Refugee Resettlement on the Horn of Africa: The Integration of Host and Refugee Land-Use Patterns

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Abstract

The enormity of the African refugee problem underscores the importance of resettlement issues in land use planning. Efforts to resettle subsistence-oriented agricultural populations have often come into conflict with host, or in-place land uses as competition for scarce resources lead to land degradation, violence, and the failure of resettlement schemes. The success of refugee resettlement will depend to a large extent on the degree to which host and refugee land-use patterns can become integrated or reconciled. The majority of African refugee populations reside on the Horn and in the Sahel, where arid and semi-arid ecologies predominate and pastoralism is a major form of land-use. This study considers a resettlement design which integrates refugee agricultural land-use patterns with those of the host pastoralist land-use in the context of the frequent droughts which visit the area. Given the magnitude of dislocation problems on the continent, successful resettlement will play an important role in African agriculture and development.

Introduction

The protracted nature of Africa's food production problems and social conflicts and the subsequent severe recurrences of famine, have resulted in enormous dislocations of subsistence oriented populations as conflict and resource degradation intensify each other (Figure 1).[1,2,3,4,5,6,7,8,9,10,11] The Horn of Africa together with the Sahel account for well over half of all refugees worldwide.[12] Refugee camps and resettlement schemes can entail huge expenditures,[13,14,15,16,17,18] and have profound impacts on the functioning of social and production systems where they are located. And inter-state conflict caused by massive cross-border migrations of famine and war refugees has been a serious problem.[19,20,21,22,23] However with often limited scope for the return of refugees to their location of origin, resettlement of displaced populations has been the most durable and widely adopted solution.[24,25]

As large numbers of refugees are resettled, conflicts and competition with local land-uses can increase dramatically as the demographic composition of whole areas is altered[26,27] and refugees are encouraged to engage in crop cultivation.[28,29,30,31,32,33] The impact on local tenure regimes, and greater competition for fixed resources in these areas can disrupt production systems which may already be stressed, resulting in pronounced social and ecological impoverishment.[34,35,36,37,38] At the same time the success or failure of resettlement schemes can have a direct impact on rural-urban migration[39] and the subsequent burden on cities and welfare of refugees.[40]

The Horn of Africa is the most severely effected of Africa's drought and famine stricken regions.[41,42,43] Due to their fragile arid and semi-arid ecologies and multiple theaters of conflict, Ethiopia, Somalia, and the Sudan have in recent decades been chronically afflicted by drought, famine, and social unrest with millions becoming displaced, and hundreds of thousands starving or migrating to refugee camps (Figure 2).[44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64] At present these three countries contain more than half of Africa's hungry.[65] It is estimated that in the Sudan alone 4.4 million people have become displaced in 1991.[66] While recent conflict and famine events and the subsequent repercussions are notable, the Horn has a history of being problematic.[67,68,69,70,71,72]

Migration and resettlement in this context brings migrant groups into contact with in-place societies and land-uses with which they are compelled to interact, each influencing the other reciprocally.[73,74] Site allocation for resettlement schemes can thus be extremely difficult. While local land-use is often governed by customary tenure regimes, national governments frequently ignore this and claim all land for the state, to be allocated according to mandate; further complicating successful resettlement. Disregard for customary tenure has caused numerous failures in resettlement efforts.[75] Discord between in-place and resettlement land-uses can cause land degradation as production systems shift to utilize more marginal resources, and the host and refugee populations come to regard each other as potential enemies competing for scarce resources.[76,77,78] The resulting total social organization is then insufficiently cohesive to mitigate the effects of deforestation, overgrazing and overcultivation.[79,80,81]

The long-term success of refugee resettlement schemes will depend on the degree to which resettlement land-use patterns can become integrated with, or reconciled with, pre-existing land-use ecologies, and operate within the context of the endemic problems known to frequent the region. While approaches to doing this may be ill-defined, one strategy is to study how proven, working constructs in culturally and ecologically similar situations might be applied. The valuable contribution by Phillips et al[82] describes very well the relevance of transferring, enhancing and learning from elements of in-place, or previous land-use systems. This paper examines a design which considers the implementation of smallholder cultivation practices common in refugee resettlement schemes, in an area of traditional transhumant pastoralist land-use, in the context of the frequent droughts which visit the area. Resettlement schemes are frequently established in areas of low population density,[83,84,85] and dry season pastoralist areas can be seen as optimal locations for such schemes due to their seasonal occupation. Following brief descriptions of the problems associated with resettlement in pastoral areas, and refugee response to dislocation, this paper presents a study from Somalia in an approach which utilizes the in-place, existing, ecological, social and land-use constraints and opportunities of both production systems as they presently function in the area. The roles of tenure, value and vulnerability in the utilization of agricultural residue fodder resources are quantitatively explored, and the application of these to resettlement efforts is examined.

Refugee Resettlement in Pastoral Areas

An important aspect of population resettlement in Africa is the influence of the extraordinary profusion of African ethnic groups upon population distribution, customs, land-use patterns, and economies. This is especially pronounced in the "zone of cultural fragmentation" stretching from the west African coast to the Horn where cultural heterogeneity predominates.[86,87,88] Figure 1 shows that the countries within this zone have large refugee problems, and that they are located in the African Sahel where transhumant pastoralism is a dominant form of land-use.

This is also a region of traditional land-use conflict between agriculturalists and pastoralists.[89,90,91,92,93,94,95,96,97] Thus displacement in this zone brings these two land-use patterns into conflict on a scale that is not replicated elsewhere. Resettlement efforts for this region need to tailor land-use designs to the specific problems posed by the integration of host and refugee land-use patterns, given the prevailing biophysical environment. Recent research has outlined the importance of orienting development projects to the characteristics of specific agroecological zones, where the development priorities and technologies are designed to accommodate the environmental conditions[98,99,100,101] as well as existing land uses.[102,103,104]

Areas occupied by transhumant pastoralists in the dry season can be attractive sites for resettlement schemes due to: the long absence of the land-users, the comparative fertility of these areas, and the marginal political nature of pastoralist groups. However occupation of these lands with settlement projects have led to serious problems in the past. Settlements in such well watered sites usually exclude transhumant herds which have traditionally used the area for dry season forage and water supplies.[105,106,107,108,109,110,111,112,113,114] Unavailable or unaccessible forage in one part of the yearly travels of livestock herders can have disastrous effects on other larger areas, because pastoralists are then forced to use range resources that are already marginal during the dry season.[115,116,117,118,119,120,121,122,123] Rangeland degradation occurs as the carrying capacity of these areas is surpassed due to overgrazing caused by higher dry season livestock densities.[124,125,126,127,128,129,130,131,132,133,134,135] Such degradation places nomadic pastoralists, their herds, and the range, in a position of increased vulnerability to drought.[136,137,138,139,140,141] This may become especially problematic considering that rangeland livestock production will be essential to many nations' ability to feed growing populations[142,143] off of a land resource where transhumant pastoralism may not only be the only sustainable use; but may be one of the few assets possessed and easily exploited by largely agrarian economies. Destitution of nomadic populations and decimation of their herds is an enormous problem in Africa, and results in large costs for famine relief and refugee programs.[144,145,146,147,148,149,150,151,152,153,154]

Incorporation of Refugee Response to Dislocation into Resettlement Planning

The inclusion of customary land-use patterns of both refugee and host populations into resettlement efforts is important because introducing new and unfamiliar systems to subsistence populations can be very expensive and time consuming; and has met with a record of failure.155,156 This is particularly important considering that following displacement, refugee populations often cope with the experience, and to new and unfamiliar situations, by clinging to the familiar and changing no more than is necessary. This is done by the transfer of old skills and land-use practices to the new environment, and/or relocating with kin, neighbors, or co-ethnics so as to be surrounded by familiar institutions and symbols.157 As Thayer Scudder observes "migrants are most willing to move the shortest psychological and sociological distance from their home areas".158

The knowledge of and experience with customary land-uses held by subsistence producers can be a valuable asset. This is because the entire population is then able to utilize a common knowledge base to engage in the process of innovation and adaptation necessary to accommodate themselves to new situations.159,160,161 Thus ensuring that adaptation as a response to dislocation is maximized.162 This can be particularly relevant, when, as frequently observed, refugee migrations can contain groups of relatively intact communities.163,164,165 Schraeder166 points out the importance of encouraging the resettled population in innovation to the success of resettlement schemes. Rogge167 and others168,169 note that the utilization of the "latent manpower resources contained in any given displaced population" is the shortest route to local integration in order to transform a refugee population into a productive asset for the host region or nation. And Ruttan170 describes the value of 'induced innovation' in agricultural development. Project planners cannot hope to foresee all possible outcomes, including the direction adaptation might take to imposed strictures which are poorly understood by the target group; and whose cultural, tenurial, and land-use patterns, along with other hidden dimensions involved in the process of adaptation are also poorly understood by planners.

The role of long standing, traditional cultural attitudes and preferences in the use of the environment in the context of resettlement efforts can be profound. Preferences for using specific plants and animals in specific ways in established land-use practices, and the exclusion of others are major factors in the functioning and potential development of the landscape.171,172,173,174,175 Such attitudes--often rooted in history--allow the development of certain opportunities of the environment and ignore or reject others.176,177 Humans do not interact directly with the environment but are cushioned by culture which leads to selective perception and action.178 In addition, traditional subsistence production systems usually already contain the complicated and long-evolving risk reduction and coping strategies necessary for survival in difficult environments.179,180,181,182,183,184,185,186,187,188,189 Understanding these aspects of both the refugee and host populations is important to successful resettlement with minimal impact on the host production system.

While the land-use practices and patterns of in-place production systems can be observed and to some degree quantified with an agronomic approach, practices and patterns familiar to a dislocated refugee population cannot. Opportunities to dovetail refugee and host tenure and production systems will be most effectively realized by obtaining information on such culturally based knowledge and preferences and history of land-use. Barring previous detailed information on the two societies and their land-use ecologies, questionnaire surveys may be one of the only ways to obtain such information with the speed necessary in resettlement efforts.

The Somalia Study

Background

In Somalia the refugee problem is considerable (Figures 2 and 3). A series of droughts and wars in the 1970s and 1980s and the resulting livestock mortalities expanded refugee numbers at that time to between one-quarter and one-third of the entire population.190 Recent political unrest in 1988 and 1989 has resulted in the displacement of hundreds of thousands of Somalis, and hundreds of thousands of Ethiopian refugees resident in Somalia for as long as ten years have also been severely affected.191 In the north of the country the unplanned return of thousands of Somali refugees from Ethiopia has further strained an area which has very little food or water.192 Presently social unrest in Somalia and the still-turbulent--although much improved--situation in Ethiopia and the subsequent disruption of food distribution and relief efforts could put the entire population of Somalia at risk.193,194,195 In recent decades considerable rangeland degradation has taken place under year-long grazing and improper land-use.196,197,198,199 Along the Shabelle river, and especially near refugee camps (Figure 3a), natural resources are severely stressed by overgrazing and deforestation.200

Livestock production (cattle, camels, sheep and goats) is the primary economic activity in the country, comprising approximately 50% of the gross domestic product and more than 80% of the export revenue.201 About 55% of the national population participates in nomadic pastoralism, while 80% of the population is engaged in livestock raising of some kind.202,203 As the most important agricultural enterprise in the country, transhumant pastoralism will be the basis for food production for future populations.204,205,206,207,208,209

Study Site

The study area is located in southern Somalia, in the lower Shabelle flood plain, approximately 100 km south of the capital, Mogadishu (Figure 3a). Located adjacent to the Shabelle river, the study site covers approximately 8,500 hectares, ranging from erratically irrigated to rainfed.

The region is classified as semi-arid, and precipitation is distributed in a bimodal pattern with two alternate wet and dry seasons.210 The Gu season is the major rainy season lasting from April to June, followed by the minor Hagai dry season from July to September. The Der season follows the Hagai and is a minor rainy season lasting from October to December, followed by the major Jilaal dry season from January through March. Characteristics of the rainfall pattern in southern Somalia include scarcity, poor distribution, variability in the onset of the wet season and high variability in the amount of precipitation from year to year. This results in a drought recurrence interval of every four to five years.211,212

The population of the area is relatively high; with the land per person averaging 0.3 ha. Mean farm size (several parcels may comprise one farm) is 2.24 ha. Small holder subsistence farms make up the majority of the study area, following Massey's213 definition of subsistence agriculture. Within the study site is a refugee settlement of 270 farms (17.2% of the total farms in the study site) in which Ethiopian refugees engage in the same land-use practices as the surrounding small farmers. The Shabelle valley where the study site resides is one of the five main areas of refugee concentrations in the country.214

Present cropping patterns in the study area are dominated by maize (Zea mays) and sesame (Sesamum indicum) cultivated primarily as subsistence crops, along with some vegetable and fruit crops. The production of fodder crops does not presently take place nor does it appear feasible in the near future. Pastoralists are usually able to obtain freely what crop residue is available in the dry season. If subsistence farmers were to grow fodder crops in a good rainfall year when plenty of free crop residue is available and fewer transhumant livestock arrive in the irrigated area, the farmer would receive little or no money for his crop. This is a risk that subsistence farmers are unwilling to take.

Livestock belonging to nomads begin to arrive in large numbers late in the Der wet season. Herds spend the subsequent Jilaal dry season concentrated on croplands close to the river where they feed primarily on crop residues. As the dry season continues this concentration increases, and in severe droughts livestock from other areas can be drawn to the area to compete for crop residues.215 Dry season livestock migrations into the Shabelle river basin where the study site is located result in one of the highest livestock densities in the country.216 During the Gu wet season these herds disperse north and northwest into the interior of the country in order to take advantage of rangeland forage and surface water and avoid tsetse fly infestations which occur along the river.217 The study site is thus an area in which successful resettlement of refugees has occurred in the context of land-use practices that provide dry season forage and water for nomadic herds.

With the expansion of agriculture and the implementation of development schemes along the Shabelle river (Figure 3b), seasonal flooding has decreased, and as a result the flood retreat areas which traditionally served as dry season forage and water locations for nomadic herds have been considerably reduced.218,219,220 This greatly exacerbates the problem of locating dry season forage and water for transhumant pastoralists.

Data acquisition

The data for this study were collected during 18 months of fieldwork, and consist of information gathered from questionnaire surveys totaling 465 interviews, key informant interviews and parcel measurements. 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, and focused on a wide variety of subjects in order to reveal present land-use practices. These included: demographics, cultivation practices, access arrangements to water and forage, livestock numbers and types, forage production from a variety of sources, forage and water locations, land tenure, and a range of socioeconomic topics. The large farmer survey was made up of 30 nonrandomly selected participants who were interviewed once and were asked for much of the same information. 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. The agropastoralists frequently themselves or had relatives engaged in nomadic pastoralism. This survey was carried out solely for the purpose of determining the relationship between the different types and states of land present in the study area and the length of time that livestock are able to live off this land. Of interest was the livestock carrying capacity of land under fallow, maize and sesame crop residue, riverine grassland, and areas of previous cultivation; in good, average, and poor precipitation/irrigation years.

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 is registered and therefore had to be surveyed, stated farm sizes were quite accurate and easily verified from the local land registry.

Initial statistics for the small and large farm surveys included: (1) total standard stock units owned, and the grazing and watering locations of livestock belonging to small farmers resident in the study area who both do and do not allow free grazing in good, average, and poor Gu, Der, and Jilaal seasons; (2) small and large farmer ownership of livestock over time; (3) determination of small farmers as subsistence agriculturalists using crop production figures; (4) fodder and grazing rights transactions for small farmers who do and do not allow free grazing during the Jilaal; (5) total seasonal hectares and proportions of the sample area under the various land categories including: crop types (monocrop and intercrop), fallow, previously cultivated, and permanent grazing land for small and large farmers; (6) the proportion of good, average, and poor water years; (7) quantity, timing, and location of transhumant herds arriving on the scheme in the dry seasons of good, average, and poor precipitation years. In addition, overflights of the area and of Somalia by Resource Management and Research221 undertaken in both wet and dry seasons facilitated additional livestock enumeration, expediting estimation of dry season SSU densities on-scheme.

Responses to the agro-pastoralist survey were averaged in order to determine the time that livestock could be maintained on land in each of the categories in all seasons of good, average, and poor water years. Livestock numbers were then converted to standard stock units (SSU).

Conversion of livestock quantities into standard stock units (SSU) was accomplished following Field222 using Somali specific breeds, herd age structure, feeding habits, and liveweights. For Somali conditions the standard stock unit is a mature bovine with a liveweight of 450 kg that consumes 4,100 kg of dry matter per year. In this framework one SSU is equivalent to two camels or cattle, 20 sheep or goats, or 5 donkeys.

Thus the data gathering and analysis was meant to obtain a representation of the in-place agricultural activities as they existed at the time of the surveys. This then serves as the foundation or context for the calculation of carrying capacity for livestock. In other words livestock carrying capacity opportunities are considered entirely within the functioning agricultural production system.

Calculation of livestock carrying capacity

In order to determine the livestock carrying capacity for the different land uses (in different states in different seasons of the year, and in good, average, and poor water years) land was grouped into five categories: 1. land under maize cultivation; 2. land under sesame cultivation; 3. previously cultivated land (applicable only in the Jilaal season and includes all land previously cultivated irrespective of crop); 4. fallow land, and 5. areas under riverine grassland.

The proportion of the total study area under each of these categories in each season was obtained by extrapolating from the category areas in the random sample. It is 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 depends on the land-use in the previous as well as the present season. For example, if a parcel is cultivated with maize or sesame in the Der season, the crop residue will not be available until harvest at the end of the season. Then in the following Jilaal season the carrying capacity for that parcel would be the carrying capacity of the crop residue from the Der season cultivation (cut and stacked in the corner of the parcel) plus the carrying capacity of the parcel itself in the category of previously cultivated. While the carrying capacity of the previously cultivated category is the lowest of any category, it is still significant due to the inefficiency of hand weeding, such that the noncrop vegetation present after harvest is able to support some livestock.

Calculation of carrying capacity for the crop residue categories in good, average, and poor water years was accomplished following equation 1. The units used for quantities of maize and sesame crop residue are known locally by the terms bal, and ambul respectively.

Eq. #1.

$$Csi = SSUi * [(Xi/Rsw)/3]$$

Where:

Csi = the carrying capacity for SSU in season s on land category i;

SSUi = the number of SSU that can live off a single unit of crop remnant of category i for one month;

[(Xi/Rsw)/3] = the monthly quantity of crop residue units available in season s in land category i (number of maize bals or sesame ambuls).

Where:

Xi = the total area (ha.) under category i;

Rsw = the area producing a single unit (bals or ambuls) of crop residue in season s, in water year w, where w is defined as good, average, or poor;

3 = number of months per season, for all seasons. Carrying capacity was calculated on a seasonal basis because season determines availability.

For the categories of fallow, previously cultivated, and riverine grassland, carrying capacities were calculated using equation 2:

Eq. #2.

$$C_{si} = (X_i * SSU_{iw}) / 3$$

Where:

Csi = defined in equation 1;

Xi = defined in equation 1;

SSUiw = the number of SSU sustainable on one hectare of land category i in water year w;

3 = number of months per season.

Comparison of observed SSU with the calculated carrying capacity using equation 3 was carried out in order to determine if the livestock carrying capacity of the scheme could support the quantity of livestock actually present during dry seasons of varying severity. This was accomplished with equation 3:

Eq. #3.

$$K_s = (\Sigma C_{si}) - O_s$$

Where:

Ks = the number of observed SSU not sustained in season s (if a negative number), or the extra number of SSU which could be sustained (if a positive number);

(Σ Csi) = the summation of all crop/land category carrying capacities i which are available in season s;

Os = the observed number of SSU in season s.

Tenure, Availability, Value and Vulnerability of Crop Residues

Tenure and management practices

In a small farmer context security of tenure and freedom of management are critical for optimal resource utilization and long-term productivity.223,224 Customary tenure regimes are not static.225 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.226 On the other hand imposed tenure structures in Africa have often not strengthened individual rights and have often blocked tenure development and adaptation in response to new situations.227 Farm and crop management decisions in resettlement need to, as much as possible, operate in the context of familiar tenure and land-use systems as well as the subsistence and market opportunities of the area in which resettlement occurs. This is why it is important to incorporate the crop and land-use change that is part of customary management practices, into the analysis of residue forage production. Crop choice and land-use change will influence greatly the availability of forage to transhumant livestock, and hence carrying capacity. Also included in this study is the consideration of maintenance of private tenure over crop residues and grazing areas as it occurs in the study area. A portion of both large and small farmers maintain private tenure over crop residue and grazing locations in the dry season. This forage is not accessible to transhumant herds and was not included in calculations of livestock carrying capacity only as areas contributing no fodder. The reason for not excluding these areas completely is that they are part of the in-place land-use of the study site.

Availability, value and vulnerability

Of the more important variables involved in the utilization of crop residue in the study area are the 'value' of the residues themselves as fodder, and the 'vulnerability' of these residues to drought. 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. Thus for any assemblage of fodder resources available from an agricultural settlement scheme, value and vulnerability will vary with the resource and will result in a dynamic carrying capacity which interacts with a spatially and temporally dynamic transhumant livestock population. Ultimately the combined effects of use and access (or tenure), value, and vulnerability of fodder resources in a resettlement scheme will manifest themselves in the displacement of livestock when the forage available drops below what is necessary to maintain the numbers of animals which frequented the area prior to resettlement. The timing and magnitude of this displacement has impacts on land degradation, and conflicts within the resettled area, and finally on the impoverishment of pastoralists and the success or failure of the resettlement scheme.

Individually each crop/land-use, or land category, will have a livestock carrying capacity (value) that extends the full range of its vulnerability. 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. This varies with water quality year. The other dimension results from the change in categories due to season, drought, needs for subsistence foods, income, market influences, etc. Table 1 gives a comparison of forage values and vulnerabilities for years of varying water availability (good, average, poor) expressed as quantities of SSUs sustained. 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. The other is category choice by the farmer.

Figure 4 illustrates the combined aspects of availability, value and vulnerability in terms of the capacity of the land categories with fodder potential to support 100 SSU. The left vertical axis represents the carrying capacity in SSU/ha, and the horizontal axis represents number of hectares necessary to maintain the 100 SSU. The upper left corner of each box is the value of the category in number of SSU sustained per hectare, and the position of that point over the horizontal axis is the number of hectares needed to sustain 100 SSU 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 SSU 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 required to offset the decrease in value in a poor year in order to continue to maintain 100 SSU.

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. Thus maize is most widespread in the Gu (the wettest rainy season), sesame in the Der (the drier rainy season) and previously cultivated land is most commonly encountered in the Jilaal dry season. In the context of this temporal availability value and vulnerability operate to determine carrying capacity on a seasonal basis.

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 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.

The problems with having the highest value categories dominating a resettlement scheme are that these residues are the most vulnerable to drought and would cause the largest livestock displacement. And mandating that the resettled population engage in continuous maize-fallow cropping would mean that unhindered customary land-uses and management would not occur, and could make this population vulnerable to drought in an arrangement where maintenance of transhumant herds is but one objective. In addition, if in a spate of good water years exclusively high value highly vulnerable crops were encouraged, the scheme could be seen as a better than ordinary forage source, drawing pastoralists and their herds from other areas, perhaps resulting in more dry season livestock on-scheme than had been there previously. The displacement which would subsequently take place during drought would also be greater.

Resettlement Policy Implications

The value of this sort of analysis to land use policy formulation is that it translates the need to integrate land-use patterns in resettlement schemes, into a quantifiable approach that can be used in land use planning. The following discussion outlines potential scenarios for using value and vulnerability of forage resources in planning objectives.

Drought proofing the integration of land-uses

In order to drought condition the integration of resettlement and pastoralist land-use patterns, livestock access to the cultivated area needs to be looked at in terms of the area under the land categories likely to be in-place in poor water years. And which categories have both an acceptable value, and a low vulnerability, as well as the area required per

SSU for these categories. Given the particular assemblage of land categories in this study, one planning option might be the position represented in Figure 4 by sesame (box no. 4). This category might be considered a good choice for a number of reasons. First, for a region with a relatively high drought recurrence interval choosing a category with a lower vulnerability to link livestock numbers to, would be wise in order to avoid frequent livestock displacement due to drought. While choosing sesame with its relatively low value would mean large areas might be needed, sesame is what most farmers in the study area cultivate if they think the coming Gu season will be a poor one, and it is the crop of choice in the Der season. The Jilaal dry season follows the Der, and thus sesame is in a position to provide the most immediate forage to livestock in the Jilaal. This is not to say however that maize residue produced for the most part in the Gu, and to a lesser extent in the Der would not play a role in livestock maintenance. Again the crops and areas under crops are based on what has been observed. Thus given the mosaic of land uses, crop choice, crop and land-use change due to farmer decision-making, individual tenure choices, and availability, value and vulnerability of fodder resources the area that would be under sesame given all of the above is what the area recommendation is based upon. It does not mean that this area is planted entirely in sesame, for it would not be. It would be planted in the mosaic of crops that is a function of the in-place cultivation practices and decision-making, etc., and a portion of this area would be in sesame. And this proportion is what the recommendation is based upon.

In the sesame scenario, for every 100 SSU, 62.5 ha of access would be needed for every 30 days, or 0.625 ha/SSU for 30 days. For the whole dry season (three months) this would be 1.875 ha/SSU. Another consideration however in the selection of a base fodder resource is the position of the categories on the curve (Figure 4) relative to each other. for example the sesame and the riverine grassland (box no. 3) categories overlap considerably. The land area difference between sesame and riverine grassland for 100 SSU is approximately 10 ha, for both good and poor years (e.g. the difference between vertical lines). And the increase in area needed to sustain 100 SSU from good to poor years is virtually the same (30.89 for grassland, and 30.85 for sesame, the length of the horizontal lines). However the difference in carrying capacity from poor to good years for these two categories is quite different. This can be seen visually by the more vertically rectangular shape of the riverine grassland box in Figure 4. In a poor year only 0.3 more SSUs/ha are maintained by riverine grassland versus sesame, whereas in a good year 1.44 more SSUs/ha are maintained by riverine grassland. Thus the argument might be made that a combination of sesame and riverine grassland would be a more reasonable planning option given that the carrying capacities between riverine grassland and sesame are so close in a poor year but that so much is gained (less area is needed) in an average or good year. For such a combination the area required would be an average of the two categories in a poor year (57.57 ha/100 SSU) which is less than the area for just sesame (62.5 ha/100 SSU). If the region in question had a lower drought recurrence interval, perhaps just the position represented by the grassland category might be chosen (52.6 ha/100 SSU) or a combination of grassland and maize (box no. 2) categories (39.5 ha/100 SSU) for yet a lower recurrence interval. The lower the drought recurrence interval the higher up the left vertical axis of Figure 4 a base fodder resource could be selected from. Ending up at the fallow category for a region with a very low interval. The idea is to match an appropriate position along the curve in Figure 4 with an observed recurrence interval. The land-use categories used in this study are particular to the Somalia study site, and are meant to serve as examples, and by no means are the only potential fodder sources available from agricultural resettlement schemes. While other crops and land-uses would have differing forage values and vulnerabilities, they would nonetheless lend themselves to a similar analysis.

The arrival of much larger than normal herds of livestock usually correlates with a poor water year or drought, such that less livestock is sustained in the interior. Such a situation could have three possible outcomes. Livestock could enter the settlement area at uncontrollably large numbers; livestock could be kept out of the settlement area, which is what frequently occurs in pastoral areas taken over by agriculture; or only a portion of the herds could be let onto the scheme. The result is the same however, in terms of the carrying capacity of the area being unable to sustain the livestock. The amount of livestock lossed, and number of pastoralists impoverished in such a situation however would depend to a significant extent on the degree to which the two land-uses are integrated. Some of the improvements involved in such integration are considered in the section below on Potential improvements.

For the model to embrace different livestock numbers, including unusually large herds, would mean that base fodder resources with lower value and vulnerability, and hence much larger land areas would be selected, until ultimately the limits to carrying capacity given the crops and land-uses in-place are surpassed. At this point livestock displacement and livestock loss would occur, which happens with some frequency in pastoral systems. The idea here however is to sustain the same number of livestock which frequented the area prior to resettlement even in poor water years, so that these animals are not displaced, and hence do not over-utilize more marginal resources, which if significantly degraded would increase livestock and pastoralist vulnerability to drought and famine. This would result in greater livestock loss and pastoralist impoverishment in poor water and drought years in which they would have fared better had vulnerability had not increased. Heightened vulnerability would also mean that when an exceptionally bad drought did occur more pastoralists would likely become completely destitute than would have occurred otherwise.

Comparison of pre- and post-settlement livestock carrying capacity

The only way livestock displacement will not occur with the implementation of a resettlement scheme, is if the same area that supported the livestock that frequented the area before scheme implementation is accessible and can support the same livestock, or, if a smaller area can serve the same function. The conversion of river basin vegetation to croplands (irrigated or rainfed) can be an advantage for transhumant livestock if crop residues are used as fodder. This is because the forage value and hence the carrying capacity of many crop residues is equal to or higher than that of natural pastures,228,229 and because a significant amount of natural riverine vegetation is woody and unusable to livestock.230 Table 1 illustrates for this study that on a per hectare basis the maize and fallow categories have higher livestock carrying capacities than riverine grassland, even without a woody component. Meaning that for the same number of livestock less land would be needed under these categories than under natural riverine vegetation.

A significant percentage of natural fodders are often avoided by livestock because of low palatability, or they are destroyed through trampling, wind, and fire, consumed by insects and other animals. As a result it has been estimated that only about 30% of the potential yield of natural forage resources may actually be consumed by livestock.231 Jahnke's232 study of livestock production systems in tropical Africa, estimates a natural vegetation carrying capacity of 13.67 ha/SSU in an area of 400 mm of precipitation per year, (the amount received at the study site). This compares with 6.96 ha/SSU needed with a sesame - riverine grassland category average for a poor year from this study. Both numbers are based on kg of livestock units that need to be maintained for a year in order that they be comparable. While sesame would not be available for the whole year, the livestock would not be in the area for the whole year; migrating back to the interior in the Gu wet season. No doubt the lower area required in the study area for the maintenance of livestock, compared to Jahnke's estimates, is partially due to the variably irrigated nature of the area. This aspect of the functioning of the study site, has been incorporated into the carrying capacities for the land categories present in the study.

Table 2 presents the results of the comparison between the calculated carrying capacity of the study site with observed livestock numbers (in SSU) which frequent the area. These numbers represent values for Ks in equation 3 for SSUs not supported (negative numbers), as well as the additional numbers of SSU which could be supported (positive numbers). Significant differences can be noted between good, average, and poor years for the small farmer area. In a good Jilaal, 10,220 more SSUs can be supported than in an average Jilaal, and 12,800 more can be supported than in a poor Jilaal. These relatively large differences again underscore the importance of incorporating the endemic problems of an area (in this case drought recurrence) into resettlement planning. While there are SSU which are not supported during poor water years, this does not mean that a resettlement scheme could not be geared to accommodate all herds in poor water years. However some stress in some years with respect to available dry season forage might be desirable in order to maintain relatively constant livestock numbers in the long term. If all nomadic herds visiting the study site were sustained even in poor years, the result might be large increases in herd size by nomads, similar to what occurs during a series of good rainfall years. In this case a good year occurs three years out of ten, an average year 3.2 years out of ten, and a poor year 4 years out of ten. Thus if a scheme were designed for an average water year it would absorb transhumant herds 6.2 years out of ten (good plus average).

Potential improvements

A possible development, could be that later if/when the resettlement scheme develops and a part of the revenues generated by the success of the production systems are put back into the scheme, such that increasingly reliable irrigation is realized, the value of the categories may increase. And, depending on the reliability of irrigation, vulnerability may decrease. If however water delivery is not reliable, then vulnerability may increase, with subsequent problems for livestock displacement when water availability is a problem.

With the development of exchange relationships between pastoralists and agriculturalists, the cultivation and storage of fodder crops might in the future become a possibility. This may allow the area needed to support livestock in the dry season to be reduced. However, nomadic pastoralists often have a history of being unwilling to pay for forage that they have traditionally had access to for free; and attempts to exchange such access for payment has in the past resulted in problems. Such an arrangement might only come about with gradual development, and the inclusion of both groups in the national monetary exchange system.

The purchase of grain by pastoralists from farmers, or trading livestock products for grain can be a significant exchange. While the pastoralists which frequent the study site in the dry season are willing and do obtain grain from farmers for themselves, they are unwilling and most likely unable to purchase grain for their livestock. These pastoralists have a history of having access to dry season forage for free, as would most pastoralists who encounter newly inhabited resettlement schemes in areas they regard as a traditional source for dry season fodder. Although the main focus of this study is livestock carrying capacity, pastoralist grain purchases deserve mention. Acquisition of grain from farmers for human consumption may serve to encourage exchange relationships between the two production systems, thus further integrating multiple land-use, to the benefit of both. This would be particularly valuable for a newly established refugee resettlement scheme, and could provide an additional component to pastoralist drought and famine coping strategies. In any case interaction with pastoralists may present significant potential in providing alternative sources of rural income for refugees, i.e., livestock production,233,234 especially if the refugees are former pastoralists themselves.

While substantial increases in the production of crop residues might be realized through the utilization of agricultural inputs, it would be unwise to include such increases in the calculation of the area needed to sustain transhumant herds, because use of such inputs does not presently occur, and, this would assume that such inputs will always be readily available, at a price that all small farmers could always afford, and that it is properly applied in a uniform manner over the entire area. Francis et al[235] outlines the problems with promoting agricultural methods based on chemical fertilizers and pesticides which are not available in many countries, or only at high cost.

While use of crop residues for livestock would mean that residues consumed would not be used for fertilizing fields, fertilizer in the form of manure would be available. Although resettlement schemes in river basins of arid and semi-arid regions often occur on the more fertile soils of these regions, it is unknown how this, together with manure availability would compare with crop residue as fertilizer on these soils.

From a land tenure perspective, having adequate free forage available onscheme for livestock in most years may decrease the monetary value of crop residue and thereby encourage a continued communal land tenure arrangement by small farmers in the Jilaal, because little would be gained by maintaining private tenure over crop residue and other grazing sites for purposes of monetary gain. This might encourage those that presently do not allow free grazing in the Jilaal to allow it, further supporting dry season communal tenure. Ultimately this may result in less dry season area needed to support transhumant herds.

Presently 61% of the small farmers in the sample own livestock. However there has been a 36% reduction in the number of livestock owned between when small farmers (as a group) first started farming and the present. Should this trend continue, it would also mean more forage for transhumant herds, and an additional reinforcement for communal tenure arrangements in the Jilaal.

Conclusions

Historically Third World agriculture has met increased food needs by increasing the areas under cultivation and irrigation, and in Africa the Green Revolution has by and large not changed this.[236,237,238] Today however additional fertile land is scarce. Most new land being brought into agriculture is of poor quality and only briefly useful.[239] Because much of Africa's high quality land is already under cultivation, refugees will likely be resettled on more marginal lands. Most of the African refugee problem resides in arid and semi-arid areas where pastoralism is a major form of land-use. However given the importance of pastoralism (present and future), attempts need to be made not to implement resettlement schemes at the expense of this land-use.

While there is no simple solution for refugee resettlement problems, it is becoming apparent that multiple land-use designs need to be a part of resettlement efforts. As opposed to importing designs and systems based on what is technically optimal, the strengths and weaknesses of the participants and institutions responsible for implementation, along with the constraints and opportunities of the biophysical environment should be the starting point.240,241 This study attempts to suggest a way to incorporate land-use practices familiar to refugees being resettled, into an evaluation of the capacity of a scheme to support the transhumant populations of livestock which make up the host land-use. An evaluation of this sort might be considered when performing questionnaire surveys on refugee populations for the purpose of resettlement in pastoral areas. However this would be but one aspect of a workable integration of refugee and host land-uses. Economic analysis is another, particularly valuable component that would be needed in order to spot additional opportunities for integration, as well as to quantify potential links with regional and national economies. From these evaluations crop incentives, operating within the existing regional economy and land-use ecology, and at the same time meaningful to the refugee population, might be introduced. Likewise crops introduced into resettlement schemes for their cash or subsistence value could be evaluated within this framework.

The future of African development depends to a very large degree on agriculture. Given the enormous dislocation problems in many parts of the continent, successful resettlement of agricultural populations will play a significant role.

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Table 1. Comparison of Forage Values and Vulnerability for Fodder Sources in Good, Average, and Poor Years. (Values are in quantity of SSUs 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
Ave. 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
SSUs/ha displaced from good to poor years:					
	5.55	3.71	2.7	1.56	1.46

Table 2. Results of Comparison Between Observed SSU and Calculated SSU Carrying Capacity for the Study Site. (Units in additional SSU sustainable (if positive) or the number of observed SSU not supported (if negative))

	Good year	Average year	Poor year
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

Captions to Illustrations

Figure 1. Refugee migrations in Africa due to civil strife and famine. Adapted from Mattson and Rapp, 1991.

Figure 2. Refugee migrations and numbers on the Horn of Africa. Adapted from Refugees, 1991; Economist 1991d.

Figure 3. (a) Refugee camps and resettlement schemes in southern Somalia; (b) Location of development projects and areas under cultivation. Adapted from Prothero, 1969; RMR 1984; and Conze and Labahn 1986.

Figure 4. Value and vulnerability of fodder resource carrying capacities for the Somalia Study.