Resource Sharing: Small Holders and Pastoralists in Shalambood, Lower Shabelle Valley, Somalia

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Introduction

Prior to the 1991-1993 conflict and resulting famine in Somalia, the Lower Shabelle region at Shalambood was the focus of several production systems which were able to take advantage of the scarce fertile soils and available water resources of the area. As one of the most agriculturally productive parts of the country, the Lower Shebelle was part of the breadbasket of Somalia, and played a major role in the production of export crops and food for urban and local consumption. Two districts alone within the Lower Shabelle, the Merca district--location of the study site--and the adjoining Quorioly district, produced 25% of the estimated national maize production in 1986 (Holtzman 1987).

At the same time these districts were home to numerous transhumant pastoralists, part of the nearly 80% of the Somali population that engaged in some sort of livestock raising (Conze and Labahn 1986; Handulle and Gay 1987). Somalia posses the greatest proportion of pastoralists in Africa (Hutchinson 1991); in the early 1980s, livestock production comprised approximately 50% of the country's gross domestic product and provided more than 80% of its export revenue (Handulle and Gay 1987). Most experts have assumed that transhumant pastoralism, as the most widespread agricultural enterprise in Somalia, will play a critical role in food production for the foreseeable future (Bennett 1984; Lewis 1975; Box 1968 1971; Biswas et al 1987; Conze and Labahn 1986).

However for transhumant pastoralism to function in Somalia there must be access to dry season and drought grazing and water resources. Numerous researchers have noted that in many cases it is the quantity of dry season forage within reach of dry season watering points that controls transhumant populations of livestock; and when this forage is depleted or access to it interrupted or denied, the result can be overgrazing and land degradation, large livestock dieoffs, and rapid sales (Riney 1979; Johnson 1986; Riddell 1982; Sandford 1983; Gulliver 1955; Lewis 1975; Horowitz and Salem-Murdock 1987; Talbot 1972; Clark 1985; Shepherd 1985; Toulmin 1985). Thus access to dry season and drought forage and water supplies critically affects the productive capacity of very large areas of the African rangeland interior, and the livelihood of pastoralists. In addition the state of the livestock industry in many arid and semiarid countries largely hinge upon the linkages associated with (Campbell 1981).

The Lower Shabelle had one of the highest livestock densities in the country (RMR 1984) due to dry season livestock migrations into the Shabelle river basin just inland from Merca (location of the study site). Because land and water resources were critical to both transhumant pastoralists and crop cultivators, this area provides a good example of how resource systems were managed in situations of competition and complementarity. However the coexistence of farming and herding in the same district has not always been an easy one. Local farmers and herders have had to accommodate one another through a series of understandings and institutional arrangements that insure the survival of each enterprise. This chapter details the ways in which land and water resources were shared between transhumant pastoralists and crop cultivators in the Shalambood area prior to the 1991-93 famine and war, and explores the effectiveness of such arrangements in sustaining the large quantities of livestock that depend on the region's seasonal resources. The chapter also points out some of the trends in recent decades that began to disturb older institutional arrangements and place both pastoralists and small farmers at greater risk. Because the Lower Shabelle region as a whole was developed earlier than the Jubba regions, its lessons with regard to multiple resource management (and the attendant risks) bear careful scrutiny for any future rehabilitation efforts.

The Shalambood Study Site

Location and history

The study area was located in southern Somalia, in the lower Shabelle flood plain, approximately 100 km south of Mogadishu, 11 km inland from the costal city of Merca, and abutting the settlement of Shalambood (Figure 1). The site where the data gathering was concentrated covered approximately 8,500 variably irrigated hectares adjacent to the Shabelle river**1**. The area was part of a larger irrigation complex put into operation by Italian colonists in the 1920s and 1930s as a way to generate income for the colonial administration. Pre-colonial history of the area as well as the circumstances surrounding the colonial occupation are dealt with by Cassanelli (1982). The owners of the Italian plantations or "aziendas" (represented by rectangles of varying

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1. The data for this study were collected during 19 months of fieldwork, and consist of information gathered from questionnaire surveys totaling 551 interviews, plus key informant interviews and parcel measurements. Subsequent to an initial reconnaissance survey of 56 small farmers in February of 1987, from August 1987 until October 1988 three formal questionnaire surveys were carried out targeting three different groups: small farmers (less than 25 ha.), large farmers (25 ha and above), and agro-pastoralists. The small farmer survey consisted of three rounds of questionnaires given to 114 randomly selected participants. The large farmer survey was made up of 30 nonrandomly selected participants who were interviewed once. The agro-pastoralist survey comprised 123 nonrandomly selected interviews with small farmers who also owned livestock and were familiar with seasonal influxes of livestock, fodder sources, and fodder requirements for livestock. These agropastoralists had relatives, or themselves were engaged in nomadic pastoralism.

Parcel measurements were obtained for all of the randomly selected small farmers in the study in order to accurately determine area. Because all of the area occupied by large farmers was registered and therefore had to be surveyed, stated farm sizes were quite accurate and easily verified from the local land registry.

While most of those interviewed (heads of household) were men, and were interviewed by Somali men, a significant number of household heads were women, and three Somali women were employed to interview this segment of the participant group.

size in Figure 1) left in the 1960s, and small holder irrigated and rainfed agriculture became the dominant form of cultivation in much of the area for the subsequent 30 years. Following the organizational and social upheaval that accompanied the departure of the Italians, the irrigation infrastructure and management deteriorated considerably (Roth et al 1987). There was stiff competition for irrigation water among and between small and large farmers, and water allocation became relatively uncoordinated. As irrigation development and agricultural expansion occurred elsewhere along the river, seasonal water shortages became serious (Roth et al 1987; LRDC 1985).

Land Use

Large farmer and plantation areas were present in a corridor along the river and the primary canals where access to water was relatively secure. Small holder areas were further away from the river, and were more variably irrigated (Figure 2). The population of the small farmer area was relatively high, with the land per person being approximately 0.3 ha/ person. Small farmer water allocation took place in a complex mixture of relationships and arrangements that were connected with numerous off-farm activities.

Average farm size for small producers (several parcels often comprised one farm) was 2.24 ha. Small holder subsistence farms made up about 60% of the study area. The lack of an irrigation scheme-wide management structure with a policy on livestock means that the decision to grant transhumant pastoralists and their herds access to the area was made by the small farmers themselves, often on an individual basis.

The production of fodder crops did not take place within the study area. In most years pastoralists were usually able to obtain freely much of the crop residue that was available in the dry season. If small-holders grew fodder crops in a good rainfall year, when plenty of free crop residue was available and fewer transhumant livestock arrived in the irrigated area, the farmers would have received little or no money for their crop, and this was a risk small farmers were unwilling to take. Large farms and plantations did not produce fodder crops for the same reasons. Government subsidy of fodder crops would have entailed the construction and maintenance of numerous storage facilities, and a long-term commitment for purchase, transport, and storage of the fodder harvested.

The majority of the small farmers with land in the study area lived in the settlement of Shalambood (approximately 22,400 inhabitants) with smaller numbers living in the nearby villages of Gandow and Buffow. All three of these settlements were situated on the southeastern edge of the scheme. And while there were smaller villages within the study area, it was uncommon that a farmer would actually live on the farm.

While the study area at the time of this research does not seem to have produced export crops on the scale it did when operated by Italian colonists, it was able, under subsequent small-holder occupation, to evolve the mechanisms that enabled it to survive numerous difficulties. Over the 30 years following the departure of the Italians in the early 1960s, the districts residents had to adapt to the severe drought (Abaar) of 1972-1975 and the subsequent influx of refugees (Lewis 1975); further droughts in 1979 - 1980, 1983 and 1986 (Hutchinson 1991); the resettlement of additional refugees from the war with Ethiopia in 1977; occasional large scale flooding; severe economic fluctuations including those associated with the change from a centrally planned economy to a market economy in the mid 1980s (Laitin 1993), and the loss of Saudi Arabia as the principal livestock export market for the country in June of 1983 (Laitin 1993). In addition, the riverine zones had to absorb the regular dry season invasion of very large herds of transhumant livestock from the pastures of the adjacent interriver plateau. These stresses of varying scale and frequency contributed to the establishment of a highly intricate land use ecology that was tied to the functioning of a regional economy and was able to accommodate both small producers and pastoralists.

Seasonal Activities and Resource Needs of Small Holders and Pastoralists

Cropping patterns for the small farmers in the study area was dominated by maize (Zea mays) and sesame (Sesamum indicum). The crop residue of both was cut and stacked as part of the harvesting process, in order to get it out of the way for the next season's cultivation, and to prevent livestock from trampling the entire field as they foraged on it.

The numbers of livestock owned by the small-holders kept in the study area varied with the season and the severity of forage and water shortages in the interior; and competed with transhumant livestock for the available crop residue. In the wet seasons of good rainfall years, much of this livestock was kept off-scheme in the interior where arrangements were made with nomadic relatives or others to graze and water the herds in a transhumant fashion. However in years of greater water and forage scarcity, these animals could spend part or all of the rainy seasons in the study area where their owners were able to ensure forage and water supplies. Because the farmers ultimately controlled access to their land by transhumant pastoralists, farmer-owned livestock got preference in access to crop residue resources, especially during forage scarcity. This meant that less forage was available to transhumant herds when they arrived at the onset of the dry season.

Transhumant livestock were found in the Lower Shabelle region from the end of the Hagai minor dry season to the end of the Jilaal major dry season, until the Gu rains began. During the Gu season these herds dispersed north and northwest into the Bay region in order to take advantage of the surface water in the interior and avoid tsetse fly infestations which occur along the river in the wet seasons (Salisbury 1988). As the surface water began to dry up the herds concentrated around wars (manmade shallow catchment ponds) and wells which were used until late in the Hagai season. When these begin to dry and forage became scarce, the herds were moved back into the Lower Shabelle region as Figure 3 illustrates. The first herds to return to the region usually belonged to the agropastoralists who were settled along the Shabelle river. Livestock belonging to nomads did not arrive in large numbers until late in the Der season. Herds arriving in the region during the Hagai were kept in the bush, 15 to 20 km away from the river as long as possible, because the Gu season crops cut off river access, and pastoralists for the most part attempted to avoid generating ill will from farmers due to trampled crops. This was important as pastoralists needed access to forage available on or near farmland later in the dry season. Animals began to move into the irrigated area after the Gu harvest (Salisbury 1988), but did not arrive in the study site in large numbers until the Jilaal dry season. Livestock spent the Jilaal concentrated on croplands close to the river where they fed on crop residues, fallow land, previously cultivated and riverine grassland areas. As the dry season continued this concentration increased, and in severe droughts livestock from other areas were drawn to Shalambood to compete for crop residues (RMR 1984).

As the number of development projects increased along the river, and agriculture advanced into new riverine areas both upstream and downstream from Shalambood, the flood retreat pastures which traditionally served as dry season forage and water areas for nomadic herds were greatly reduced (LRDC 1985; Conze and Labahn 1986; TAMS 1986). This exacerbated the problem of locating dry season forage and water for nomads and their herds, which, again, is critical to the operation of transhumant pastoralism. This also put added stress on overlapping land and water resource use of both farmers and pastoralists.

Arrangements for Multiple Use and Access of Land and Water Resources

Context of resource sharing arrangements

The accommodation of significant numbers of livestock within irrigated areas in Africa is usually viewed by development planners as antithetical to the rational use of riverine land. However, the colonial developers of Shalambood apparently recognized the desirability of permitting livestock to make seasonal use of the area. During the heyday of Italian operation of the irrigation scheme, the arrangement between Italian landowners and local farmers set the following priorities for water allocation during the course of the dry season: first for human consumption, then stock watering, and if water was still available finally irrigation maintenance of cash crops. A group of private canal guards enforced these allocations (McGowan et al 1986). The canal guards were also charged with ensuring that livestock did not break down canal walls while grazing along their banks. If livestock did damage canals, the owner of the animals was fined or punished. Another feature of the irrigated area at that time was that two jibals (50 m) were left along either side of the larger canals and were used for livestock grazing. Following independence the Ministry of Agriculture maintained a similar system of livestock accommodation for a time.

Certainly among the important reasons for the priority livestock held at this time, were the longstanding and intimate ties the local farmers and villagers--the labor source for the Italian plantations--enjoyed with livestock producers and herders. In many cases the local farmers themselves were descendants from, and related to pastoralists, and frequently raised animals themselves. In addition, the enormity of the livestock presence in the area in the dry season, and the problems that may have surfaced had the Italian landowners attempted to ban all livestock from the area, most likely had an impact on water allocation as well.

At the time of this research, 61% of the small farmers in the random sample owned livestock. Both small and large herds were present. Small herds, made up of between 1 - 5 animals, tended to be kept around the homestead and the farmers' fields, while larger herds (more than 6 animals) were usually grazed in a transhumant fashion by a family member, relative, or paid herder. Because of their involvement with the pastoral sector, most small farmers in the area were knowledgeable about the importance of livestock access to dry season water and grazing.

Subsequent to independence many of the grazing zones alongside the major canals (other than swampy locations) were put under cultivation, and the canal guards were less of a presence and less reliable. By the late 1980s many small farmers cultivated under rainfed or erratic irrigation conditions. Nevertheless livestock continued to have access to available land and water resources in the dry season, adapting to new and changing circumstances as the state assumed control over water management and access to land, and as overall population and agricultural activity in the area increased.

Small farmer - pastoralist exchange

While ethnic and historical ties between pastoralists and farmers may have formed the basis for their relationship, certainly its continuation rested to a large degree on exchange arrangements between the groups. When queried during the course of this research about the relationship, farmers stated that they recognized that livestock was the backbone of the Somali economy. The farmers emphasized that banning livestock from the irrigated area, and even fining livestock owners to prevent canal damage, would be unjust if there were not alternative grazing and watering areas set aside for livestock.

At Shalambood a number of linkages between pastoralists and farmers provided benefit to both. In exchange for fodder access, livestock provided meat and milk, manure for house construction and fertilizer, and hides and leather products. During the dry seasons and droughts, local farmers provided most of the markets where herders could sell their weakened animals and purchase grain. Farmers often found livestock to be a relatively secure investment following a good harvest; and, as noted above, they typically hired pastoralists to herd their animals in the interior away from the river during the year. A few farmers were able to gain income from selling crop remnant to herders during the dry season, and some utilized pastoralist labor. In general, agreements granting pastoralists access to farmers' land served to build relationships between clans, sub-clans, lineages, and families that could be activated for mutual benefit in less favorable times, ie., drought, famine, and conflict.

Temporal and spatial aspects of pastoralist access to fodder resources

Dry season arrangements between herders and farmers were designed both to insure access to critical resources and to protect those resources. Pastoralists needed to reach water and forage along the river, and farmers needed to mitigate the potential damage to their fields and irrigation canals. Farmers pointed out in interviews that most of the damage tended to occur as large herds of animals moved between grazing and watering locations. Crops in as yet unharvested fields could be trampled, and small tertiary canals that serviced individual farms were vulnerable to cave-ins.

timing was thus important to the effective sharing of riverine resources. During the final weeks prior to the Gu harvest, when herds were beginning to move back from Bay region pastures into the Lower Shabelle, cropped fields still blocked access routes to watering points along the river. As a result, pastoralists had to hold their herds in the bush just beyond the cultivated zones, were they paid for watering at private wars such as the Boojalow war, until the harvest had been completed. Their willingness to accommodate farmers in this way (see Salisbury 1988) was no doubt partly due to the expectation that farmers and local authorities were willing and able to punish violators. Small farmers combined to guard their canals, and required nomads either to repair any damages caused by their herds or to pay fixed fines for specific damages. However, a significant amount of the farmer's time had to be spent watching canals; and since not all canals could be guarded at all times during the labor-intensive harvest period, local authorities had to called upon periodically to pursue wrongdoers.

Once pastoralists reached the Shalambood area, they found that not all farmers allowed grazing on their fields. This study showed that a percentage of both large and small farmers maintained private tenure over crop residue and grazing sites in the riverine zones. This forage was thus not openly accessible to transhumant pastoralists. Table 1 compares the percentage of total land area that was accessible to transhumant herds under each fodder producing category, for large and small farmers. For all categories except grassland, large farmers allowed much less free grazing on their land than did small farmers. For maize and sesame, small farmers allowed free grazing on 81% and 70% more land respectively, than did large farmers. For fallow land small farmers allowed free grazing on 43% more land. In previously cultivated, or just harvested areas, 21% more land was available in the small farmer area. Plantation agriculture (such as bananas) excluded 100% of the transhumant livestock which would have occupied the area otherwise. Only for riverine grassland did large farmers leave 62% more area open for free grazing than did small farmers.

The implications are clear. Large farmers in general were less accommodating to the transhumant pastoralists, opening a smaller proportion of their harvested land for free grazing. The reasons are almost certainly related to the fact that large farmers tended to practice more intensive agriculture and, because they were more likely to be producing for export, had only minimal market relationships with neighboring pastoralists. Moreover, to the extent that many of Shalambood's large farmers were 'outsiders' to the region, they shared none of the history or reciprocal exchange relationships that had linked farmers and herders in the past. Whatever the explanation, the consequences for resource sharing were dramatic. Transhumant livestock that were excluded from or could not be supported by available forage in the large farmer areas had to use the small farm residues. This increased the livestock density in the smallholder areas and intensified competition for dry season resources there[2].

Because the fodder sources available varied from season to season, small holders had to be particularly careful in managing them. The impact of livestock owned by resident farmers on the temporal availability of fodder supplies could at times be considerable. In poor precipitation years, more farmers kept their livestock in the area during the wet season as opposed to sending them out with herders. This then reduced the forage available later for transhumant herds at a time when fodder production was already less due to less precipitation, and greater numbers of livestock arrived earlier in the study site in response to the poor forage and water availability in the interior. Thus the existence of large farms that restricted

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2. Complicating the fodder situation for both farmers with small herds kept around the house and farm, as well as for transhumant herders, is that not all fodder sources were available at all times. The fodder available to be utilized for forage in the Gu season included only riverine grassland and fallow land, as all other land was under cultivation. For the Hagai season available forage sources included fodder left over from the Gu season, plus maize and sesame crop residue from the Gu season harvest, as well as Hagai season grassland areas. Der season forage sources included fodder left over from the Hagai, and Der season fallow and grassland areas. In the Jilaal, maize and sesame crop residue produced in the Der season, plus the categories of 'previously cultivated', Der fallow land, grassland, and any fodder left over from the Der season were available. While the carrying capacity of the previously cultivated category was the lowest of any category, it was still significant due to the inefficiency of hand weeding, such that the noncrop vegetation present after harvest was able to support some livestock. These temporal availabilities of fodder resources were subject to rates of biomass decay, and consumption by insects.

seasonal grazing put pressure both on the herders themselves and on the small farmers--increasing risks to both groups.

Variables affecting livestock carrying capacity

However reasonable the arrangements worked out between herders and farmers to share resources, the real test was whether the resources made available through such arrangements were able to sustain the livestock that seasonally arrived in the area. In other words, how sufficient was the livestock carrying capacity of the study site? this is a central question for analysts of livestock management systems, and it is extremely relevant for many parts of Somalia where pastoralism and agriculture compete for resources. Analyzing the carrying capacity of the Shalambood site, with its multiple production systems, requires attention to several spatial and temporal variables. These include the type of crop/fodder resources, water availability (both seasonally and from year to year), type and size of holdings, and farmer preference. Taken together, these factors generate a capability that fluctuates both in terms of 'value' (the nutritional ability of a crop remnant to support livestock) and of 'vulnerability' (the reduction in value due to drought). This dynamic model of livestock carrying capacity is explained more fully in the Appendix, but its estimates may be surprising.

Based on calculations that include availability, value, and vulnerability of different fodder resources, and on observations of actual livestock displacement to the study site, it is evident that resource sharing was effective in most years to support the herds that entered the area. At Shalambood a good water year occurs three years out of ten, an average year three out of ten, and a poor water year occurs four years out of ten. Table 3 presents evidence that in the Jilaal most herds were supported in good and average water years, in other words, six years out of ten; with a comparatively small number not supported in the Jilaal of a poor water year. Thus the resource use and access arrangements that the small holders and pastoralists participated in, in the late 1980s appeared to operate at a magnitude which allowed most herds to be sustained in most years, given the political, social, and biophysical context of the area.

Conclusion

Land tenure and registration

On the Horn of Africa the disenfranchisement of local populations from traditional land and water rights has been a major factor contributing to conflict and instability (Hutchinson 1991). The implementation of land registration programs in many parts of Africa, and the success or not of these in increasing tenure security for occupants and transient users, can have unexpected repercussions in pastoralist access to resources during the dry season and drought.

The 1975 Land Reform Act in Somalia was formulated to give advantage to state enterprises and mechanized agricultural schemes; with limited rights accorded to small farmers, and no rights given to pastoralists (Hutchinson 1991). The national land registration program in place just prior to the 1991-1993 famine was unrelated to the traditional tenure regime which was well understood by small farmers and pastoralists of the study area, and which continued to operate in many areas into the 1980s, despite the existence of the 1975 law.

The national land registration procedure was cumbersome, required a great deal of time and money for small farmers, was centralized in Mogadishu, and was most easily used, abused and manipulated by well connected officials and their associates in the capital. This, together with the initiation in 1986 of an irrigation rehabilitation project at Shalambood, allowed 'outsiders' to gain title to large tracts of small holder land within the study area. Fear of 'outsiders' laying claim to their land was the most important tenure security concern expressed by the small farmers.

While the displacement of small farmers by state-connected elites raises important questions about power and equity, their discussion is beyond the scope of this chapter, which has focussed on multiple resource use between agriculturalists and pastoralists. However, small farmer dislocation due to tenure machinations do have repercussions for multiple use and access to forage and water resources. Although this research project ended before it was possible to document all of these repercussions, we can, given our analysis and with the advantage of hindsight, speculate with some confidence about the impact of national policies on local resource use.

As previously noted, large farmers are much less willing and, because of commercial cropping, usually less able to allow dry season access to pastoralists. 'Outsiders' who managed to secure land around Shalambood were typically unconnected to the pastoralists who seasonally frequented the area, and hence less likely even in hard times to accommodate their herds. As more arable land was registered to large farmers, transhumant herds were forced to turn to fodder resources on the remaining small farms, or simply to utilize the more marginal lands nearby. One consequence was increased competition between herders and small farmers, many of whom had themselves been displaced from better watered locations near the river. Thus not only did small farm resources bear the brunt of the livestock displacements that occurred; but the increased competition in the marginal zones away from the river contributed to the more rapid degradation of those areas. As is well known, even the large wet season rangelands involved in pastoral transhumance can be put at ecological (and productive) risk if pastoralists are forced to stay on them longer because they have been denied access to dry season pastures. Thus one can witness a ripple effect in land use practices over a wide area as a result of tenure changes in the Shabelle valley.

To speculate a bit further, it seems just a short step from the local disruptions described here to the conditions that came to prevail not only in Shalambood but through much of the riverine region during the 1991-1994 civil war. Small farmers lacking security of tenure and the support of the state either had to defend their farms through their own force or seek refuge in periurban slums or refugee camps; in either case, productivity suffered. Desperate herders, for their part, had increasingly to rely on force to secure access to dry season fodder and water; the alternative was the loss of their animals and a serious threat to their survival. Together, these pressures almost certainly worked to dissolve some of the longstanding arrangements of reciprocity and resource sharing that had bound valley farmers and herders together in the past. Recourse to guns rather than to law became the means of resolving disputes; and it is probably not stretching too far to suggested that the mobile militias which emerged in 1991 gained ready volunteers among the young, displaced pastoralists of the interior. Urged on by ambitious cliques of politicians, merchants, and elders, these armed nomads jumped into the scramble for riverine resources that increasingly had been denied them during the course of the previous decades.

Looking to the future, is not easy to envision a restoration of the original arrangements between pastoralists and agriculturalists. It will take a long time for mistrust to be dissolved, and the scarcity of good land will make competition in the future even more intense. Even if a central government is restored for Somalia, is likely to be a government that will in some way continue the process of supporting and subsidizing large farmers for national food production or commercial farming. Similar scenarios are in fact being repeated in many other parts of the African continent.

One option in such a situation is to consider ways of making the local traditional tenure regime legitimate at the national level, in order to preserve the dynamics of the resource use rights connected with in-place land use systems; rather than attempting to implement tenure structures and procedures that are poorly understood by small producers, and whose response to these will be less than predictable. Customary tenure regimes are not static (Lawry 1989). Traditional systems usually provide security of tenure in culturally relevant ways that are understood locally, and do evolve in ways that extends greater security and allows for adaptation (Lawry 1989).

The history, climate, and increasingly fragile economies of many locations in arid Africa strongly suggest against dividing resource use and access up into fixed parcels to be used exclusively by a particular person or set of persons with defined resource boundaries (Riddell 1982), especially where other economic opportunities are lacking. Overlapping resource utilizations are common in Africa, especially among transient users. Transient rights of access to resources can be backed either by law, or, as in the Shalambood case, by what Riddell

(1982) calls subjectively valued, time-honored rights, or "law-in-action". In other words, what is in place are the "ad hoc arrangements that develop to meet the variety of situations in which people find themselves" (Riddell, 1982). It is these preferential behaviors that outline the rules of resource use that are actually in operation, and which can precede formal law (Riddell, 1982). The law-in-action which allowed pastoralist access and utilization of crop residue resources on the Shalambood scheme, providing a carrying capacity that supported most livestock in most years, demonstrated that irrigated agriculture in Africa can play a role in supporting both residential and transhumant populations of livestock. Such an arrangement especially if legally reinforced, would allow agricultural development while not contributing to overgrazing and land degradation elsewhere, minimizing detrimental impacts on the livestock industry.

In all likelihood, pressures on resource-rich ares like Shalambood will continue to intensify, even if and when peacetime conditions return. First, these areas will almost certainly be targeted for the resettlement of refugees, and this may pose significant constraints on utilization of the area for dry season livestock grazing[3]. Second, with peace will probably come the resumption of development projects, like that of eradicating the tsetse fly from agricultural regions of southern Somalia, which may encourage small farmers to attempt to restock their local

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3. Issues surrounding the integration of refugee and pastoralist land use patterns, and restocking refugee pastoralists, are presented in more detail in Unruh (1993a) and Unruh (1993c).

herds4. If residential herds were to increase, the amount of fodder available for transhumant herds in the dry season would diminish accordingly. With more animals consuming fodder year around, and potentially more being sent out with herders to be grazed in a transhumant fashion, the carrying capacity of the study area in both good and poor years will have been approached.

In other words, there is every reason to expect that the resource systems of the Shalambood area will continue, as they have in the past, to experience dynamic and ever-changing demands. For this reason, planners should not ignore the historical capacity of the area's residents to find adaptive mechanisms, even as innovations are introduced. There are a number of ways in which the resource sharing arrangements present at Shalambood in the late 1980s could be built upon, to the potential benefit of both pastoralists and small farmers. Some of these have to do with increasing the value, and decreasing the vulnerability of the crop residues themselves through more reliable irrigation and the application of agricultural inputs. In addition, fodder producing trees such as *Acacia albida* could be incorporated into the functioning of some small farmer irrigated farmlands (Unruh 1993b). Such an arrangement would supplement fodder needs, contribute to the woody biomass supply for local populations, and increase crop (and hence crop residue)

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4. For the small farmers in the study area, 89% said they would increase their herd size if tsetse fly in the area were eradicated.

production by the positive influence of such trees on crop yields**5**.

Maintaining regional linkages with transhumant pastoralists in the advent of river basin development is important in the functioning and potential improvement in regional land use ecology and economy. Development schemes which interrupt regional linkages, risk disruption of regional land use and often the viability of the proposed schemes themselves. Areas like the Horn of Africa need to receive development programs that can productively operate within the context of the difficulties of the area, as opposed to unwieldy schemes with lofty goals that may work well in other places but can easily create or encourage donor dependency and succumb to one of the many endemic problems of a disadvantaged area. These designs need to be fused with in-place, traditional production systems for the benefit of local and regional economies; instead of pursuing exclusively urban or national development agendas at the expense of local and regional sustainability, and even stability.

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5. In many cases this increase in yield constitutes the most important single benefit for integrating species like acacia onto croplands (Poschen 1986). Felker (1978) has estimated that the addition of acacia on rainfed farms in some areas could increase the human carrying capacity from 10-20 to 40-50 people/km^2.

Appendix

While exchange relationships between farmers and pastoralists and historical and ethnic ties did provide pastoralists structured access and use of land and water resources in the area, one of the more important questions for resource sharing between farmers and pastoralists is, were the resources accessed by pastoralists, at the time and the way they were accessed, able to sustain the numbers of livestock that arrived in the area seasonally; given the variabilities involved in the production of forage. This section reviews some of the variables involved in the livestock carrying capacity of the study site, and the following section looks at estimates of the quantity of livestock sustained during the different seasons of different water years, ie., good, average, and poor.

Accessible land area is a crucial variable to sustaining livestock, however there are impinging variables which affect the role land area plays in carrying capacity. The different fodder resources available within the study site (existing as areas under maize and sesame residue, and fallow, grassland, and previously cultivated areas), were differentially affected by water availability in the growing season, resulting in different contributions to carrying capacity. As well the total area under the different categories were influenced by aggregate farmer decision-making as to what crop to plant when, over what area and how efficiently to weed these areas. To the extent that farmers were subject to, or willingly participated in larger economic forces, or more local subsistence concerns, also affected decision-making. And this, together with a host of household and cultural factors such as individual farmer agricultural beliefs, traditions, practices, openness to new techniques, and farming abilities ultimately determined the total areas planted in different crops.

A multitude of in-field biophysical variables affected fodder source productivities and hence livestock carrying capacity. The more significant of these was soil quality, which varied widely over the study site, as did differences in access to irrigation water due to field location. The levelness of fields was important for optimal water distribution within the field, or it could be responsible for swampy and over-dry locations, all affecting productivity.

Ultimately the combined effects of fodder use and access, together with the carrying capacity provided via the above variables manifested themselves in the displacement of livestock when the forage available dropped below what was necessary to maintain the numbers of animals that frequented the area. The timing and magnitude of this displacement could have impacts on land and water resource use and competition in other locations. The only way livestock displacement could not occur is if the area could support the numbers of livestock that were present in dry seasons and droughts of varying severity, or if a smaller area can serve the same function.

In order to explore further displacement and carrying capacity due to several interrelated factors affecting forage production and availability, carrying capacity can be examined within the framework of two variables, 'value' and 'vulnerability' (Unruh 1993a). Value and vulnerability are intertwined, and both are important in the dynamics of livestock carrying capacity. Value denotes the nutritional ability of a crop remnant to support livestock. And vulnerability designates the reduction in value due to drought. Individually each fodder producing category provided a livestock carrying capacity (value) that extended the full range of its vulnerability. Thus for the assemblage of fodder resources that were available in the study site, value and vulnerability varied with the resource and resulted in a dynamic carrying capacity which interacted with a spatially and temporally dynamic transhumant livestock population. Figure 4 illustrates the combined aspects of availability, value and vulnerability in terms of the capacity of the fodder categories to support, as an example, 100 Somali stock units. Stock units were calculated following Field (1980) using Somali specific breeds, herd age structure, feeding habits, and liveweights. The left vertical axis of Figure 4 represents the carrying capacity in stock units per hectare, and the horizontal axis represents number of hectares necessary to maintain the 100 stock units. The upper left corner of each box is the value of the category in number of stock units sustained per hectare, and the position of that point over the horizontal axis is the number of hectares needed to sustain 100 stock units in a good water year. The lower right corner of each box represents the value of that category in a poor water year, and the area needed in such a year to maintain 100 stock units for that category. The vertical lines of each box then represent the vulnerability of each category, between good and poor years, or, the reduction in carrying capacity within a given area. The horizontal lines of the boxes represent the amount of additional land which would be required to offset the decrease in value in a poor year in order to continue to maintain 100 stock units.

The right vertical axis of Figure 4 represents both when the different categories are available (seasonally) and the relationship between dry season/drought and value. In the context of this temporal availability, value and vulnerability operated to determine carrying capacity on a seasonal basis. The range in vulnerability from good to poor years, is greater with greater forage value, meaning that more livestock are displaced in poor years on land where high value fodder sources occur.

It can be observed in Figure 4 that vulnerability and area are inversely related. While a large drop in value due to drought (high vulnerability) for higher value categories (fallow, maize) will result in large livestock displacement, this also means a smaller increase in area is needed to sustain a given number of livestock than for lower value categories (sesame, previously cultivated). However a small change in land use (due to farmer decision-making) from a high value category to a lower one will result in a large livestock displacement. Whereas a similar change in land area for a low value category (to yet a lower value category) will result in a much lower livestock displacement. Table 2 compares fodder values and vulnerabilities on a per hectare basis for the sources that were present in the study area, and the per hectare livestock displacement due to decreases in value with different vulnerabilities of the fodder sources.

The assemblage of all categories will result in a total dynamic carrying capacity that extends in two dimensions. One dimension is the carrying capacity as a result of the summed positions within the vulnerability range of each land category at a point in time. This varies with the water year (good, average, poor). The other dimension results from the change in categories due to season, drought, and farmer decision-making based on needs for subsistence foods, income, market influences, etc.

Estimations of livestock carrying capacity for the 8,500 hectare study site using value and vulnerability of fodder resources is detailed in Unruh (1991 1990) and will only be briefly summarized here. Carrying capacity estimations for the crop residue categories of maiz and sesame involved:

a. the required kg of dry weight plant biomass to sustain a Somali standard stock unit, one unit having a liveweight of 450 kg which consumes 4,100 kg of dry matter per year, and is equivalent to two camels or cattle, 20 sheep or goats, or five donkeys (Field 1980);

b. the number of Somali standard stock units sustainable on one unit of crop remnant (different units of remnant for the different crops);
c. fodder productivity for different seasons, in different water years (good, average, poor);
d. fluctuating total areas planted under maize and sesame, seasonally and in different water years;
e. and the fluctuating area producing a single unit of crop residue in different water years.

For the fodder categories of fallow, previously cultivated, and riverine grassland, much of the same information was incorporated into the calculation, focusing instead on the number of stock units sustainable on one hectare of the category in different water years instead of the number of stock units sustainable on a unit of fodder. Carrying capacities were then summed for all categories into season specific estimations, and then compared with observed seasonal livestock numbers.

It was possible for a single piece of land to belong to several different categories over the course of the year, producing different livestock carrying capacities depending on the season and the use. And while carrying capacity was calculated on a seasonal basis, the carrying capacity in any one season depended on the land use in the previous as well as the present season.

Table 3 presents the results of the comparison between observed Somali stock units and the calculated carrying capacity for the small and large farm areas. This table shows the estimate of the quantity of stock units in the study area which were not supported (negative numbers), as well as the additional numbers of stock units which could be supported (positive numbers). Significant differences can be noted between good, average, and poor water years for the small farmer area. According to these estimates, in a good Jilaal, 10,220 more stock units could be supported than in an average Jilaal, and 12,800 more could be supported than in a poor Jilaal. The values for stock units not supported in large farmer areas are higher overall, reflecting the large area under permanent agriculture and thus unaccessible for livestock grazing. The stock units not supported in the large farmer area then seek fodder access in the small farmer area. This quantity, in addition to the stock units already in the small farmer area plus the stock units excluded from the plantation area, represented the total number of stock units which ended up in the small farmer area in the Jilaal (Unruh 1991).

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Table 1. Percent of Total Area Available to Transhumant Herds for Large and Small Farmers
Small farmer area: 5133.0 ha. Large farmer area: 3126.7

Category	Small Farmers (%)*	Large Farmers (%)*
Maize	63.75	12.03
Sesame	38.34	11.43
Fallow/Idle	29.0	16.66
Prev. Cultivated**	66.48	20.47
Grassland	2.0	5.25

* Spatial double accounting has taken place in order to realistically account for all forage available.

** Jilaal season only.

Source: Unruh 1990

Table 2. Comparison of Forage Values and Vulnerability for Fodder Sources in Good, Average, and Poor Years.
(Values are in quantity of Somali standard stock units sustained from one hectare of fodder resource for 30 days.)

	Fallow/ idle	Maize	Riverine Grassland	Sesame	Previously Cultivated
Good yr.	10.15	7.5	4.6	3.16	1.87
Average yr.	7.35	5.04	3.2	2.3	1.14
Poor yr.	4.6	3.79	1.9	1.6	0.41
Fodder reduction from good to poor years (%):					
	55	50	59	49	78
Stock units/ha displaced from good to poor years:					
	5.55	3.71	2.7	1.56	1.46

Source: Unruh 1991

Table 3. Results of Comparison Between
Observed stock units and Calculated stock units
Carrying Capacity for Small and Large Farmers
(Units in additional units sustainable (if positive) or
the number of observed units not supported (if negative))

Small Farmer Area

	Good yr.	Average yr.	Poor yr.
Gu	792.3	29.3	-728.8
Hagai	8797.6	4881.0	2895.8
Der	13057.9	4619.3	3681.1
Jilaal	11857.8	1640.7	-939.5

Large Farmer Area

	Good yr.	Average yr.	Poor yr.
Gu	370.6	230.4	92.1
Hagai	1658.8	1076.9	551.4
Der	2029.5	1307.3	643.5
Jilaal	-644.8	-1765.5	-2821.8

Source: Unruh 1991

Figure Captions

Figure 1. The study site in southern Somalia, and within the old Italian irrigation area. Source: Unruh 1991.

Figure 2. Small and large farmer areas within the study site. Source: Unruh 1993b.

Figure 3. Dry season livestock migrations, and livestock densities in the Lower Shabelle. Source: Unruh 1991.

Figure 4. Value and vulnerability of fodder producing categories. Source: Unruh 1993a.