences between pastoralism and agropastoralism, a case of an ecological argument advocated by a social anthropologist. Haaland analyses traditional pastoralism as consisting of two forms in balance: one of livestock and grazing, and one of animal numbers and human consumers. These self-regulating balances, according to Haaland, lead in the long run to stability in the pastoral adaptation and imply an automatic control on both animal and human populations. Before the pastoral population as a whole would suffer and starve due to high grazing pressure, some animals would die, some households would drop out of the system and balance would be restored. The risk of disaster would be carried by individual households rather than by the collective community, since animals are individually owned. Haaland's construct combines ecological model elements, which essentially apply to an aggregate level, with other elements referring to individual households, setting a necessary minimum of animal numbers in relation to the consumption needs of a household.

Haaland includes all the three parameters, people, land, and herds in his model but does so only in a partial way. The human population is not treated as an independent variable but fluctuates, with some delay, with the rhythm of the animal population. The model thus does not account for the people/land relation in any other way than through the link of food produced by the herds. But, from an analytical point of view, the relation between people and herds has two important aspects. People are both consumers of off-take from domestic herds and supply the labour needed for their care. This makes the people component difficult to handle comprehensively. Haaland's model is reminiscent of Stenning's (1958) well known discussion of «household viability», but differs from it in that it sees people only as consumers. Stenning describes the relation between people and livestock both in terms of labour requirements for adequate care of the livestock, and livestock requirements for an adequate supply of food for the human population⁷.

Despite the fact that such an emphasis on pastoral labour is inherent also in Paine's phrasing of the triad «herds, pasture and personnel» rather than «animals, land and people»; the vital questions regarding pastoral labour supply and organization remain so far only unsatisfactorily answered by social anthropologists. Animal/land and people/land relations as expressed in pastoral migrations are usually analyzed in terms of climatic fluctuations and the needs of animals; yet, the relation between domestic animals and land is always mediated by people. This implies that the animals may be taken to areas where they would not be able to go on their own, areas where

human work provides them with water and gives them protection against predators⁸. Also it implies in certain cases that human considerations slow down the «natural» movement of the livestock, such as when there is too little labour to follow the animals, or a need to keep milk animals stationary and close to an immobile section of the human population such as the aged, the sick, and young infants with their mothers.

Oddly enough, the extent and location of actually overstocked areas have not today been properly mapped in areas with extensive animal husbandry, although the belief in an almost universal overstocking in the arid areas is close to doctrinal. Reports that animals in a particular area or belonging to a certain group are dwindling in numbers tend to be politically volatile and quickly suppressed by concerned central authorities. However, it is possible to find counter-cases where land is understocked rather than the contrary, and which show that land in itself is a conditional parameter. Its quality as well as its areal boundaries depend on its continuous use by a certain number of stock and the maintenance, in fact, of a visible relation between food production and human labour.

Dahl's (1979: 51ff) example from the Borana and Sakuye in northern Kenya provides an illustration. Due to a secessionist war in the 1960s and subsequent droughts, these two groups lost most of their animals. The cattle-keeping Borana recovered at least partly from this shock, but the camel-herding Sakuye had to leave the pastoral economy altogether. The land Sakuye used to keep their camels on contained, good seasonal cattle pastures where Borana herdsmen took their livestock. In the pre-war period pastoralists of both groups cooperated in defending common pastures. Today, the cattle-keeping Borana suffer from the absence of allies permanently stationed in the wet-season grazing area and have no possibility of utilizing these pastures. The defense of pastures, as well as the organization of stock migrations were activities that required a lot of labour, and the reduction of labour potential made the situation of the remaining Borana even more vulnerable. The prospect of starvation forced many poor households to send their sons downcountry. As a result important categories of pastoral labour were lost; migration distances shrank and led to increased wear on pastures near water on the one hand, and bush growth at areas in the periphery on the other. In consequence, encroachment by Somali camels could not be stopped.

This case raises the problem of understocking and its relation to land deterioration. With few animals, few humans can be supported and, hence, the available labour power is limited. And with limited labour power the herds need to be concentrated and not all pastures can be exploited. Thus areas close to permanent water become permanently rather than seasonally grazed and peripheral areas may suffer from uncontrolled bush growth.

Although overgrazing in a local spot is a sign of too high a concentration of stock in that spot, it should not be taken as a safe sign of a general excess of animals since parts of the land use unit may be left under-utilized at the same time. The pastoralist, as a worker and as a consumer, mediates between animals and land, and we must first ascertain the conditions for his mediation before we can judge the reasons for overgrazing.

The problem of scale

It is obvious that established ecological system models for pastoral and animal populations built on a small scale emphasize factors related to biological reproduction, particularly when they deal with the ecological conditions in a rather narrowly defined locality. However, as soon as we move to a larger scale we move into the kinds of problems encountered by Dyson-Hudson (see above) and the limitations of the model become apparent.

The «Lotka-Volterra» model presupposes an aggregate level but it is not exactly clear what kind of an aggregate we are dealing with: its size, the nature of the system's boundaries, the adjustments that have to be made when there are subsystems in the aggregate, etc. Already when we have to deal with two neighbouring pastoral groups difficulties emerge. The following graph illustrates direct relations between people, land and animals in the two societies:

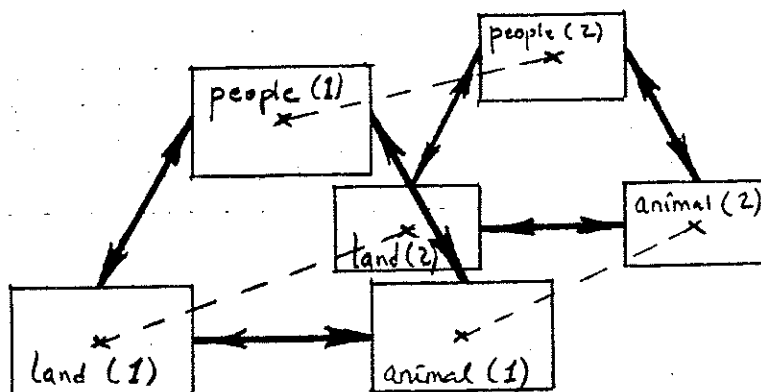


Figure 4: People, land and animal components in two neighbouring pastoral societies

The replacement of such an aggregated model by an integrated and more comprehensive one would be possible at a particular point in time, but in order for it to remain valid over time, there must be a perfect commutation (the dotted lines in the figure) between the respective micro parameters (people₁ and people₂; animal₁ and animal₂; and land₁ and land₂) which we in actual fact have no reason to expect. In reality we will, for instance, encounter situations in which land₁ and land₂ may overlap and be a subject of competition between members of the two groups. It may, however, be that land use of the two groups is complementary if these groups herd different species of livestock. In the event of one of the groups losing a substantial

part of its livestock, the more comprehensive model suggests a redistribution of livestock. But such redistribution cannot be taken for granted. It may or may not occur depending on factors of a type which the model does not handle. Hence, animal₁ and animal₂ might still need to be treated as separate entities.

Factors not immediately obvious within the framework of the model are the degree and kind of culturally prescribed contacts between the societies which may have regulatory effects just as well as the elements in the ecological model. Socially sanctioned patterns of behaviour, for the protection of the group or other reasons, create rules which make a purely ecological model on this level too simplistic. We may still find a variety of balanced situations; for example, a growth in the number of livestock belonging to Group 1 in the figure may give the result of assimilation of individuals (labour power) from Group 2 just as well as it may allow for a human population growth in Group 1 and/or a territorial expansion of this group. Just how the parameters combine is situationally defined and there is no reason to assume that all people, animals and land would be affected in a way a comprehensive three-dimensional model might suggest. The latter will, on the contrary, most likely obscure information on differences between various pastoral groups which might be crucial for an understanding of pastoral change.

There is a danger of losing perspective; in fact there is no scale of variability in any of the three relations concerned (people/animal, people/land and animal/land). One can easily assume functional relations between people, animals and land for a limited and isolated human population acting in a bounded territory. However, the territories exploited by local ethnic groups or pastoral «tribes», common units of anthropological analyses, are certainly so such isolates.

In the complexity of real life situations, access to land proves to be constrained by factors outside the local community, for example by the simple fact that neighbouring groups compete over the same pastures. In a regional or national perspective the constraints set by the model are subordinated to other political and economic factors (Cf. Asad 1979). When pastoral societies are discussed on a more general level, or when we take larger regions into consideration, we cannot make the assumption that the process of balancing between the three functions is self-regulatory for the simple reason that we no longer deal with a closed system.

The dwindling land base

The relation between people and land is closely linked to the double relation between man and his animals but also contains independent qualities which are of a jural and political nature. And this seems to be a factor which is most easily neglected by the ecological approach.

Land is a resource which has become increasingly scarce for pastoralists. Although this fact has often been stated, it still deserves emphasizing. In models of an ecological kind, the quality of the vegetation cover, but not the spatial extension of pastures, is normally treated as a variable. Generally, the area available is assumed to be constant while the vegetation on it fluctuates in response to how much it is grazed by the livestock. Land boundaries are only mentioned in passing, and if at all, in connection with overpopulation. As a rule, little information is given on how boundaries are

changed and whether there is any relation between the number of livestock and actual control over land by the animal owners. One could imagine situations where a thriving livestock industry is exported into new grazing lands, especially when water availability improves or tsetse bush is reclaimed. But the general trend is most likely, as will be exemplified below, the opposite -- a dwindling land base for pastoral societies.

Crises in pastoral systems are often attributed to changes in one of the population parameters, while land areas are seen as a constant. Pratt's and Gwynne's (1977: 38) discussion of overgrazing provides an example of this aspect:

«There are, therefore, two recognizable forms of overstocking. The first arises when the human population is excessive; when every family, regardless of the range condition, attempts to keep enough stock to keep itself alive. ... The second arises when the pastoralist, reluctant to sell his surplus animals, accumulates more livestock than is needed for subsistence.»

Such a position is, generally speaking, sufficient for discussing purely ecological problems but not satisfying for an analysis of crisis in pastoral production systems. It does not account for land losses occurring simultaneously with the development of ecological imbalance. Pastoralists, all over the world it seems, lose important parts of traditional land through a general land-grabbing process, be it for private commercial or well-intended development purposes. Tourism and the game industry, commercial ranching, mechanized dryland farming, irrigation and mining are the main culprits, and the areas first lost are usually those of some strategic significance, such as better-watered areas to be relied upon during drought periods. In effect many pastoral economic systems have been forced out of balance. Misdirected ambitions to settle nomads or neglecting to consider nomadic populations when planning development projects pose no less a threat to their well-being than outright and unmasked competition for land. Recent publications bear witness to the shrinking pastoral resource base as illustrated by the following examples.

The Kenyan Maasailand has drawn much attention. The gradual Maasai loss of land during and after colonialization is accounted for in many sources (Cf. Jacobs 1973: 4, Jacobs 1975, van Zwanenberg 1975: 85, Wisner 1977: 27f). The loss was caused both by a forced migration of Maasai to leave room for white settlers and then by a gradual expansion of agriculture into what was left of Maasailand (Great Britain 1934: 192). Land in such areas as Ngong Hills was taken over by smallholder farmers from Central Province, who were pushed from their homes through structural changes there, which were connected with land reform and the commercialization of Kikuyu agriculture. Later, mechanized wheat production became a major source of Maasai land loss. Furthermore, several of the more famous game reserves of Kenya and Tanzania are to be found on former Maasai grounds. All in all, the Maasai have lost control over considerable land areas: Kaputei Plains, Central Rift Valley, Mau, Laikipia and Uasin Gishu (Migot-Adholla and Little 1981). In a similar fashion the neighbouring Kamba people have lost their best pastures (Mbithi and Barnes 1975: 37ff).

The group ranches of the Livestock Development Project in Maasailand (see Lele 1975) have seemingly not been entirely successful (Cf. von Kauffman 1976). The idea has been to establish ranches with ecologically sound pasture sizes and utilization for their members. A number of technical problems connected with size, membership, loans and output have occurred. In between the group ranches are found private ranches, wherever too little land has been left to allow for another group ranch, often on better-than-average land. Such private ranches, being fenced, take away important resources from established pasture utilization. The loss even of small patches of land may prove disastrous for a regional system of pastoral production; and whereas private ranches are fenced, group ranch pastures can still sometimes be utilized by private ranchers.

Loss of land is also the most serious problem met by the pastoral Barabaig (Kjaerby 1979: 138ff). Initial losses of high-rainfall areas were made when the colonial government handed over Barabaig land to the agropastoral Iraqw in an effort to stop erosion in Iraqw areas. After that, Barabaig have suffered continued encroachment by semipastoral cultivators, and an expansion of capitalist and parastatal cash crop farming. The effect has been a marginalization of Barabaig animal husbandry.

One example from Ethiopia, typical for the conflicting interest of pastoralists and central national powers, is the situation of the Dassanetch in the southwest of the country (Carr 1977). They have experienced severe reductions of their traditional lands because of the establishment of controlled security zones along the Kenya-Ethiopia-Sudan borders. As a result both their environment and their society have changed.

From West Africa, Gallais (1967, quoted in Johnson 1978) describes how large-scale (but fairly unsuccessful) irrigation projects have been tried in the interior delta of the Niger River in Mali on land which is seasonally flooded. This land has traditionally been of great importance for dry season grazing to the pastoral population. From neighbouring Senegal, Aronson (1981) also mentions how irrigation projects have replaced important flood pasture areas. He furthermore notes that dryland farming has increasingly expanded into the rangelands in Niger and Nigeria.

Irrigation projects have replaced dry season pastures also in the Sudan (Aronson *ibid*). The Khasm el Ghirba scheme which will ultimately reach a size of 540,000 acres (El Ghoneimy 1971) has turned pastoral land into irrigated fields for cash crops. The Butana plains, used by the Shukriya Arabs, were turned into mechanized farms of millet and sesame during the 1950s and 1960s (Cf. Sörbö 1975: 4f). Irrigation erodes traditional rangelands along the Blue Nile, Rahad and Atbara Rivers (Sörbö 1977).

If we look at the Middle East outside Africa, Bahhady (1981) reports from Syria that mechanized farming in the 1940s and 1950s has led to a forced change for Bedouins from pastoralism to settled agriculture. The Syrian land reform of 1958 brought agricultural practices further into marginal steppe areas, but when farming failed there, the Bedouin had to migrate to the cities. Sanford (1977: 48) suggests for both Turkey and India a rate of decrease (in area) of pastoral land to be as high at 1% per annum.

With all these examples I have by no means exhausted the list of specific cases. The reader may, however, with some justification express hesitation to accept those mentioned as more than isolated examples. This brings us to another odd point. Although it is easy to raise examples from the literature, these are normally not set in a context of general land transfers. It is surprising how little systematic research has been carried out on losses of land and on the effects of such losses on, for example, pastoral migration patterns on a regional or national scale. An exception representing the kind of perspective needed, but still lacking in necessary systematic detail, might be the French literature on the Sahel situation provided - for example, by Copans (1975) and Meillassoux (1974). As a rule, the often narrow local perspective of social anthropologists causes us to take a myopic view of the pressures our own «favourite» pastoral groups are subject to. More seldom are we in the position to judge whether the pressures exerted by one group A on another group B depend on the expansionism of group A, on the pressures that they themselves suffer from a third group, or are part of a larger pattern of shrinking land resources. Perhaps this could be a field for fruitful cooperation between geographers with a wider regional perspective and anthropologists with access to more detailed localized information about patterns of land use. Certainly, it would lead to a better appreciation of the local relations to the macro-society if present-day local conflicts over grazing are not only analyzed in the ethnic terms which govern the contestants' perceptions, but rather in terms of a competition between different economic systems over productive land which pushes its victims against each other.

The immensity of the problem of pastoral land loss seems to fail to impress planners and public opinion alike. Perhaps harsh figures on the rate of resource shrinking is the only way we can communicate it? This is an example of research anthropologists as well as ecologists should do if we want to be of any practical use to those whom we study.

Ecology as ideology

It is the apparent pressure of external factors on pastoral production systems that forces us to raise the question of the real utility of traditional ecological models for the study of pastoralism. Ecological models or analyses that are valid on the micro plane are expanded to yield aggregate level generalizations for which they were never intended, and then take on the role of objective truth, often in contrast with what is felt to be the professional subjectivity of anthropology. Such generalizations may become supportive of an ideology which sees development as a purely technical problem and which in its turn may have disastrous side effects for those who have to live with its results. In particular, the «irreversible destruction» variety of the model of pastoral systems is used as a justification for external intervention to create drastic changes:

«It is necessary to stress that any solution involves radical changes from traditional customs. Such changes are always resisted. However, existing disease controls and the control of intertribal warfare have already changed the habits of rangeland people and will continue to do so. The reduced capacity of deteriorated and deteriorating rangeland to absorb

the results of periodic excess will make further changes necessary at increasing pace. Measures such as the issue of dried milk in times of drought, though humanitarian, do nothing to solve the basic biological problem of humans living on rangeland - the ecologically unwise dependence on milk in country where milk production should not be attempted. They are not only not a solution, but actually prolong and aggravate the problem.» (Pratt and Gwynne 1977: 40).

True enough, drastic changes are required. The problem, to my mind, is that technical changes are unlikely to yield any solutions to the issue of imbalanced pastoral production systems.

This idea of a self-regulatory system, on the other hand, might also have another ideological basis. It can be seen as an attempt to protect pastoralists against non-appropriate interventions justified on the basis of the assumed «irrationality» of the pastoral system. There are, however, great risks in using a systemic approach which presupposes self-regulation and ultimate balance in a situation where the conditions do not make the conservationist's dream realistic, where the pastoral production system is not in practice isolated but undermined both by «unplanned change» and the external competition for pastoral land.

That the ecological outlook serves ideological ends has been observed by others (Cf. Galaty, 1981). The case of pastoralists is particularly critical because they are caught in the conflicting interests of several political power-fields. Nomadic pastoralists tend to inhabit political boundary areas over which nations may dispute. Frequently they are obliged to cross political boundaries in their search for pastures and in most cases they are difficult to reach with social and other services, two factors which complicate a nation's domestic politics. They inhabit areas which technological development has recently rendered attractive for other land use purposes (farming, ranching, tourism, mining). They make up ethnic minorities in the countries they inhabit. The history of many pastoral groups provides multiple examples of how land-grabbing or sedentarization of nomads, etc., has created further problems for a balanced pastoral economy under the pretext of «development». The «ecology approach» to some extent is an answer to the desire by development planners to reduce complicated problems to a level where the solutions can be easily identified, and where the problems can be handled with «inputs» to proper «target groups»; we get an ideology, a «technical reductionism», characterized among other things by a set of dogmatic answers to complex problems.

Conclusion

When we move from the analysis of conditions in a narrow local area, the ecological models may serve as providing illustrations of particular aspects of pastoralism, but can have only little explanatory value if isolated from the economic, political and social context. To ascribe the causes of present-day imbalances in pastoral production systems primarily to ecological conditions alone, is to avoid complex political and economic issues. In a long term perspective this means focussing on symptoms rather than causes. I have in this article endeavoured to demonstrate some difficulties

in generalizing an ecological analysis. We have seen how the apparently unbiased elements of an ecological model -- man, land and animals -- in fact need careful scrutiny, how a seemingly technical concept like «carrying capacity» requires careful consideration of social factors, how external political factors can make ecological models meaningless for empirical research, etc. But the problem is not only one of method; it becomes political because there seems to exist an implicit demand for certain kinds of statements which fit the ideology of capitalist economic expansion and political centralization.

However, my intention is, of course, by no means to suggest that the use of ecology for the study of pastoralism should be discarded. The dialogue between professional ecologists and representatives of social scientists must continue, but needs to be established at another level than where it hitherto has been found. We must leave the field of grandiose models and move into that of empirical research. In recent years, ecologists have started doing field-based research on topics pertinent to the understanding of husbandry practices on the household level, and are contributing in a most important way to the development of our knowledge of pastoral production systems on the large scale. They approach problems such as the interaction between game, domestic stock and pastures, the interplay between soil texture, vegetation and animal body temperature adjustments, the ecology of parasites and so on.

Part of the relevance of ecology to us anthropologists is that it can explain the natural constraints under which pastoral societies operate. Ecologists can make intelligible to us vast fields of knowledge and cognitions which pastoralists themselves have developed through long experience with their environment. But ecologists also need something from anthropologists; namely how animal movement and grazing patterns organized by people are influenced by social and economic changes put into proper context. In short, what is needed today with growing scores of people being pushed out of the pastoral economy is proper detailed analyses of the varying ecological conditions that exist in specific pastoral production systems, and the links between these systems and economical and political conditions on the macro level. Let us seek a «political ecology» of pastoralism.

FOOTNOTES

1. This article has been written for a research project, «Pastoralism, society and ecology», financed by the Swedish Agency for Research Cooperation with Development Countries (SAREC). Particularly I want to thank Gudrun Dahl for comments on early versions of this manuscript. I also wish to acknowledge helpful comments by Stephen Sandford, Ulla Wagner, Håkan Wahlquist, Prudence Woodford-Berger and Wilhelm Ostberg. This paper will also be published by Ethnos, Vol. 46: III-4, an issue in honour of the late Erich H. Jacoby.
2. All three graphs treat pastoral herds as an unproblematic entity. This is by no means the case. In Dahl and Hjort 1976: 114-129 and 1979: 10-17 we have demonstrated the decisive importance of herd structures for responses to circumstances of overgrazing.

3. Differences between the two sets say something about nutritional conversion efficiency of the various species.
4. Prole (1967: 92), for example, demonstrates how annual average rainfall and an area herd size relate (the case is Kajiado District, Kenya). He shows how consecutive good or bad years relate to increases and decreases in the area herd. The kind of problem that aggregate data on such a scale as district/annual entities provides is demonstrated in his graph with an extreme case. The year 1961 exhibits much rainfall but a sharp decline in the area herd. The reason for this «anomaly» is twofold; 1961 saw the end of a major drought period and it ended with heavy rains and flood.
5. Cf. the effect of burning mentioned by Baker 1975: 193.
6. Personal discussions with Urban Emanuelsson, Department of Vegetation Ecology, University of Lund.
7. The problem of balancing food production and labour requirements pose very different questions at different levels of herd sizes; hence the concept of viability can not imply a directly linear relation as one perhaps would infer from Stenning. For a discussion of this and Stenning's concept of household viability see Dahl and Hjort 1979: 25.
8. Ingold (1980: 27ff) claims that unlike animals who tend to maintain territories and move individually, most «pastoral» animals are of species who used to have a natural regulation of animal numbers not through the availability of fodder but through the activity of predators.

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