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Changes in landscape vegetation, forage plant composition and herding structure in the pastoralist livelihoods of East Pokot, Kenya

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ABSTRACT

Oral evidence from pastoral Pokot on vegetation changes in the rangelands of northern Baringo District points to major changes in structure and biodiversity composition over the past century. A landscape of perennial grasses has turned into an *Acacia*-dominated bush-land. *Pelil* (*Acacia nubica*), *talamogh* (*Acacia mellifera*), or *anyua* (*Acacia reficiens*), which characterise the pastoral landscape today, have increased rapidly since the 1950s. This article compares perceptions of current changes in grass compositions with former accounts, highlighting local assessments of declining high-quality grasses such as *abrute* (*Brachiaria deflexa*, *Setaria homonyma*) or *puyun* (*Eragrostis cilianensis*). The changes described are linked to a number of causal factors (high grazing pressure, restriction of pastoral mobility, increasing population numbers), allowing us to historicise the profound change in landscape vegetation. The costs and benefits of bush encroachment are also examined. The tremendous increase in goat numbers, and the sizeable growth of camel herds, is closely connected to the increased availability of fodder plants for browsers. The article concludes by contrasting the views expressed on landscape by Pokot elders with scientific accounts of environmental change.

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Numerous challenges and transformations in pastoral livelihoods in eastern Africa have come to the fore in recent scientific observations. Land losses,[1] bush encroachment,[2] crop cultivation coupled with increased sedentariness,[3] fragmentation,[4] commodification of livestock husbandry,[5] violence,[6] and wage labour,[7] are among the many issues that are held to characterise the dynamics of pastoral systems. In an edited volume that emphasises change and development in pastoral areas, Little identifies several 'powerful and harmful narratives' that 'equate pastoralism with poverty, violence, illegal trade, economic inefficiency, ineffective tenure systems, environmental degradation, hunger and food aid dependency, and/or "vacant" wastelands'.[8] Furthermore, he highlights political participation, population growth, rural–urban migration, education and ways of exiting pastoralism as future key issues to recent pastoralists. Non-pastoral activities will increase, he

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contends, also competing with pastoral land-uses, implying the necessity of pastoral communities to employ or sustain a large number of non-pastoralists. Little also predicts an increase in cultivation activities for pastoral communities, particular affecting 'poor' pastoralists, and leading to tension and conflict over water and access to land between cultivators and herders.

This article takes up the notion of an inherently changing pastoral way of life, focusing upon the interactions between herders, herds and their environment. Pastoralist groups are often blamed for the misuse of their environment and accused of environmental degradation. Anthropologists, on the other hand, tend to overemphasise the profound local knowledge of environment that enables pastoralists to sustain their livelihoods. These contrasting views are examined here in the case of East Pokot, where population growth, environmental change and conflict, as well as the growing importance of livestock markets, have dramatically altered the pastoral economy to accommodate both subsistence and commercial needs. However, the changes in socio-economic and socio-ecological environments do not point to a single 'new pastoralism', and Leslie and McCabe are correct in calling attention to the 'response diversity' of pastoral communities. They assert that 'not all actors respond the same way to challenges, opportunities, and risks',[9] and emphasise variation and individual decision-making.

To examine these issues in relation to landscape change, the opening section of this article will introduce the study area of East Pokot. This is followed by a short description of the research methodology employed in the study. The rankings of fodder plants are then discussed in comparison to results published by Bollig and Schulte[10] for East Pokot, and in relation to recent trends towards small-stock and camel husbandry. Next, the environmental history of the Pokot grassland savannah will be set against our understanding of the recent development towards a dense bush savannah. The article concludes by contrasting the views expressed on landscape by Pokot elders with scientific accounts of environmental change

Study area: East Pokot

This study, carried out in Nginyang and Mondi Division in East Pokot, deals with the perception of a changing environment where a formerly grassland savannah has transformed into a dense bush-land savannah, encroached by *Acacia* spp. and other bush species. The study area is located in the plains between Nginyang Centre and Mount Paka (see Figure 1), at an altitude between 900 and 1200 m. The population numbers in Loyamoruk location, including Paka, Kokore and Nginyang East, rose from 4000 inhabitants in 1979[11] to almost 12,000 in the 2009 census.[12] In an area of 436 km^2 population density increased from 9 to 27 people/km^2, while East Pokot in total shares an average population density of 41 people/km^2, in an area of about 4500 km^2.

The plains can be characterised as bush savannahs with dominating Acacia trees such as *Acacia tortilis*, *Acacia mellifera*, *Acacia reficiens*, and *Acacia nubica*. On the slopes of the extinct volcanoes of Paka and Silali, grass availability is higher, though for forage regeneration and dry season meadows, mountain sites are periodically closed for grazing by a council of elders (*kokwö*).[13] The average precipitation in the area is about 600mm/y/m^2 (42 records from 1942–1991 from Nginyang[14]), ranging between 204 (in 1984) to 1125mm/y/m^2 (in 1961). In contrast to the Pokot lowlands, around Paka and the mid-

Figure 1. The study area in East Pokot.

hill areas around Tangulbei, which are still characterised by pastoral modes of land-use, highland areas towards the Laikipia Plateau are today characterised by crop-farming with a share of 88% of households cultivating crops in 2010.[15]

Livestock numbers, especially the number of goats, are understood to have increased tremendously in East Pokot during the twentieth century. Cattle numbers rose slightly and oscillated around 100,000 animals within the past century, while small-stock numbers grew significantly.[16] The exact number of goats and sheep is difficult to identify, since estimations vary from 330,000[17] to 700,000[18] head of small stock, rising to estimates of 1.855 million goats and sheep in the most recent livestock population census in 2009.[19] Despite the wide range of estimates, the tendency is towards browse-dependent small-stock husbandry. The shift in herd structure in East Pokot has been depicted by Oesterle, who also claims a twofold increase of camel populations over recent decades.[20] These animals are associated with prestige, wealth and prosperity, as they provide livestock services such as milk and meat during the dry season. Cattle, on the other hand, depend on the pastures which are under pressure, due to a high degree of grazing, on the one hand, and bush encroachment, on the other. Along with population increase, the tropical livestock unit (TLU) per capita is 3.3 and therefore still akin to other pastoral groups in Africa.[21] However, the TLU/km^2 is 35.4, and therefore extraordinarily high in comparison to similar groups such as Borana (17.4), Maasai (16.8) or Turkana (5.0).[22] Moreover, the person to cattle ratio has dropped from 1:14 at the beginning of the twentieth century to 1:2 at the beginning of this century.[23] These results are clearly bound to the restriction of territorial expansion, the enormous population increase of the last decades, and the comparably moderate increase of livestock numbers. Hence, the livestock numbers per square kilometre are astonishing high, while the livestock numbers per person are mean.

Against the assumption of Pokot resistance to change,[24] Oesterle describes the profound and rapid changes of pastoralism in East Pokot, which have 'transformed from

[a] specialized, highly mobile and subsistence-oriented cattle herding to largely sedentary and market-oriented keeping of small-stock'.[25] General trends show a tendency towards economic diversification of livelihoods, sedentarisation of former mobile households and a social stratification of Pokot communities. Oesterle highlights two important trends: first, the shifting focus from a cattle-oriented mobile pastoralism to a more sedentary form of small-stock husbandry; second, the implementation of farming techniques in a formerly specialised pastoral group. These transformation processes also go along with the contestation of formerly exclusively ethnic-based communal land tenure,[26] and result in the 'de-facto privatisation' of land for cultivation in the agro-pastoral highlands around Churo.[27]

Research methodology: a cognitive approach

The research for this paper was conducted during 2014 and 2015. The project addressed the question of how local actors perceived and conceptualised a rapidly changing environment. Standard methods of participatory observation and interviews were complemented with cognitive methods, including free listing and ranking. Free listing is a tool to identify reasonable forage plants from herders,[28] while ranking subsequently deals with the sorting of the plants according to specific categories such as quality or availability of forage. This cognitive approach to herders' perception towards their environment implies a more holistic view of herding. The ranking results derived from interviews reflect the continuing engagement between herder, livestock and environment, incorporating past memories as well as present perceptions. Ingold describes this perspective as follows:

> to perceive the landscape is therefore to carry out an act of remembrance, and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perceptually with an environment that is itself pregnant with the past.[29]

Before starting the forage rankings, three major focus groups were identified: cattle-, goat - and camel herders, mostly born in the 1980s. These groups are not distinct, however, since most pastoralists interviewed had herded both goats and cattle, and some had also kept camels. Which category a herder went into was based upon individual experience. During 27 interviews with herders of cattle, goats and camels at the dam sites of Merikalle and Tuwo during the dry season, 117 plants were named in the Pokot language. Most frequently mentioned plant species were identified and sorted, according to herder categories. Subsequently, group interviews were conducted with several herders from each category, asking whether cattle (respectively goats or camels) graze or browse on these plants. Three lists of plants were compiled that include the most important forage plant species for the particular livestock categories; 37 plants for the cattle forage ranking, 34 for goats, and 34 for camels were identified (see the appendix). These were ranked in single interviews with 30 herders – 10 for each livestock category. Initially, plants were ranked according to perception of quality. Herders often ranked the plants in categories such as 'these plants make the animals fat', 'if the animals eat these plant, they give a lot of milk', or just in terms of the opposition between 'sweet' (*anyin*) and 'tasteless' (*tadagh*). The lowly ranked plants species are often referred to as 'not preferably eaten', 'only eaten during the dry season', or 'the animals do not become fat'. In a second step the herders were asked to rank the same plants again according to their prevalence in

the area: this made the comparison of different plant species somewhat difficult in such a variable environment.[30] The herder subsequently ranked the plants according to categories such as 'these plants grow abundantly when the rains come', 'you find this species in the whole area', or 'they grow very fast', in contrast to 'they are only found in the river beds', 'the grasses disappear completely after grazing, until the rains come back' or 'these trees grow very slow'. In addition to the quantity ranking of the plant species, the particular plant species were sorted into four categories which were predefined as: increase (1), stable (0), decrease (−1) and hardly seen (−2). These categories were taken into account to compare our cattle ranking to the results Bollig and Schulte[31] published in 1999, based on data obtained in the late 1980s and early 1990s. In addition, an historical ranking was conducted with 10 elders in Chepungus, using the same approach, and referring back to the perceived situation in 1975.

Livestock forage rankings

The pastoral community of East Pokot holds a vast knowledge on plants and their uses through the everyday interaction with their environment. Compared to goat and camel herding, cattle herders walk the longest distances, due to the dependence on relatively scarce grasses. Thus, cattle herders give very detailed accounts of different places within their grazing range. During rainy seasons they return home, grazing animals close to their main homesteads. Highland pastures on Korossi, Paka and Silali are protected after rainy seasons to preserve their vegetation recovery, and when these pastures are also exhausted, the herders must move further afield. Surrounded by other pastoral communities, Pokot herders often enter 'enemies' land' to the north, east and south, in search of pastures, sometimes provoking violent conflicts with Turkana, Samburu, and Il Chamus.

By contrast, small stock and camels are husbanded in the vicinity of the homestead – as long as water is available. A huge variety of bushes and trees provide a forage basis for both camels and goats, and no herder ever mentioned difficulties in feeding these animals. However, goats are perceived to easily contract infectious diseases, such as contagious caprine pleuropneumonia (*lowkoi*), and die in high numbers during disease outbreaks. Camels are perceived to perform well and to be affected by few diseases – although herders mentioned that once infected, diseases have a disastrous impact on camels. Bollig claims that camels are especially prone to diseases in wet years.[32] Cattle, in contrast, are seen as relatively resistant to disease.

Figures 2–7 display the results of forage rankings for cattle, goats and camel. For each species, two figures explain, firstly, the abundance and quality notions of forage plants in the area, and, secondly, the perception of decrease and increase of the particular plants.

The ranking of cattle forage was the most variable of all rankings, especially in terms of availability. *Sehima nervosum* (*chaya*) is perceived as the best and most abundant grass species in the area, followed by other plant species such as *Cynodon niemfuensis* (*seretion*), *Tetrapogon* spp. (*angoleyekion*) and *Enteropogon macrostachys* (*kipaupau*) (Figure 2). *Eragrostis cilianensis* (*puyun*), *Triumfetta rhomboidea* (*koserinyan*), *Brachiaria deflexa* (*abrute*) and *ngilet* (see the appendix) are also ranked high in forage quality, but the availability of these grasses is perceived to be rather low. Especially *E. cilianensis* (*puyun*) and *B. deflexa* (*abrute*) have been decreasing in the recent past (Figure 3). Only four grass species

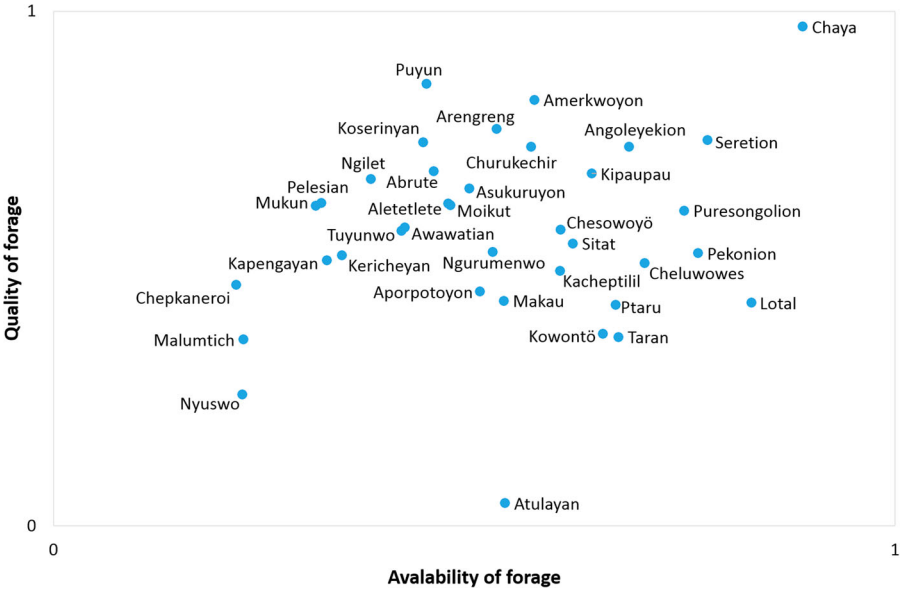

Figure 2. Forage ranking for cattle.

– *C. niemfuensis* (*seretion*), *E. macrostachys* (*kipaupau*), *Aristida mutabilis* (*puresongolion*), and *Aristida adscensionis* (*cheluwowes*) – are seen as increasing, while almost 80% of the plants covered in the ranking are perceived to have decreased recently. Interestingly, the five tree species included in the ranking were all placed in the lower range of Figure 2, their forage value being quite low, except during dry season when grasses disappear and

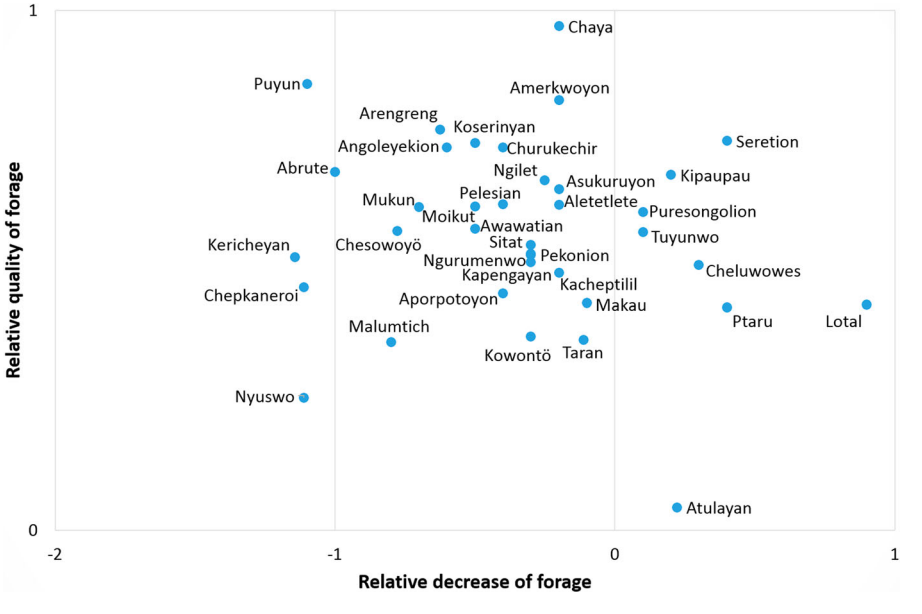

Figure 3. Relative decrease of cattle forage.

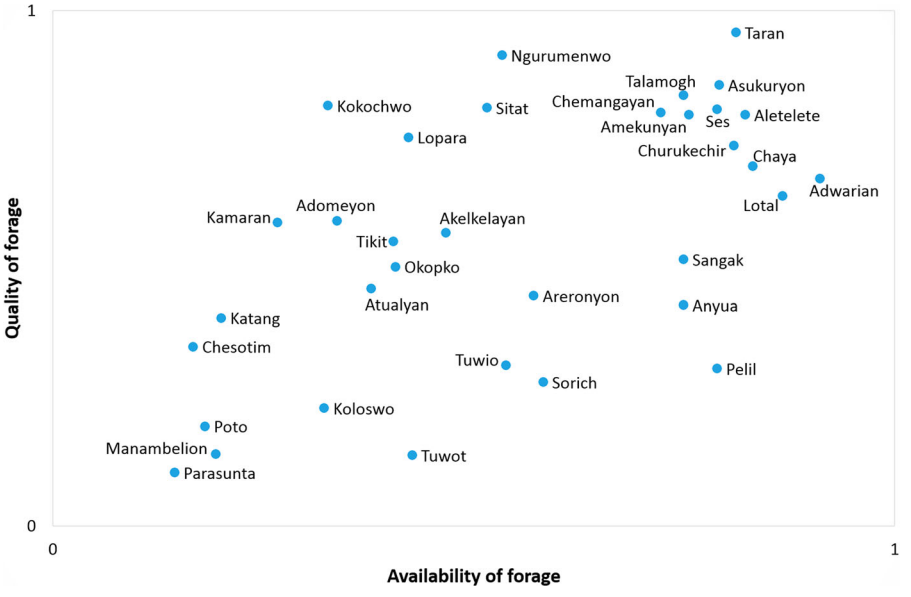

Figure 4. Forage ranking for goats.

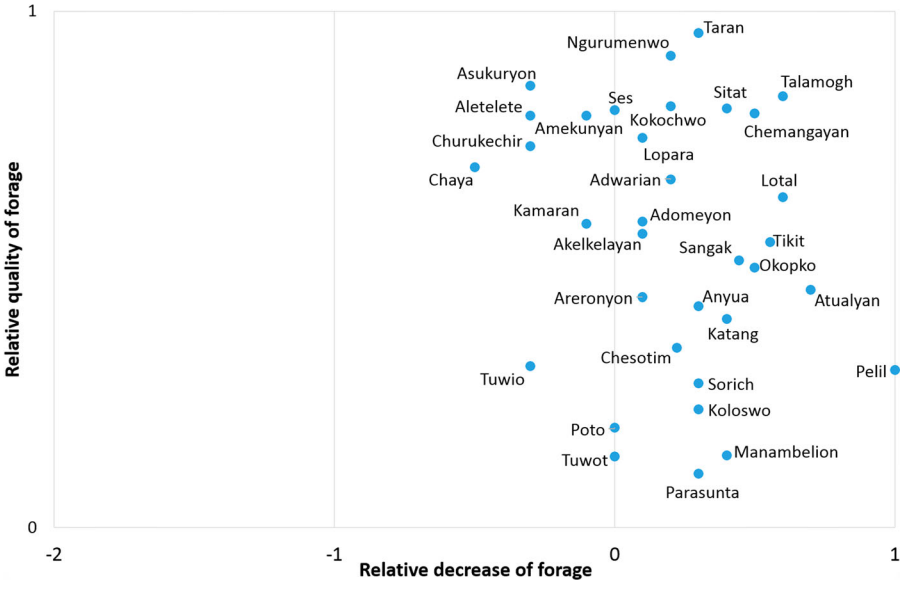

Figure 5. Relative decrease of goat forage.

cattle browse on trees.[33] One possible reason for the cluster formation in Figures 2 and 3 might be that the landscape changes are intra- and inter-annual. This is especially important with grasses, since they are the first to germinate and the first to die back. Additionally, cattle herders have the widest range of mobility in search of grasses. The experiences cattle herders have are thus far more diverse than for those herders who stay around homesteads.

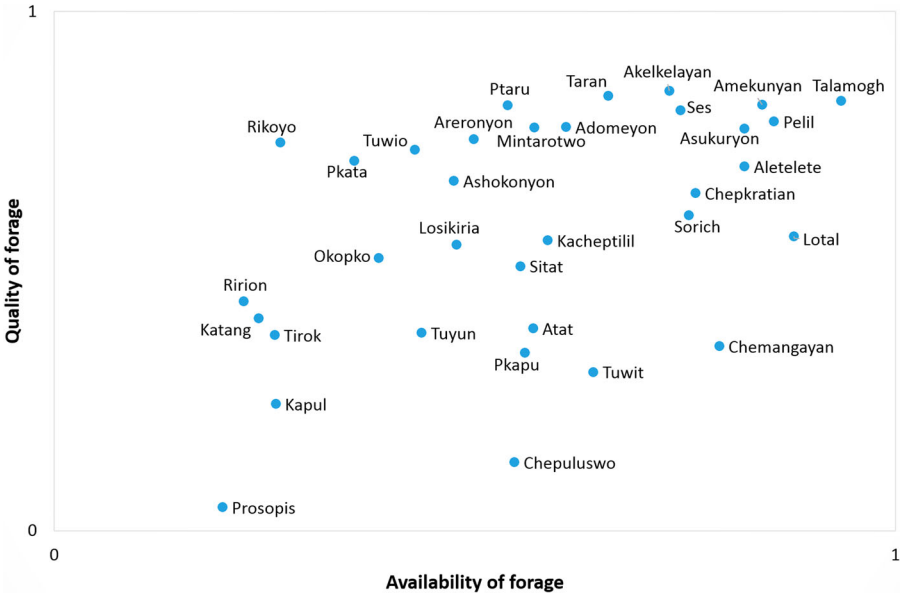

Figure 6. Forage ranking for camels.

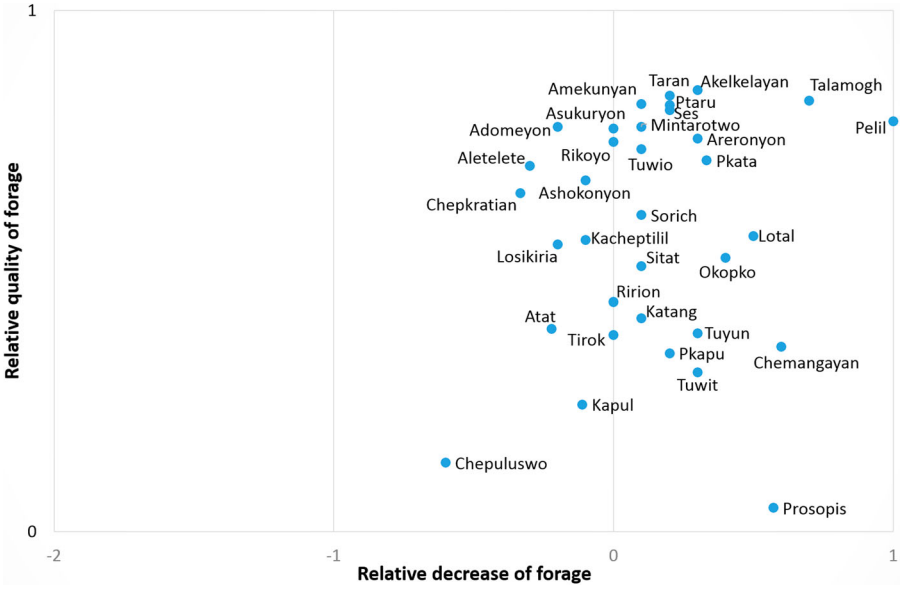

Figure 7. Relative decrease of camel forage.

In contrast to the forage available for cattle, the herbs, bushes and trees goats use to browse are abundantly dispersed in the area. *Grewia tenax* (*taran*), *Tribulus* spp. (*asukuruyon*), *A. mellifera* (*talamogh*), aletelete (see the appendix), *A. senegal* (*chemangayan*), *Indigofera* spp. (*amekunyan*), and *A. tortilis* (*ses*) are recognised as high-quality forage plants (Figure 4). The image drawn by goat herders in Figure 4 is far less ambiguous than the picture from Figure 2, since goat herding takes place around the main homestead

the whole year. Hence, the reference area for goat herding is smaller and clearly defined. The availability of plants depicted in Figure 4 varies widely, but only 20% of these plants included in the ranking were perceived to be decreasing (Figure 5). The pods (*sakaram*) of Acacia spp. are perceived as a favourite feed for goats, and so three out of five Acacia spp. were ranked highest, with four out of five perceived to be increasing rapidly in the area. In general, the goat feed is highly diversified and forage is available year round.

Camel forage displays a similar pattern to the goat ranking. The best forage plants are *A. mellifera* (*talamogh*), *Indigofera* spp. (*amekunyan*), *A. nubica* (*pelil*), *Tribulus* spp. (*asukuruyon*), *A. tortilis* (*ses*) and *Cyathula orthocantha* (*akelkelayan*). These plants grow abundantly in the study area (Figure 6). Approximately 25% of the plants discussed in the ranking are perceived to be decreasing slightly, while only *Maerus spp*. (*chepuluswo*) is perceived to be in severe decline (though its forage value is markedly low, Figure 7). *A. nubica* (*pelil*) is seen as the highest 'increaser' throughout the camel and the goat rankings. While goats only browse on its pods, camel prefer the leaves. This plant severely encroaches the landscape and is often found as the first intruder into cultivation areas, where in high-density stands it forms an impenetrable mass. However, camel forage is perceived to be abundant and of high quality in the lowlands and on the slopes of Paka.

Bollig and Schulte described a similar scenario in regard to cattle forage availability.[34] In their ranking, high-quality grasses such as *S. nervosum* (*chaya*), *E. cilianensis* (*puyun*), *T. rhomboidea* (*koserinyan*), *Eragrostis superba* (*churukechir*), and kericheyan (not specified) were ranked as strongly decreasing, while the unpalatable *Cymbopogon caesius* (*kowontö*) was spreading into degrading grasslands. Only 5 out of 26 plant species were assessed to be increasing or stable, while the remaining grasses were all estimated to be decreasing:

> Degradation involves a nearly complete replacement of perennial grasses by annual grasses and the widespread encroachment into grassland communities of *Acacia* thornbush (*Acacia spp*.), a process frequently dubbed 'green desertification'.[35]

Grass availability appears to have been higher at the time of the Bollig and Schulte study. Herders interviewed in our study were in their 20s and 30s. They perceive an enormous change in landscape over this period, typically recalling that they were 'able to see far' when they were young, but now the bushes grow everywhere. Thus, the environmental changes reported from the 1980s and early 1990s now appear more acute.[36]

The grasslands of the past

This section deals with memories of the past and scientific accounts of the environment in East Pokot. While both Pokot memory and scientific notions refer to the incremental decline of pastures, it does not suffice to assess land cover change on a single aspect, such as rangeland degeneration. While grasses certainly declined, bushes as high-quality fodder for browser increased. Pastoral Pokot point out these changes without over-emphasising negative over positive effects. The character of land cover change also depends on the context of land degradation,[37] whereas perceptions of degradation vary with changing subsistence patterns.[38] For instance, the value placed upon grazing grounds might change when browsing species complement cattle herding, or when livelihood transitions occur, such as the adoption of new agricultural practices, or increased market orientation of livestock production.

The descriptions of the past in East Pokot describe an open grassland with few, big Acacia trees (mostly *A. tortilis*), and with a variety of grasses such as *amerkwoyon* (see the appendix), *C. niemfuensis* (*seretion*), *A. adscensionis* (*cheluwowes*), *E. superba* (*churukechir*), and *B. deflexa* (*abrute*). In a year of very good rains, 1988, Bollig wrote an interesting field note that gives a glimpse of this:

> We camped in Chepungus, about 1½ hours from the top [of Mt. Paka]; about 20 kilometres from Nginyang. After 11 kilometres the bush savanna turns into open grassland. A closed grass area with few Acacia trees. On our way big herds of cattle. Towards the top of Paka exist excellent meadows; up into the crater. However, water points are dispersed widely; water for Chepungus is taken from Tapogh.[39]

Two years later, in 1990, Reckers indicates a similar situation:

> The [volcano] Paka provides a very good grass cover combined with a very good coverage percentage of 95%. There are perennial grasses like *Enteropogon macrostachis* [kipaupau], *Eragrostis suberba* [churukechir], *Hyparrhenia rufa* [solyon], *Cymbopogon giganteus* [kowontö], and *Chloris virgate* [pekonion]. The common trees are *Balanites aegipytiaca* [tuyunwo], *Commiphora africana* [katang], *Albizia amara* [panan], *Sclerocarya birrea* [oroluo] and *Acacia nilotica* [okopko], even *Acacia xanthophloea* [renoi]. The bush species diversity is low.[40]

Bollig differentiates between four types of vegetation zones in East Pokot. 'Bush savannah' and 'grass savannah' are the two dominating types of vegetation, each shaping the landscape of approximately 40% in the late 1980s, while 'highland meadows' form 15%, and 'gallery forests' along river beds constituted the remaining 5% of the land cover.[41] Similar to Bollig, Timberlake, who mainly conducted his study around Chemolingot, earlier differentiates four ecological categories in his ethnobotany of the Pokot and indicates the first signs of severe overgrazing. *A. mellifera* bush-land is

> … a heavily overgrazed unit found on the plains, with scattered shrubs, small trees and an impoverished ephemeral herbaceous layer. The principal species is A. *mellifera*, along with *Boscia coriacea* and *Balanites orbicularis*. Shrubs of A. *nilotica*, A. *nubica* and A. *reficiens* are found along shallow lines, […] A few annual grasses such as *Aristida mutabilis* are found. The unit is the most extensive in the study area.[42]

Timberlake furthermore distinguishes 'mixed woodland on hills' (2), '*Acacia tortilis* riverine woodland' (3) and 'river beds' (4). He states that:

> … grazing of domestic livestock has markedly altered and impoverished the ecology of the area as shown by the relatively rich and lush growth found in enclosures. The Acacia bushland unit is the most severely affected and is now relatively poor in production and diversity.[43]

Reckers also identifies 15 different vegetation types, and specifies one type as 'thick *A. nubica* bushland' occurring east of Paka, but this is described as an island of bush vegetation at that time.[44] Currently, *A. nubica* is omnipresent in the landscape and infests the lowlands as well as some parts of Paka. The encroachment of *A. nubica*, *A. mellifera* and *A. reficiens* was already observable during the 1980s and has been characterised by its low suitability and poor productivity for specialised, cattle-based pastoralism.

In our historical ranking referring to 1975, the elders of Paka ranked the same plant species displayed in Figures 2 and 3, according to forage quality and availability.

Figures 8 and 9 show these results and indicate a trend towards an incremental decline of the grass cover from 1975 up to now. The picture displayed is more explicit than depicted in Figures 2 and 3. The elders have given an account of the forage availability and quality in 1975, at a time when the bush encroachment was not as severe as today, and grasses were still abundantly spread (Figure 8). Figure 9 shows the perception of forage decline and especially high-quality grasses, such as *E. cilianensis* (*puyun*), *B. deflexa*/*Setaria homonyma* (*abrute*), *ngilet* (see the appendix), *Tragus berteronianus* (*arengreng*), *Dactyloctenium aegyptius* (*mukun*) and *E. superba* (*churukechir*), are perceived to tremendously decline. The picture drawn by the elders is far more intense than the picture drawn by recent herders (see Figure 3), but the tendency is the same. Grass forage is far less available nowadays, compared to the past decades. Only five plant species with very low forage quality for cattle were ranked as having increased since 1975, among them three tree species.

During interviews with elders, one explanation of the changing environment was the Pokot–Turkana war from 1969–84,[45] which caused a migration away from the conflict prone areas and into the core zone of Pokot population, around Mt. Paka. Bollig calls the conflict between the pastoral Pokot and Turkana people a 'bush war' that has developed a new dimension due to the armament of Pokot and Turkana since the early 1970s, although all conflicts between these groups still deal with livestock and especially cattle issues.[46] But this war did not only have the effect of creating overgrazing: it also led to difficulties in the abandoned places because of 'under-management'. As Conant comments:

> The periodic slaughter of old and young, male and female, together with the loss of nearly all livestock (cattle, goats, sheep) forced the Pokot to abandon their traditional grazing/browsing areas on the Masol plains in 1974. The Pokot herders on the Masol plains withdrew to four

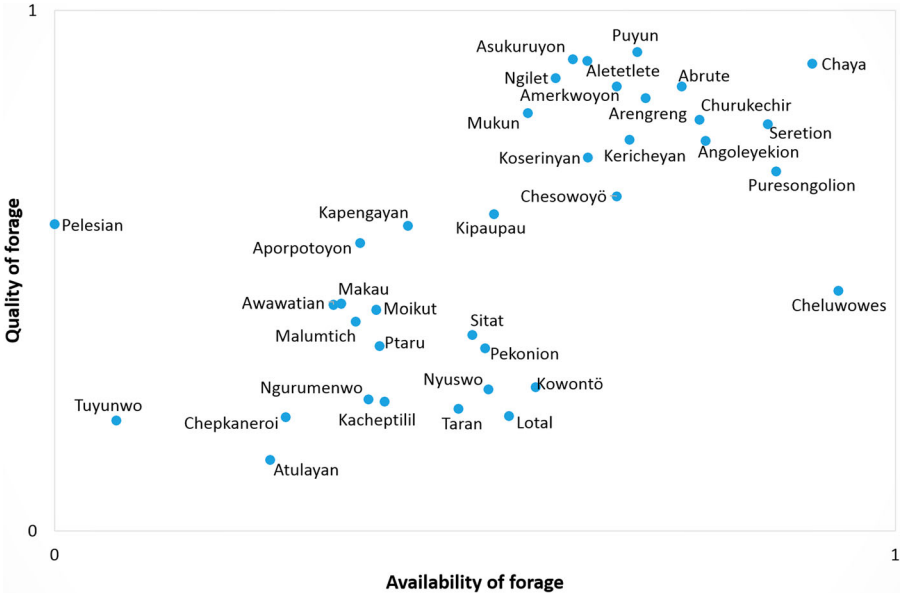

Figure 8. Forage ranking for cattle in 1975.

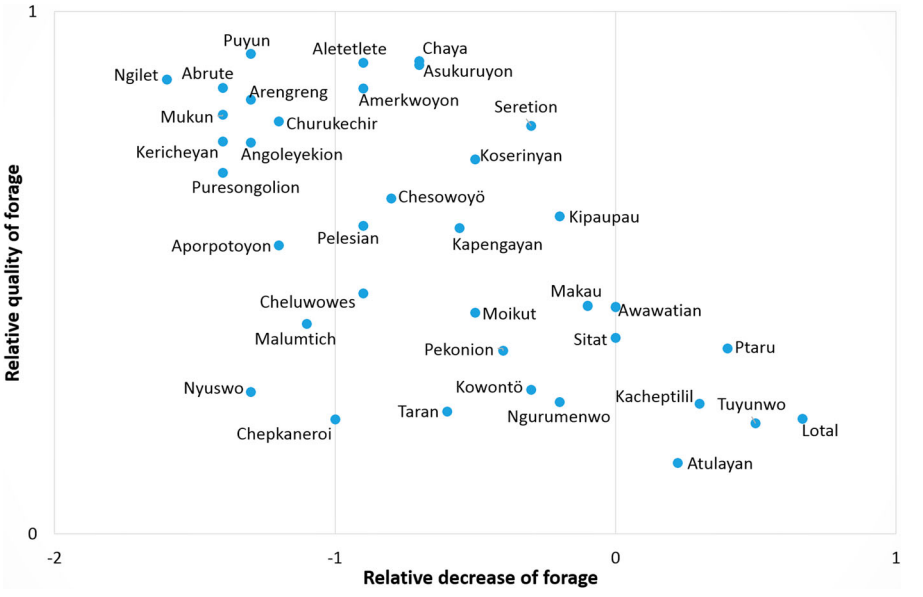

Figure 9. Relative decrease of cattle forage between 1975 and 2015.

> refuge areas at the foothills of the Sekerr and Cherangani ranges. The Masol plains were abandoned. The cultural controls were now absent – no burning off of the old, dead grass or the new *Acacia* seedlings; no cattle to graze, no goats to browse.[47] […] Thus, in the absence of Pokot, Acacia spp. doubled its distribution. Grass retreated, from 38% of the classification area in 1973 to 13% in 1978.[48]

Consequently, the grassland savannah which was by then already undergoing a gradual change, experienced very intense overstocking, on the one hand, and under-management, on the other. The scarcity of grasses, as explained by many elders, gave way to the encroachment of bushes. Bush encroachment was difficult to control, especially as management practices of burning were restricted by government legislation. These degradation processes gradually started in the early twentieth century, as Bollig and Schulte[49] indicate, and accelerated in the last quarter of the century, when Pokot were confined to the area around Paka due to the conflict with Turkana. This resulted in high-density bush coverage of *A. mellifera*, *A. nubica*, *A. reficiens*.

In a discussion about former descriptions of the environment, Bollig and Oesterle conclude that even these images of the past, described as pristine pastures with few trees, constitute a landscape that was already heavily influenced by humans and was to some extent already overgrazed.[50] Grasses, such as *E. cilianensis* (puyun) and *A. mutabilis* (*puresongolion*), are identified as indicators of this overgrazing and have supported the conclusion that the environment in East Pokot cannot be viewed as a stable. They further state:

> Environmental change is generally valued as negative both by outsiders and cultural insiders. The change from a grassland savannah to a bush savannah diminishes chances for cattle pastoralism significantly. However, both goats and camels (both browsers) profit from this expansion of bushland and indeed the increase of camel and goat herds may be encouraged by bush encroachment.[51]

The ranking results thus clearly show that changes towards an Acacia-dominated bush savannah significantly favours browsing species such as goats and camels, at the expense of cattle husbandry.

The land cover change across East Pokot also appears in another shape. *Dodonaea viscosa* (*tabalak*), for instance, has recently spread into the Highlands around Churo. Similarly, *Prosopis juliflora* is a well-known invader at Lake Baringo,[52] and also occurs at Nginyang and Chemolingot. The spread of *P. juliflora* is not perceived to have a major influence on herding, but some elders see *D. viscosa* differently:

> Like Churo now, the whole area has becoming tabalak (*Dodonaea viscosa*) only – no grasses. And people have to move from the highlands where the grasses are few. So, the area is changing.[53]

In the cases of *P. juliflora* and *D. viscosa*, the time scale is rapid in comparison to the long-term spread of acacia spp. in the plains. Intra-annual vegetation growth must be distinguished from inter-annual variations, for instance droughts, medium-term spreads (such as the cases of *D. viscosa* and *P. juliflora*), and long-term trends (for instance the acacia bush-land expansion). While the expansion of both *D. viscosa* and *P. juliflora*, took only a decade, the transformation from grassland savannah to thornbush savannah took much longer.

Internal reasoning: the renewal of Pokot pastoralism

While scientific accounts find high grazing pressure, changing land-use practices, population growth and diminishing rainfall to be the principal causes of landscape change in East Pokot, elders among the Pokot take a radically different view. Changes in land cover and environmental degradation are recounted by Pokot herders in great detail, as this typical statement indicates:

> This one, we call panyarit, like chemangayan (A. *senegal*) they were few, anyua (A. *reficiens*), they were few, and there were lots of grasses in the area, like Chepkohio here was flat. From Mondi up to almost Adomeyon. […] And the area becomes a bush. This arekayan[54] (A. *reficiens*), talamogh (A. *mellifera*), pelil (A. *nubica*) and chemanga (A. *senegal*) have grown up and taken place in the area. And the grass cannot live in here much, they cannot merge. […] So the area has completely changed. And the sun now becomes very hot, the area becomes a desert.[55]

In such accounts, the beginning of degradation is often dated to the start of the war against Turkana, and causes for recent changes are found within the community. In the following detailed account an elder from Chepungus gives explanations that link environmental and social changes. He refers to the past and the misbehaviour of a young generation at the beginning of the twentieth century. The consequences were believed to be tremendous, and the restoration of the land and its people was thought to be impossible before the next generation set was introduced.

> When I was growing up, the land was beautiful. I first lived near the river Nginyang. Those days no disease affected the stock of goats, camel and even cattle. There were droughts, but not such long droughts like nowadays.

In case adultery happened, the culprit was punished and had to kill his big bull among his stock, and the elders ate it. Then he had to take one gallon of honey and tobacco to the husband of the woman. The culprit was cleansed with milk. In those days, there was no sita-sita,[56] like it's happening now. And there were no fights with Turkana in the past.

Sapana[57] has been there since, but then only few elders attended the ceremony; only old women and men were blessing the opening of the ceremony and local brew [buzaa and kipketin] was only given to elders. It was made in small quantities. Also, there were no quarrels during the ceremony.

During the onset of fighting in Silali [with Turkana], the area changed. People were even moving to Nginyang and back again for water, but the area was full of grasses. By that time the trees started to grow, like panyarit (several acacia species) emerged.

With the emergence of bushes, livestock diseases appeared. Humans also fall sick with Typhoid, brucellosis[58] and also diseases, like dehydration or shortage of blood. Again, a disease appeared, called *yomöt*,[59] and the hands are paralysed and you die immediately. Also *kayitan* (cholera) begins.

The fights with Turkana continued and guns came to the area. When we went for raid the roads were open, but became bushes, and the places which were full of grasses became bushes. These areas were full of churukechir (*Eragrostis superba*) and cheluwowes (*Aristida adscensionis*). The land was open from Monti, Paka, Kasakaram up to Kapogh. Now it is panyarit all over. Even other areas where seretion (*Cynodon niemfuensis*) was growing, atulayan (see Appendix) came out of it. Even places like Napokoriatom and Moruase were really open places, but now it is bush. Even Paka was open and full of grasses. The area of Tilam was full of makäny (*Ficus sycomorus*) trees, but now is even impassable and full of bushes. Tilam was also full of seretion (*Cynodon niemfuensis*).

All these changes were caused by humans. People have all kinds of bad behaviour, adultery cases, rampancy, and young men moving with old women. I can see the elders cursed the people and the land.

In the past there was an outbreak of a disease called Molmoloi[60] with the reduction of the population in big numbers. What has happened before the disease was, that young men (of the Maina generation) mistrusted the elders and were beating them for no reason and forcing them to kill parts of their stock, for the young warriors to eat. This group of warriors did the same again and again up to Tiaty. They met a very old Nyonjon (a man of the Nyongi generation) and his daughter who were moving with the animals. The warriors asked him to kill his big oxen, which the old man used for the transportation of millet. The old man was beaten and the warriors slaughtered the animal and left only the head for him. The rest they ate. The next day, the warriors went to raid in Turkana land. All of them were killed with only two remaining to pass the message of failure. This was followed by several raids, and wherever the young Maina generation attempted to raid, they were killed in numbers.

Peace came again and the Nyungi generation was left with very few Maina. And Nyongi[61] add the members of the generation of Maina, which was cursed before, to the generation of Chumwö. So the remaining few Maina joined the Chumwö and were blessed for the generation to come. This is how the land was and I believe soon this will repeat. After the generation of Merkutwo or next one coming, because the signs of the past are repeating themselves.[62] You can see now, the young generation are starting to steal from the old, like cases of camel and goats being stolen and sold by young men.

> […] It was a prophecy for a long time that a disease will come, animals will be affected, and human beings also will die of diseases. You'll only see the fire of human dwellings in Mt. Tiaty. Nobody will remain in the plains. Later the land will burn until you can see clearly. Then, heavy rains start all over the land and grass will be all over the land. The few people left will start to move from the hills [Mt. Tiaty, Korossi, Loroki and Silali]. So it is said by the clan Katumewio, and this has to come.[63]

According to Riteluk, then, environmental changes are linked with social transformations. In the past, the occurrence of diseases and the failure of raids are attributed to the bad behaviour of youths. When the Maina generation behaved badly towards the Nyongi generation, for example, a fatal disease 'Molmoloi' broke out: this brought a curse upon the warrior generation, many of whom subsequently died during raids. According to the oral histories of this, only after the Maina generation was decimated and their remaining numbers absorbed by the Chumwo generation, was the age-set again blessed by the elders.

Regarding the present situation, many Pokot believe that the war with Turkana and the aberrant behaviour of their youths are signs of a curse upon the land and its people. Bush encroachment and disease are the physical signs of this curse. It is said that a great fire will finally sweep the land clean, rolling from north to south and ending at Loruk. Only then will the survivors re-establish a pastoral way of life, once the bushes have been burnt away and the grasses restored.

Persistent changes and shifting livestock husbandry strategies

Older views, blaming the behaviour of pastoral communities as the sole cause of degradation, have long ago been challenged.[64] Recently, Marchant and Lane have reiterated the complexity of the genesis of pastoralist socio-ecological systems, and the huge range and variability of potential factors that have played a role in this process.[65] Fire, for example, might have played a significant role in the case of East Pokot. Roques, O'Connor, and Watkinson have discussed the interactions between grazing, fires, browsing and rainfall variability in bringing about bush encroachment in the case of Swaziland, where they detect a strong link between grazing pressure and the occurrence of fires in the savannah, and further emphasise the prevalence of bushes in the study site:

> Frequent fires, facilitated by low grazing pressures, were capable of preventing shrub encroachment. When coupled with drought, frequent fires could reduce high shrub densities.[66]

Officially, the use of fire in public places in Kenya is restricted by the colonial Grass Fires Act of 1968.[67] While Reckers[68] and Bollig and Oesterle[69] report that fire continues to be used for bush and tick control in some areas, Boonman identifies the absence of fire, along with high grazing pressure, as major causes for land cover change:

> A more general problem is bush encroachment due to overgrazing and absence of fire. In Pokot and similar semi-arid areas, the grass cover has been reduced to the point of denudation. For a large part of the year the soil is bare and hard, partly due to treading and hoof impact […], so that rain does not infiltrate, while run-off is not checked by grass vegetation. […] Not enough grass can accumulate because of the high grazing pressure, low soil-moisture and bush encroachment; conversely, bush growth increases since there is not enough grass to provide a burn in the dry season.[70]

The influence of fire or rainfall patterns still needs further investigations, and synergy effects between overgrazing, livestock composition changes, grass coverage, water storage capacity, soil erosion, fire impacts on the vegetation cover are little understood. However, the process of bush encroachment is often perceived – both by insiders and outsiders – as a result of many factors, such as overstocking, population growth, changing rainfall patterns, and altering land-use practices in terms of cultivation or burning. As Midgley and Bond have observed, acacia bush encroachment can seem to be caused by a 'bewildering diversity of factors'.[71]

Among Pokot, burning is associated with the renewal of the landscape and the restoration of pastoralism. Pokot cosmology presents life as a cycle, with and each recurring named age-set having its own area (*kor*). The area of Korongoro age-set, for example, is quite different from that of the current Kaplelach age-set. When Merkutwo are initiated, yet another 'kor' will commence. From a scientific perspective, the rehabilitation of grasses can only be related to the reduction of grazing pressure, but it is recognised this can occur relatively speedily. As Boonman states, 'one year of effective protection following bush clearance is enough to change this type of denuded land into a reasonable grass cover', but 'if rehabilitated land is not protected against overstocking, no effort is worthwhile'.[72]

Currently, environmental conditions in East Pokot favour neither the cattle herding, nor the ways Pokot have herded their animals during the past century. New ways of herding are already emerging, with an emphasis on goats and camels, all-year round water access, and reduced mobility. As Little notes, this shift is marked by a shift away from a specialised cattle pastoralism towards flexible pastoral livelihoods that are not wholly dependent on livestock:

> With reduced lands, especially those that support perennial grasses, and restrict mobility, herders are keeping hardier, browse-dependent goats and camels, as well as innovating in other ways.[73]

Conclusion

Though Bollig and Schulte found obvious signs of degradation in their study in the 1990s, herders collectively remember the abundance of grasses at that time.[74] Korongoro elders currently (2014) blame the Kaplelach generation for causing these changes, while some decades ago, Chumwö elders blamed Korongoro. However, the bush encroachment is not merely seen as negative, its positive aspects also being emphasised. Browsing species are often favoured: bush branches can be taken for garden fences, acacia honey can be harvested,[75] firewood is greatly valued, and local handicrafts benefit from the availability of wood. While cattle are often seen as losers in these environmental changes, goats and camels are definitely favoured. Herders of these browsing animals do not recognise the landscape as bush encroached and degraded.[76]

East Pokot today is therefore a radically changed landscape from that of 1988, when Bollig was able to describe the abundance of grasses and water scarcity at Mt. Paka. Close grass cover has disappeared from the plains, to be replaced by several Acacia species. Absurdly, water is now more widely available, often provided by boreholes – a recent example drilled in Adomeyon at the foot of Mt. Paka – and huge pipelines are planned from Lake Baringo to Korossi, Paka and Silali, to provide water both for

geothermal projects and community use.[77] The change in natural plant composition is accompanied by other significant economic and social developments that will have major impacts on the livelihoods of pastoral communities in this area. The 'specialised pastoralism' associated with Pokot cattle herding probably reached its limits in the mid-twentieth century and has been in decline for over half a century.[78] New forms of pastoral livelihoods now in evidence are more flexible and are well adapted to the recent trends in landscape change. Casual labour and farming practices constitute new forms of income and now contribute to a livestock-based mode of subsistence. Land tenure is still communally managed, though privatisation is already occurring in the highlands and might play a role in the competition between herding and cultivation activities in the near future. Furthermore, the high mobility of cattle herders, due to low forage availability towards the end of the dry season, has also been accompanied over the last 50 years by elevated conflicts towards the Il Chamus area in the south, the large-scale ranges in Laikipia towards the east, Turkana County in the north, and Samburu County in the north-east. These conflicts continue to be frequent and violent. With Kenya's government now making plans for the economic development of East Pokot in connection with the Vision 2030 LAPSSET project – pipelines, a railway, and a road from South Sudan to Lamu, will all traverse East Pokot – even greater and more rapid changes lie ahead that will surely require the curtailment of the raiding and violence that has characterised the decline of cattle pastoralism. It remains to be seen how well Pokot herders will adapt to this next wave of socio-economic and environmental transition.

Notes

1. Galaty, "Land Grabbing."
2. Roques, O'Connor, and Watkinson, "Dynamics of Shrub Encroachment."
3. Fratkin and Roth, *As Pastoralists Settle*; Greiner, Alvarez, and Becker, "From Cattle to Corn"; McCabe, Leslie, and DeLuca, "Adopting Cultivation."
4. Galvin, "Transitions."
5. Catley and Aklilu, "Moving Up or Moving Out?"
6. Bollig and Oesterle, "Changing Communal Land Tenure."
7. Fratkin, "Seeking Alternative Livelihoods."
8. Little, "Reflections on the Future of Pastoralism," 244.
9. Leslie and McCabe, "Response Diversity," 114.
10. Bollig and Schulte, "Environmental Change."
11. Republic of Kenya, *Kenya Population Census 1979*, 98.
12. Republic of Kenya, *2009 Kenya Population and Housing Census.*
13. These councils have effectively managed the highland pastures in the past, and still try to do so. But the power of decision-making is eroding in an environment that cannot provide sufficient forage for cattle.
14. Bollig, *Die Krieger der gelben Gewehre*, 44.
15. Greiner, Alvarez, and Becker, "From Cattle to Corn," 1480.
16. Oesterle, "From Cattle to Goats," 83.
17. Republic of Kenya, *Annual Report 2011: East Pokot.*
18. Oesterle, "From Cattle to Goats," 83.
19. Republic of Kenya, *Census Vol II Q11: Livestock Population 2009.*
20. Oesterle, "From Cattle to Goats," 84.
21. Ibid., 84.
22. Ibid.
23. Ibid., 83.

24. Schneider, "Pakot Resistance to Change," 149.
25. Oesterle, "From Cattle to Goats," 81.
26. Bollig and Oesterle, "Changing Communal Land Tenure," 318–19.
27. Greiner, Alvarez, and Becker, "From Cattle to Corn," 1484.
28. Russell Bernard, *Research Methods in Anthropology*, 346.
29. Ingold, *Perception of the Environment*, 189.
30. Little et al., "Environmental Variations," 316–17.
31. Bollig and Schulte, "Environmental Change," 500–2.
32. Bollig, "East Pokot Camel Husbandry," 36.
33. Timberlake, "Ethnobotany," 12.
34. Bollig and Schulte, "Environmental Change," 502.
35. Ibid., 498.
36. Timberlake, "Ethnobotany," 5–6; Bollig and Schulte, "Environmental Change," 502–4.
37. Warren, "Land Degradation Is Contextual," 457.
38. Roba and Oba, "Efficacy of Intregrating Herder Knowledge," 591.
39. Bollig, "Paka Besteigung," 3.
40. Reckers, *Potential of Nginyang*, 14.
41. Bollig, *Die Krieger der gelben Gewehre*, 44–6, with reference to Reckers, *Land Potential in Nginyang.*
42. Timberlake, "Ethnobotany," 5.
43. Ibid., 6.
44. Reckers, *Nomadische Viehhalter*, 50–2.
45. Bollig, "Ethnic Conflicts," 73 ff.
46. Bollig, "Krieger und Waffenschieber," 148.
47. Conant, "Thorns Paired," 117.
48. Ibid., 119.
49. Bollig and Schulte, "Environmental Change," 503.
50. Bollig and Oesterle, "Changing Communal Land Tenure," 311.
51. Ibid., 312.
52. Mwangi and Swallow, "Prosopis Juliflora Invasion," 130 ff.; Becker et al., "Land Use Changes."
53. Amos, interviewed on 14 September 14 2014. Diminishing grass cover around Churo is one reason for leaving the highland pastures, among others. Often, the emergence of *lopus* (East Coast Fever) in the highlands is also mentioned to explain the abandonment of these places.
54. The interviewee used both terms *anyua* and *arekayan*. The former is the Pokot name, the latter the Turkana name for *A. reficiens*.
55. Amos, interviewed on 14 September 2014.
56. 'Sita' means 'six' in Kiswahili, and 'sitasita' refers to a recent punishment of giving six cows and six goats in adultery cases.
57. Sapana is the most important *rites de passage* in Pokot pastoral communities for young men.
58. Typhoid and brucellosis were named with their English terms.
59. Yomöt is a disease that has not occurred before, and has taken many lives in the middle of the twentieth century. It is called Yomöt (Pokot: "air"), because it spreads through the contact with infected people. Bianco, "Songs of Mobility," 29, describes it as a disease which paralyses the legs, and could be caused by witchcraft, after elders are abused.
60. Unidentified disease.
61. Bollig, *Die Krieger der gelben Gewehre*, 85, gives a detailed account for the sequence of generation sets in Pokot. The Nyungi generation set was circumcised around 1865, Maina around 1890, and Chumwö from 1916 to 1920.
62. The reference to 'after Merkutwo', refers to the generation set which is going to be circumcised after Merkutwo, probably in 30–40 years from now (i.e. 2045–2055).
63. Interview with Riteluk, 4 September 2014.
64. Homewood and Rodgers, "Pastoralism," 111.
65. Marchant and Lane, "Past Perspectives for the Future," 14–18.
66. Roques, O'Connor, and Watkinson, "Dynamics of Shrub Encroachment," 268.

67. Republic of Kenya, "Declaration," 90.
68. Reckers, *Land Potential Nginyang*, 8.
69. Bollig and Oesterle, "Political Ecology," 301.
70. Boonman, *East Africa's Grasses and Fodders*, 54.
71. Midgely and Bond, "Demography of African Acacias," 871.
72. Boonman, *East Africa's Grasses and Fodders*, 56.
73. Little, "Reflections on the Future of Pastoralism," 248.
74. Bollig and Schulte, "Environmental Change," 503.
75. Mwaka, "Bee-keeping and Honey Production."
76. Galvin, "Responses of Pastoralists," 370.
77. Geothermal Development Company, "GDC Plans to Irrigate."
78. Bollig and Oesterle, "Political Ecology," 309.
79. Timberlake, "Ethnobotany"; Reckers, *Potential of Nginyang*; UNESCO, *Safeguarding Intangible Cultural Heritage.*

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Appendix. Plant identification.[79]

Identification	Binomial names	Family
abrute	*B. deflexa*, *S. homonyma*	Gramineae
adomeyon	*Cordia sinensis*	Boraginaceae
akelkelayan	*C. orthocantha*	Amaranthaceae
aletelete	*Gisekia pharnaceoides*, *Trianthema triquetra*, *Portulaca oleracea*	Aizoaceae; Portulacaceae
amekunyan	*Indigofera cliffordiana*, *Indigofera Hochstetteri*, *Indigofera apicata*	Leguminosae-Papil.
amerkwoyon	*Cenchrus ciliaris*, *Pennisetum setaceum*, *Setaria pumila*, *Setaria verticillata*	Gramineae
angoleyekion	*Tetrapogon cenchriformis*, *Tetrapogon Tenellus*	Gramineae
anyua	*A. reficiens*	Leguminosae-Mimos.
aporpotoyon	*Aneimilema johnstonii*, *Aneimilema petersii*, *Commelina benghalensis*, *Commelina bracteosa*, *Commelina forskalaei*, *Commelina latifolia*, *Commelina petersii*, *Cyanotis lanata*	Commelinaceae
arengreng	*T. berteronianus*	Gramineae
areronyon	*Cadaba farinose*	Capparaceae
ashokonyon	*Salvadora persica*	Salvadoraceae
asukuruyon	*Tribulus cistoides*, *Tribulus terrestris*	Zygophyllaceae
atat	*Acacia elatior*	Leguminosae-Mimos.
atulayan	*Indigofera tinctoria*, *Phyllanthus rotundifolius*	Leguminosae-Papil.; Euphorbiaceae
awawatian	*Saccarum spontaneum*	Gramineae
chaya	*S. nervosum*	Gramineae
cheluwowes	*A. adscensionis*	Gramineae
chemangayan	*Acacia senegal*	Leguminosae-Mimos.
chepkamatian	*Hypoestes* spp.	Acanthaceae
chepkaneroi	*Cleome hanburyana*	Capparaceae
chepkratian	Not specified	–
chepuluswo	*Maerus subcordata*, *Maerus decumbens*	Capparaceae
chesotim	*Ormocarpum keniense*, *Turraea parvifolia*	Leguminosae-Papil.; Meliaceae
chesowoyö	*Cymbopogon* spp.	Gramineae
churukechir	*E. superba*	Gramineae
kacheptilil	*Justicia exigua*, *Justicia Uncinulata*	Acanthaceae
kamaran	*O. keniense*, *Ormocarpum kirkii*, *Ormocarpum trichocarpum*	Leguminosae-Papil.
kapengayan	Not specified	–
kapul	Not specified	–
katang	*Commiphora africana*, *Commiphora madagascariensis*	Burseraceae
kericheyan	Not specified	–
kipaupau	*E. macrostachys*	Gramineae
kokochwo	*Premna resinosa*	Verbenaceae
koloswo	*Terminalia brownie*	Combretaceae
koserinyan	*T. rhomboidea*	Salvadoraceae
kowontö	*C. caesius*, *C. giganteus*, *P. setaceum*	Gramineae
lopara	*Justicia odora*, *Leucas jamesii*	Acanthaceae; Labiatae
losikiria	*Seriococomopsis hildebrantii*	Amaranthaceae
lotal	*Ruellia patula*	Acanthaceae
makäny	*Ficus sycomorus*	Moraceae
makau	*Grewia villosa*	Tiliaceae
malumtich	*Bothriochloa insculpta*	Gramineae
manampelion	*Teclea pilosa*, *Vepris glomerata*	Rutaceae
mintarotwo	*C. africana*	Burseraceae
moikut	*Cyperus articulatus*, *Cyperus rotundus*, *Cyperus tuberosus*	Cyperaceae
mukun	*D. aegyptius*	Gramineae
ngilet	*Eragostris namaquensis*, *Sporobolus cordofanus*, *Sporobolus ioclados*	Gramineae
ngurumenwo	*Digera muricata*, *Talinum portulacifolium*	Amaranthaceae; Portulacaceae
nyuswo	*Loudetia flavia*	Gramineae
okopko	*Acacia nilotica*	Leguminosae-Mimos.
oroluo	*Sclerocarya birrea*	Anacardaceae
panan	*Albizia amara*	Leguminosae-Mimos.

(*Continued*)

Appendix. Continued.

Identification	Binomial names	Family
panyarit	Umbrella term for several *Acacia* species, such as *Acacia etbaica*, *A. mellifera*, *A. reficiens* and *A. senegal*	Leguminosae-Mimos.
parasunta	*Combretum molle*	Combretaceae
pekonion	*Chloris virgata*, *Heteropogon contortus*	Gramineae
pelesian	*Sporobulus festivus*	Gramineae
pelil	*A. nubica*	Leguminosae-Mimos.
pkapu	*Abutilion fruticosum*, *Abutilion hirtum*, *Abutilion mauritianum*, *Hibiscus calyphyllus*, *Hibiscus vitifolius*	Malvaceae
pkata	*Lycium europaeum*	Solanaceae
poto	*Tarenna graveolens*	Rubiaceae
prosopis	*P. juliflora*	Fabaceae
ptaru	*Acacia brevispica*	Leguminosae-Mimos.
puresongolion	*A. mutabilis*	Gramineae
puyun	*E. cilianensis*	Gramineae
renoi	*Acacia xanthophloea*	Leguminosae-Mimos.
rikoyo	*Combretum aculeatum*, *Seddera latifolia*	Combretaceae; Convolvulaceae
ririon	*Delonix elata*	Leguminosae-Caesalp.
seretion	*C. niemfuensis*	Gramineae
sangak	Small bushes of *A. tortilis*	Leguminosae-Mimos.
ses	*A. tortilis*	Leguminosae-Mimos.
solyon	*Hyparrhenia rufa*	Gramineae
sorich	*Boscia coriacea*	Capparaceae
sorokit	*Sansevieria ehrenbergii*	Agavaceae
sitat	*Grewia bicolor*	Tiliaceae
taran	*G. tenax*	Tiliaceae
tikit	*Terminalia spinosa*	Combretaceae
tirok	*Ziziphus mucronata*	Verbenaceae
talamogh	*A. mellifera*	Leguminosae-Mimos.
tuwio	*Maerua crassifolia*	Capparaceae
tuwot	*Diospyros acabra*	Ebenaceae
tuyunwo	*Balanites aegyptiaca*	Balanitaceae