DAY-TO-DAY ACCUMULATION OF INDIGENOUS ECOLOGICAL KNOWLEDGE: A CASE STUDY OF PASTORAL MAASAI CHILDREN IN SOUTHERN KENYA

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ABSTRACT This study focuses on pastoral Maasai children in Kenya with the goal of understanding the processes by which children accumulate Indigenous Ecological Knowledge (IEK) in the context of their current social and natural environment. I examine how children accumulate IEK through their participation in livestock management activities in a Maasai village on the Kuku Group Ranch in southern Kenya. In addition to attending school, Maasai children participate in different pastoral chores as part of their daily routines. Participation in these activities is gradual and involves observation, helping with tasks, and direct action, according to the individual developmental stage of the child and established Maasai gender-age roles. At about 2 years of age, children begin to participate in pastoral chores, starting with easy tasks such as livestock herd separation and gathering. Children 10 years of age and older independently take part in pastoral chores that require comprehensive IEK utilization. A high frequency of daily participation in livestock management shows children's willingness to become a qualified Maasai adult. My findings indicate that a child's participation in formal education does not necessarily result in a decrease in *in situ* pastoral IEK accumulation, as long as the child is actively participating in pastoral chore routines.

Key Words: *In situ* knowledge accumulation; Pastoral children; Indigenous Ecological Knowledge (IEK); Daily practice; Chore participation.

INDIGENOUS ECOLOGICAL KNOWLEDGE AND SOCIAL CHANGES

Indigenous Ecological Knowledge (IEK), also called Traditional Ecological Knowledge, is "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship between living beings (including humans) with one another and with their environment" (Berkes, 2008: 7). Berkes states that the term "ecology" here refers not only to the narrow sense of the relationship between humans and the natural environment, but also to the entire living environment of an indigenous people in a broader sense. Ohmura (2013: 44) further explains that the living environment, in contrast with the term "nature" in modern science, also "consists of the socio-cultural and the supernatural environment, inside which the synthesis of indigenous ways of knowing, believing, and practicing exist."

The earliest studies of IEK can be traced back to the 1950s. Studies of ethnoscience and folk science, as antecedents of IEK, have documented the indigenous identification, naming, classification, and utilization of wild plants and animals. These works include folk taxonomy, ethnobotany, and ethnozoology

(Berkes, 2008). On the other hand, studies of cognitive anthropology and interdisciplinary human ecology have explored indigenous knowledge systems from different points of view. Cognitive anthropology examines the structure and systematic nature of folk knowledge (Brush, 1993: 658). Human ecology also attempts to understand ecological processes or functional relationships, as well as people's perceptions of their own roles, within environmental systems (Berkes, 2008: 50). For instance, the life of pastoral groups in arid and semi-arid lands in Africa has been documented together with detailed descriptions of the natural environment, pastoral strategies for maintaining seasonal mobility, and the skills various groups use in managing different types of livestock. However, before the widespread use of the term IEK, most indigenous knowledge, values, and practices were thought of as traditional or undeveloped; they were expected to disappear through modernization.

A reevaluation of IEK began in the 2000s. This reevaluation was closely related to indigenous property rights movements, applying IEK to public policy and development projects. This reevaluation was also due to an increased demand for alternative resource-management techniques in cases where scientific approaches failed to achieve sustainable development goals. IEK has gradually been granted increased recognition for its contribution to the maintenance of indigenous identity and biodiversity, as well as for its potential contribution to the improvement of local natural and social sustainability. With regard to pastoral societies in Africa, pastoral IEK has been advanced as an alternative for improving local capacity and resilience in coping with climate change. The issues most commonly encountered in the turn to IEK relate to unpredictable natural hazards, such as drought (Butt et al., 2009) and changes in biocultural diversity (Oba, 2012). Pastoral IEK also provides alternative approaches for reducing human-wildlife conflicts (Sitati & Ipara, 2012) and improving local public health (Kiringe, 2005; 2006).

Meanwhile, changes in the social and natural environment, particularly within the last three decades, have exerted considerable influence on pastoral societies. Internal changes within pastoralist groups in Kenya have been documented together with broader social changes. For example, the expansion of farming, together with a national development strategy centered on tourism, has diversified the subsistence activities of the Maasai, who are increasingly involved in income-generation activities, becoming urban workers, scouts, and tour guides (Fratkin, 2001; Fratkin & Mearns, 2003).

Consequently, these changes in pastoral societies have raised concerns about the loss of IEK, especially as younger generations are increasingly participating in formal education. Kiringe (2005: 237) examined the use of wild plants as ethnomedicine in the pastoral Maasai society of southern Kenya, stating "they [the elders] felt that the youth had little respect for Maasai traditions and culture, including ethnomedicine." Although the results of his research were not able to show clearly how formal education affected the accumulation of IEK (referred to as ethnomedical knowledge and practice) in the younger generation, Kiringe was concerned that "its [formal education's] future contribution to erosion and collapse of their primary health care system [i.e., IEK] cannot be overlooked." Similar results were found in a study of Borana pastoralists in southern Ethiopia by

Gemedo-Dalle et al. (2006: 113), who noted that the "young generation in the area has not only limited knowledge but also less interest in learning."

Another example is a study by Ohmagari and Berkes (1997: 207) of Western James Bay Cree women in Subarctic Canada. The authors examined the transmission of bush skills among the Cree women, finding that children who had grown up and been socialized in residential schools acquired values and orientations that were not adaptive for bush life. They observed that formally educated Cree children "had become foreigners to Cree tradition, not only by failing to acquire skills and knowledge of the land, but also by lacking an appropriate attitude for life on the land. Thus, formal schooling led to the weakening of the existing social system." The authors also noted, "less well known is whether the children in local schools fared any better with regard to retaining Cree culture and learning traditional knowledge and skills."

IEK has been examined from different perspectives with different purposes. On the one hand its contribution to the improvement of the environmental and social sustainability of local societies has been highlighted; on the other hand, as a knowledge system, it is concerned with potential negative impacts from social and natural environment changes. I use IEK to describe indigenous ways of knowing considering both its social and natural aspects. I also note that previous studies of IEK, especially in pastoral societies, have limited understanding of children's living. Especially after formal education has become a daily routine, the process by which pastoral children accumulate IEK in their daily life (i.e., *in situ* knowledge accumulation), is still largely unknown.

Since the 2000s, research has shown increased interest in the process of indigenous knowledge formation, characterizing it experiential learning, or learning-by-doing (Berkes et al., 2000; Berkes, 2008; 2009), embedded in a constantly changing natural and social environment. In studies of pastoralists, Galaty (1989: 215) emphasizes "[the] cognitive concomitants of herding systems apparent in the quasi-formal cultural classification of domestic animals, of the arid environment, and of forms of labor, and also in the more informal reasoning implicated in pastoral experience as a dynamic process." Historically, the process of learning-by-doing has been explored in cognitive anthropology, psychology, and many other disciplines, from the perspective of understanding human cognition development and its relation to culture. A notable theory was proposed by Lave and Wenger (1991), referred to as legitimate peripheral participation; they showed that learning is a complex social process situated in specific contexts in certain natural and cultural environments. I here adopt this theory, examining IEK as an *in situ* learning process that should be investigated with consideration of constantly changing natural and social conditions. In this paper, I study the daily life of pastoral Maasai children to understand the *in situ* accumulation of IEK in their current local social and natural environments.

PASTORALISTS IN EAST AFRICA AND PASTORAL IEK

Historically, researchers have approached the study of pastoralists and their IEK in various ways. In this section, I review these historical approaches and the challenges of pastoral IEK in East Africa. Pastoral societies in East Africa inhabit arid and semi-arid land and are primarily involved in herding different types of livestock (e.g., camels, cattle, goats, and sheep). The IEK of these pastoralists has supported their way of life for centuries. The IEK of pastoralists in East Africa has been studied from different perspectives, including those of cultural anthropology, ecological anthropology, and ethnobiology. Although most of these studies do not use the term IEK, they show attempts to understand pastoral ways of life by examining the relationships between pastoralists and their natural surroundings as a whole. These studies provide the best information on what is meant by pastoral IEK and how pastoralists use IEK. I have classified the different approaches of prior studies into four groups, according to the features of IEK discussed.

The first group includes research comprehensively documenting the ecology of pastoralism (e.g., for the Maasai: Homewood & Rodgers, 1991; Homewood, 2009; for the Rendille: Sato, 1980; Bekure et al., 1991; for the Turkana: Little et al., 1999). These studies described the ecological conditions of different pastoral groups and their pastoral subsistence. They also investigated the different contexts of pastoral culture and the surrounding natural environment. Against different sociocultural and natural environmental backgrounds of pastoralism, this first group of studies identified pastoral IEK through both livestock management and relevant perceptions and use of natural resources.

The second group focused on more detailed micro-aspects of pastoral subsistence, investigating local herding strategies (e.g., Maasai: Bekure et al., 1991), human-livestock interactions, perceptions of livestock and wildlife among pastoralists, and local livestock health management (e.g., for the Turkana: Ohta, 1982; 1984; 1987; for the Maasai: Galaty, 1989; for the Samburu: Konaka, 2010). Since the beginning of the 21st century, accelerated changes in both the natural and the social environments have had a strong impact on pastoral subsistence.

The third group of pastoral studies focused on pastoral adaptation strategies and the impact of external, social, and natural environmental changes. For example, Butt et al. (2009) studied strategies of livestock management during drought, when sedentarization and wildlife conservancies limited the mobility of pastoralists. These authors found that the pastoralists managed the seasonal movement of animals vis-à-vis the availability of spatiotemporal natural resources. Butt (2010; 2011) noted that this had previously been misunderstood as simply "overgrazing," although it is now known to be a complex process. He also accused sedentarization and decreased pastoral mobility of causing the degradation of savanna biodiversity (Butt, 2010).

These studies are also related to a fourth group of pastoralism studies, which highlighted the resilience of different pastoral societies. The pastoral way of life has been reevaluated in light of its contribution to local sustainability. This reeval-

uation can be found in studies that focus on pastoral adaptation strategies in the face of global commercialization and modernization (e.g., for the Rendille: Sun, 2005; for the Samburu: Konaka, 2005).

In contrast with the aforementioned pastoral studies, the term IEK is widely used in natural resource management and ethnobotanical studies, especially in policy movements related to indigenous property rights. A worldwide trend of using IEK in local nature resource management has taken place over the last three decades. In East Africa, pastoral ways of classifying landscapes and vegetation following seasonal changes in rangeland have been studied and recently adopted into rangeland management (Mapinduzi et al., 2003; Oba, 2012). In Tanzania, Oba (2012) found that pastoralists have detailed knowledge of their rangeland with regard to the landscape, types of soil, vegetation distributions, and livestock production, such as milk yield. By combining pastoral IEK with scientific methods, rangeland degradation has been successfully assessed. According to these findings, Oba suggested the potential for using pastoral IEK more extensively in crafting rangeland policy. Other studies have also focused on pastoral utilization of IEK for supporting local subsistence, such as wild plant use in ethnomedicine (Kiringe, 2005; 2006), local ceremonies (Saitabau, 2011), and wood usage for firewood and house construction (Bussmann et al., 2006).

Using these studies, I have extracted five common features of livestock management-related pastoral IEK in different pastoral groups in East Africa: i) identification of individual animals in a herd, ii) livestock grouping, iii) reproduction control, iv) milking, and v) disease management.

Through these five practices, pastoralists are able to effectively manage livestock. The identification of individual animals in a herd is a basic skill that pastoralists use for counting and identifying their livestock. Instead of being purely counted by numbers, livestock are identified by their individual physical characteristics such as age, sex, horn shape, and coat color (Ohta, 1987). Pastoralists also give names, brands, and earmarks to their livestock. Based on individual identification, the livestock are separated into several groups for herding, according to mobility, diet (the amount and frequency of water consumption and different types of vegetation consumed), and kinship within the herd. For example, adult cattle can only go 1 or 2 days without water, whereas adult goats and sheep can go longer. Hence, cattle, calves, and other small animals are usually separated into different groups for herding. The repetition of being separated and gathered with other livestock helps an individual animal in a herd become familiar with the other members of its group, and this, in turn, reduces the risk of losing livestock (Ohta, 1987).

Reproduction control is another common but vital livestock management practice among pastoralists. Reproduction systems vary according to the different physical characteristics of each species. Pastoralists castrate some males to control the population, leaving a small number of reproducing males in each herd. Reproduction control is also exercised by herders during herding and other pastoral activities.

Epidemic diseases are a factor that can cause severe damage to a herd. Ohta's study of the Turkana people (1984) reported that they did not have therapeutic

measures for livestock disease management, but that they did have detailed disease classification systems and managed the health of animals through daily observation and care practices. Homewood (2009) stated that, in contrast to Western science, pastoralists often regard livestock disease as natural or inevitable, but also as a potentially manageable part of the environment. To manage livestock health, pastoralists diagnose ailments by first checking the external symptoms of the animals.

Becoming a qualified pastoralist who is skillful in managing livestock requires constant participation in several daily pastoral chores. The skills of identifying individuals, grouping, milking, and conducting health care of livestock are gained in mutually interactive ways. For instance, the skill of individual livestock identification is also used in grouping and managing animals and, in turn, the knowledge earned from the latter activities helps to improve livestock identification. To examine the process of pastoral IEK accumulation, I chose seven daily pastoral chores (milking, naming, herd separation and gathering, herding, identification through brands and earmarks, reproduction control, and health management) to further analyze children's participation in livestock management.

CHARACTERISTICS OF CHILDREN'S PARTICIPATION IN DAILY CHORES

In pastoral societies in Africa, children participate in different daily chores from an early age. Specifically, from age 6 or 7, boys begin to participate in herding and checking the health of livestock, whereas girls at this age participate in livestock management, mostly taking care of goats and sheep (Grandin, 1991). Girls also help their mothers take care of younger siblings, fetch water, and do housekeeping tasks. Spencer (1988: 51; 1993: 150) observed the herding activities of Maasai boys, finding that the "skill of herding boys is confined to daily experiences," and that the elders' "wider understanding [referring to the extended knowledge of migration and survival during serious droughts] grows out of the intimate knowledge of cattle, goats and sheep acquired during boyhood." From the perspective of skill acquisition, he states that daily childhood practices are vital processes through which children accumulate IEK and become qualified as Maasai adults.

Generally, and not only in pastoralists, in many indigenous societies the ability to participate in different daily chores is an informal learning process for children to train, develop abilities, and ultimately qualify as adults. Mead (1928) conducted research in Samoa, finding that through the early chore of running errands, children gradually became capable of harder tasks as they grew stronger or more skilled. Lancy (1996; 2012: 24) defines the daily participation of children in household subsistence as a "chore curriculum." According to Lancy (2012: 24), "a chore is any task that all children should master by a roughly agreed-upon age and carry out willingly and efficiently"; the term "curriculum" here "conveys the idea that there is a discernible regularity to the process whereby

children attach themselves to, learn, master and carry out their chores." Following the concept of the "chore curriculum," I focused on the daily routines of Maasai children, and analyzed their *in situ* pastoral IEK accumulation processes through their step-by-step involvement and skill development in different pastoral chores.

METHODS

I relied on a literature review and firsthand data collection for this study. The literature review focused on ethnographic studies of the Maasai, their pastoral subsistence, social system, and changes in the social and natural environment. I also reviewed relevant social and ethnographic documentation of IEK in different regions to capture the historical trends and changes in pastoral IEK studies.

In total, I conducted fieldwork over 4 months, from July to August in 2012 and from May to July in 2013, mainly through unstructured interviews and participant observation. The subjects of study were 18 children in 1 homestead. Data on their daily activities were collected through unstructured interviews and dawn-to-dusk participant observation. I interviewed children individually, and further confirmed data from the interviews through unstructured talks with the children's companions. I made participant observations of different daily activities both within and outside the village. Based on these firsthand data, I analyzed differences in chore participation among the children with regard to their gender and developmental stages.

STUDY AREA

I. Natural and Social Environment

The study area was a Maasai village on the Kuku Group Ranch, in southern Kenya (Fig. 1). Its environment is categorized as arid and semi-arid, with an annual rainfall of less than 500 mm. Vegetation is dominated by open grassland, bush land, riverine woodland, and dense forest on lava flows and hillcrests (Leeuw et al., 1991; Ntiati, 2002). Natural water resources include a seasonal river (Eata River) crossing the west side of the village and a seasonal water pool (Losaragi) on the north side of the village. These water resources are used for herding during the rainy seasons (March to May, October to December). Near the town, several manmade seasonal water pans (*incholoi*) have been constructed for securing the water supply during the dry seasons (January to February, June to September). In addition to these seasonal water resources, permanent water resources, mainly used for human consumption, included a borehole in the center of the town and a water-pipe system extending from the town to each sub-village. Unpredictable drought, a recurrent problem in the area, has been recorded here 14 times since the 1920s (Campbell et al., 2003; Rutten, 2005; Western et al., 2009; KWS, 2010). The 2009 drought had a strong impact on the local Maasai, and led to a

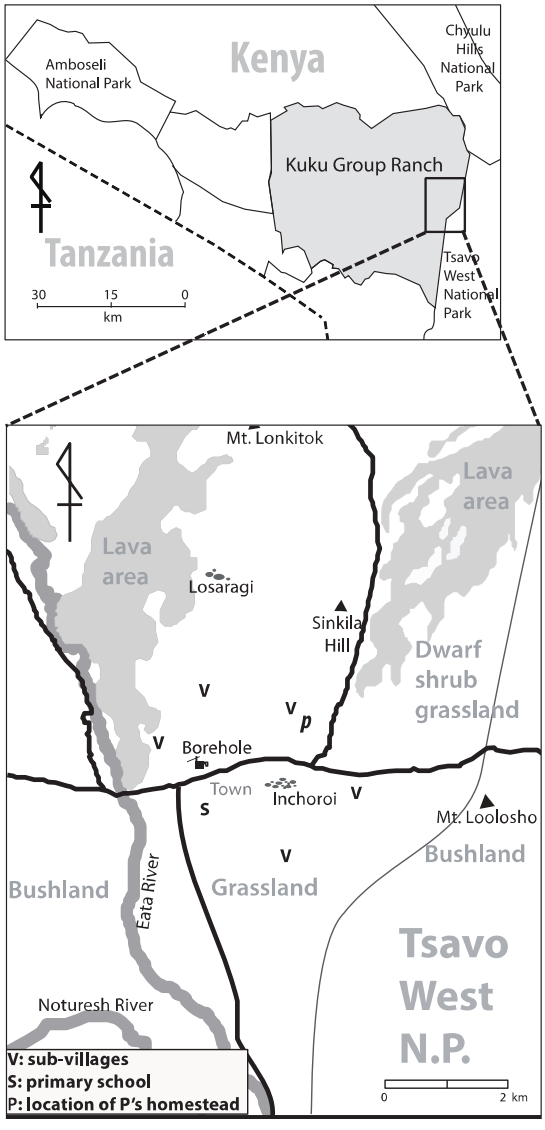


Fig. 1. Study area: Localtion and landscape
Landscape classification follows Campbell et al. (2003). The map is made based on the material provided by a local NGO, and modified with firsthand data.

loss of more than half the total livestock. However, despite these devastating losses, pastoral subsistence still plays an important role. Moreover, local people have strong willingness of rebuilding their herds (Wangai et al., 2013).

The residential areas are concentrated in the middle of a grassland plain at the south end of two lava areas, and the town is constructed in the center of five

sub-villages. The main road runs through the middle of the town, with commercial shops on both sides. The primary school is also located near the town. Most of the local Maasai informed me that they asked their children to avoid the town on their way to school, because they feared the influence of television programs being shown in the town shops, people drinking, cars, and waste. In 2013, there were 40 commercial shops in the town. Elders usually passed through the town in the morning to talk with each other, and women went there to shop.

Accelerated modernization is visible not only in the town, but also in the diverse construction of houses. Traditional Maasai houses are constructed with cow dung and wood. The houses in the town are all built in line with Western-style construction, using iron sheets and/or concrete. In each sub-village, housing construction is not limited to the traditional style but rather varies from house to house, with the use of different materials in both traditional and Western styles. However, regardless of the style of the respective houses, kraals used for livestock are fenced with thorn branches.

II. Division of Labor

In Maasai society, pastoral subsistence tasks are shared among household members, which show clearly delineated gender-age roles. Grandin (1991) described the labor distribution of the Maasai, according to the differential participation in pastoral chores by elders, *moran*s (*ilmuran*, unmarried young men), women, and children. Maasai elders (*ilpayiani*, married men) have authority in decision-making regarding natural resource use and livestock management. *Moran*s are young men who have been circumcised. They are responsible for protecting the village from dangerous wildlife and hostile groups, and they are also responsible for maintaining local manmade water resources as well as long distance cattle grazing during the dry season. *Intasati* are females, both married and unmarried, who have been circumcised. They are responsible for house construction and repair, as well as household work such as childcare, collecting firewood, and occasional small stock herding. The Maasai word for children (*inkera*, which includes girls, *intoyie* and boys, *ilayiok*) refers to all children from newborn, juveniles to those who have not yet been circumcised. When a child starts to talk and walk, he/she gradually becomes responsible for routine household chores, such as herding, firewood collection, and taking care of siblings.

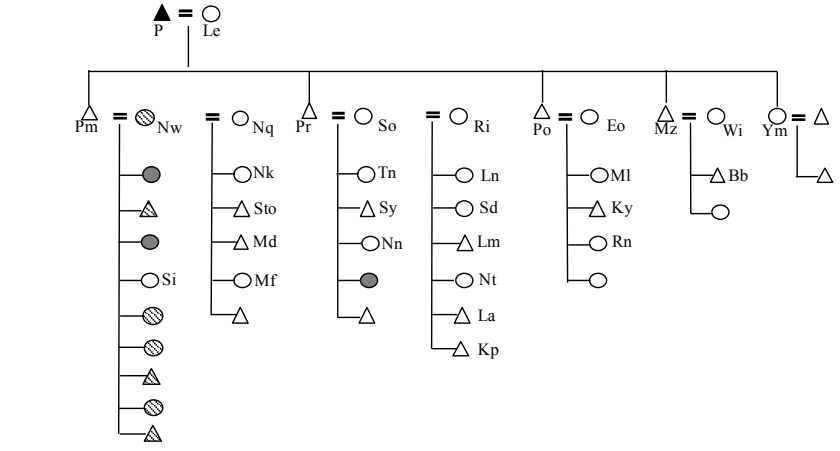
In recent years, elders and *moran*s have increasingly been participating in various income-generation activities (Homewood et al., 2009), such as acting as game scouts, tour guides, watchmen, drivers, or shop owners. Some have moved to urban areas for work; they send their income home, and only return to the village for short visits. As a result, married women are more involved in herding and other livestock management activities, to cope with the absence of children and men during the daytime. They also work on farms or in town (e.g., helping with harvesting, taking water to restaurants, and selling vegetables) for additional income.

DAILY ACTIVITIES OF MAASAI CHILDREN

Kenya has an 8-4-4 formal education system, comprising 8 years of primary, 4 years of secondary, and 4 years of university education. Children are required to attend primary school from the age of 6. In the study area, primary education was established in the 1990s, with classes being conducted under trees instead of in classrooms. Initially, local Maasai did not value school education. Elders believed that school education would make their children leave Maasai land and go to other societies. They only sent to school those children who did not herd or who were not good at taking care of livestock, with the purpose of getting the food and clothes that were distributed at the school. The official enrollment data in the district education office can be found only for dates starting with 2004, and they show that the number of students attending the primary school in the study village gradually increased from 256 (132 boys and 124 girls) in 2004 to 655 (313 boys and 342 girls) in 2013. According to two local chiefs, all the children in their village are checked at least twice a year to obtain a higher enrollment rate, since the government emphasizes education. The chiefs also said that in 2013, approximately 80% of the children in the village of primary school age were attending school. With the increase of national awareness and international donations for the formal education of children, Maasai children who graduate from local primary schools have a greater chance of going on to higher education outside the village. Consequently, many graduates move to urban areas for further education.

In primary school, children in Grade 3 and below spend approximately 6 hours in school, from 06:45 to 12:45. Children in Grade 4 and above spend another 3 hours in school, from 14:00 to 17:00. One week before I left the village, during my field survey in 2013, children in Grade 8 were required to attend school for half a day on Saturday for examination preparation. In Kenya, as a supplement to the formal education system, children from 3 to 6 years of age are required to attend preschool education. In the village, there is one preschool class, together with a baby class for children under primary school age. Children in these classes are relatively free to come and go. During free time at home, school children are asked to participate in different pastoral chores, including milking, taking care of adult goats and sheep in the hills near the homestead when they return from grazing, and dawn to dusk day-trip herding during the holidays. The children also mentioned that during the dry season, they join herding camps in the Chyulu area on the northeast side of the village, which is more than 20 km from their homes.

In this study, I focused on the daily life of 18 children (10 girls and 8 boys, approximately 2 to 15 years old), who lived in the homestead of P (Fig. 2). The children included two boys under primary school age (Kp and La, approximately 2 to 3 years old), five girls (Rn, Mf, Nt, Nn, and Ml), and six boys (Bb, Ky, Sy, Lm, Md, and Sto) of approximately 5 to 8 years old, who were in Grade 3 or below in the local primary school, and five girls (Sd, Ln, Tn, Nk, and Si) of about 10 to 15 years old, in Grade 4 and above (Table 1).



▲ : passed away
△◎ : live in Manyatta (a ritual homestead) following Nw, as her first son joins a ritual initiation after he graduated from primary school
● : not live in P's homestead during the survey
Children in the present study are indicated with pseudonyms.

Fig. 2. Composition of P's homestead

Table 1. The age and formal school enrollment of the 18 children in P's homestead (data from 2013 field survey)

Girls	Approximate age	Grade	Boys	Approximate age	Grade
Si	15	5	Sto	8	3
Nk	14	5	Md	8	3
Tn	11	4	Lm	7	2
Ln	11	4	Sy	7	2
Sd	10	4	Ky	6	1
Ml	8	3	Bb	5	baby class*
Nn	7	1	La	3	
Nt	6	1	Kp	2	
Mf	5	pre-unit*			
Rn	5	pre-unit*			

* "pre-unit" and "baby class" are further explained in the text.

GENERAL INTRODUCTION TO P'S HOMESTEAD

P's homestead[1] was located in a sub-village near Sinkila hill (Fig. 1), and comprised the households of P's four sons and his daughter Ym (Fig. 2), who sometimes returned to the homestead, although she was married. The homestead consisted of nine houses aligned in a circular array, a large corral for cattle in the center of the array, and four small corrals for smaller livestock located next to the cattle corral and near the houses belonging to the elders' wives. There were four elders in this homestead, the sons of Le. The houses in P's homestead were all constructed by the women using cow dung, wood sticks, and grass roofs. With the exception of Le, who owned two houses, each of the married women owned one house. The cattle (approximately 50 in total) were all gathered together in the central corral. Small stock herds were further separated into adult and juvenile herds. The adult herds were separated into four surrounding corrals, whereas the herds of juveniles were managed by the wives in different ways. A small hut was placed in front of each of Ri, Eo, and Wi's houses, for keeping the juvenile goats and sheep. Ri and So's small stocks were put together in a hut in front of Ri's house. Le, Nw, and Nq combined their herds of juvenile goats and sheep, managing them in one of Le's houses. In this homestead, Ym was the only woman who did not own goats and sheep.

The elders used thorn branches to fence all of the houses and corrals in a circle, with four entrances (*kishomi*) opening in different directions. The entrances were completely closed during the night to prevent attacks by carnivores. During the rainy season, all the cattle were gathered together with the neighbor's cattle herds for herding day trips. The four elders together hired two *moran*s for their cattle herding. The *moran*s would take the cattle out in the early morning, bringing them back to the homestead in the late evening. The goats and sheep were separately managed by each elder and his wives.

Elders Pr, Po, and Mz worked in tourism lodges not far from the town, returning home during the weekends and holidays. The herding of goats and sheep was left to the women during the weekdays when the children went to school, and was managed by the children during the weekends and holidays. In 2013, Pr had approximately 30 adult goats and sheep, and his wives So and Ri took turns herding. During the survey period, So and Ri took their adult goats and sheep and mixed them with Pm's for herding when both of them were unable to leave home because of other duties. Pm was the only elder who stayed at home and went for herding day trips with his goats and sheep (approximately 50 in the survey period in 2013). Eo and Wi were responsible for their own goats and sheep during herding day trips. They sometimes gathered their herds together and took turns cooking and fetching water. I also observed the women herding with an axe and rope on their backs, to collect firewood during herding day trips. During weekdays in the rainy season, adult goats and sheep were usually brought back from herding day trips earlier. Children, once they came home from school, usually took care of them in the hills near the homestead.

PARTICIPATION OF CHILDREN IN PASTORAL SUBSISTENCE ACTIVITIES AND *IN SITU* PASTORAL IEK ACCUMULATION

A typical day in the life of the children began on awakening, around 5:00 in the morning, with milking the goats and sheep, and helping with cooking and other housework. Milking was a chore in which all the children participated. The younger children usually collected and brought the juvenile goats and sheep to their mothers for suckling. After milking, the mothers and juveniles were separated and grouped into different herds for grazing. School-age children left home around 6:00, after breakfast. Children under school age started their day by taking care of the juvenile goats and sheep, as well as, occasionally, the juvenile cattle, near the homestead. Sometimes they were entrusted with the house key during the absence of their parents and older siblings.

After returning home from school, the children in Grade 3 would join their younger siblings in looking after the juvenile livestock near the homestead. At the same time, they also took care of and played with their younger siblings. When the adult goats and sheep came back from herding, the boys checked for any that may have been lost, and also checked their health by, for instance, touching their hair or searching for hidden ticks. They looked after them on the hills near their homestead until approximately 18:00, when milking would take place, sometimes without instruction from their mothers. Around the same time, the children in Grade 4 and above returned home. Participation in milking was always the first task. After milking, all of the children would spend time together inside the homestead, where the girls would help with cooking and other housework, and the boys would check for absent goats and sheep, also checking their health again (including checking on the cows if they had returned). If there were any missing livestock, they reported this to their parents and then went in search of them. The children's day ended at approximately 22:00, after dinner, playing, singing, and storytelling. The older girls and boys also washed their school uniforms by themselves before going to sleep.

During their daily routines, children participated in different pastoral chores. The following section describes the aforementioned seven pastoral chores relating to livestock management. I chose these activities because of the high rate of participation observed in the children's daily routines.

I. Milking

Conducted near or inside the homestead, milking was the subsistence activity that children participated in most frequently from an early age. It was conducted twice a day during the surveyed portion of the rainy season in 2013, in the early morning and evening. With the approach of the dry season, as the amount of milk gradually declined, livestock were sometimes milked only once a day, in the morning. The whole process included the milking itself, plus uniting the juveniles with their mothers, and sometimes repeating these two actions. Milking was conducted after uniting the juveniles with their mothers for a short time, in close cooperation with the children, who separated them. Each parous female was left

with some milk to feed her juveniles.

The act of milking a goat or sheep was usually quick, although the children's techniques, such as tapping and pressing the teat, differed. For instance, Ln (approximately 11 years old), who had very proficient milking skills, usually took about 4 minutes to milk 1 goat, which involved 195 presses and taps of 1 teat. Compared to her, the younger girls usually performed at a slower speed and took more time. They sometimes milked the same goat or sheep twice, because of distractions, such as short periods of play, catching other parous livestock, or engaging in conversation. During the surveyed part of the rainy season in 2013, one milking session took about 45 minutes. Children, especially those under 10 years old and living in the same house, usually participated in milking together, and sometimes with their mothers. During the survey, their mothers sometimes joined them at the beginning of milking in order to take enough milk for preparing milk tea. They would then leave the children to finish the milking. Both boys and girls from 5 years old took cups or gourd containers for milking. During the process, I observed no gender differences. Children in Grade 4 and above usually gave instructions to their younger siblings, such as telling them to stop juvenile goats and sheep from heading to their mothers. The daily repetition of milking was the basic chore curriculum for these Maasai children, which enabled them to become familiar with livestock identification and classification.

II. Naming of Livestock

In Africa, giving names to livestock is one of the ways by which many pastoralists identify their animals. In the study area, children participated in naming with regard to their ways of knowing the individual animals. Identification of individual animals in a herd in pastoral societies has been studied together with the classification of physical characteristics such as coat color, coat condition, horn shape, and kinship. In Maasai societies, the custom of naming parous females has been described (Jacobs, 1965; Galaty, 1989). The animals are usually named by their physical appearance, kinship among the livestock, or human relationships. During the fieldwork for this study, I found that children from 6 to 11 years old named both juvenile and adult goats and sheep, and that the naming was not limited to parous females. These names carried particular meanings, such as Kipeke (no breast feeding) or Entepelese (likes to move), and were shared among and used by the children during different pastoral chores, especially when the children gave instructions to or communicated with each other. According to the children, the names were commonly shared only among themselves. However, they used these names when adults participated in their pastoral chores as well. It is quite likely that the adults also knew these names and shared them with the children.

Children of different developmental stages participated in livestock identification in different ways. For example, 2-year-old Kp helped separate juvenile goats and sheep from their mothers at every instance of milking, following his brothers' and sisters' instructions. He was more likely to follow the instructions that

his brothers and sisters gave him when they told him the names of the animals, and pointed out their locations. In contrast, Kp's 3-year-old brother, La, caught and stopped juvenile goats and sheep heading to their mothers for suckling during milking, without any instruction. His father Pr said that "children at La's age can tell which livestock belong to his father and which do not. That is why I entrust him with taking care of the juvenile goats and sheep near the homestead when the other children go to school." It is possible that early participation in milking provides the children with the chance to learn livestock identification. As a result, 3-year-old children were already able to identify individual goats and sheep in their household.

III. Herd Separation and Gathering

Herd separation and gathering were the activities that children conducted most frequently, as part of their pastoral chores. Gathering and separation took place before and after milking, sometimes during herding, and also as part of health management. For example, before milking, taking a juvenile from its mother stimulates lactation. This process would happen very quickly, with the children separating juveniles from their mothers and beginning to milk soon after. Children usually divided themselves into two groups; one group would take the juveniles away and the other would milk the mothers. The juveniles were released to their mothers after milking, as the children would leave some milk for the juveniles.

In P's homestead, in the process of the children's work of separating and gathering the livestock for milking, both younger girls (from 5 to 7 years old; Rn, Nt, Nn, and Mf) and younger boys (from 2 to 5 years old; Kp, La, and Bb) spent more time with the juvenile animals. In comparison, children older than 6 years of age tended to stay with the mothers in order to milk them. As mentioned above, the older children also gave instructions to the younger children who managed the juveniles during separation and gathering. Through repeated separation and gathering of the livestock during different pastoral chores, as well as observing and interacting with the animals during their chores, the children became familiar with both individual animals and the herd.

IV. Herding

In P's homestead on Saturdays and Sundays, the goats and sheep were separated into two herds and managed by two teams of boys for herding day trips; 5-year-old Bb, 6-year-old Ky, and 8-year-old Sto herded Po and Mz's goats and sheep together. These three were commended by elders Pm and Pr for being very good at herding. The elders said, "the boys check the livestock carefully during herding, and control the speed of the livestock well. They always bring back livestock with full stomachs and good quality milk." Another weekend herding team for Pm and Pr's goats and sheep were the 7-year-old Sy and Lm and 8-year-old Md. However, the elders Pm and Pr did not trust the skill of these children in herding, sometimes sending them to join the neighbor's herds (those of Le's

co-wife's homestead), to follow an older herding boy. Some girls also mentioned that they had experienced day-trip herding with other children. During the field survey, however, I observed only one girl, Sd, who was 11 years old, participate in herding day trips. Girls likely participate in herding more often during the longer holidays.

In herding day trips, children used pastoral IEK relating to the day-to-day uncertainties of the natural environment, such as dangerous wildlife that may be encountered at any time. A successful herding day trip requires the ability to utilize knowledge about the natural environment and the livestock to solve any problems that may be encountered. Md's mother told me a story about Md, who got lost at the age of 6 when on a herding day trip with a 9-year-old herding boy, S, from the neighboring homestead. Md left S with the herds to search for wild fruit along the way. When he returned, he could not find S. S waited for Md until dusk and then hurried back to the homestead with the herds. He reported to the adults that Md had gone missing. The village elders decided to go to search for the boy at night. Md's mother described how desperate she was, thinking that the boy would be hunted by carnivores after sunset. Surprisingly, they found the boy right after sunrise in a place more than 70 km away. The boy fainted on the ground when he saw the adults approaching him. Md told the adults he had kept running and walking to avoid attacks of carnivores. He had made noises when he saw the eyes of hyenas glowing behind the trees at night, and he had eaten wild fruits gathered on the way. He tried to identify footprints of the wild animals and follow human footprints.

Uncertainties encountered during herding included unpredictable movements of dangerous wildlife, irregular changes in weather, and different actions of livestock in various environments. Thanks to past herding experiences, the children were able to predict potential dangers in many ways, for instance by observing the footprints of livestock, wildlife, and passing people. They also carefully checked the surrounding environment, avoided taking the herds through tick-infested grasses, and observed the traces of such wildlife as elephants and buffaloes, seen in the form of scars left behind on barks or leaves. Any omission in repeatedly attending to this pastoral chore could result in the herding boys being exposed to dangerous situations.

When I attempted to check whether the boys remember the cattle belonging to their homestead, I asked all of them to tell me the names and description of the cattle they knew. Bb took 3 hours to review the more than 60 cows he knew, including the ones that had died, been sold, or been given as gifts, as well as ones in neighboring homesteads. He gave not only the name, but also the color, ownership, and the status: parous cattle and those that were not yet pregnant. Boys older than him (i.e., Sto, Md, Sy, Lm, Ky) were able to list more cattle than Bb, including cattle from ranches of neighboring groups. I asked the *moran*s with whom the boys (i.e., Sto, Md, Sy, Lm, Ky) go herding in the dry season, during the longer vacations, about their herding skills. The *moran*s told me that they usually had more than 200 cattle, which belonged to more than four homesteads in the herding camp. There were cattle from homesteads of other Maasai

group ranches. A *moran* would separate the cattle into two groups (i.e., the calves and the cattle), and shift boys to different herds heading to different grazing lands. These schoolboys needed 2 or 3 days to get used to the new environment, but soon, they could go day-trip herding and complete the twice-daily milking of all the cattle independently. A *moran* told me that because the children have the ability to manage the cattle independently in herding camp, it is possible for him to do other tasks alone, such as checking potential grazing land, or even take a day off.

V. Livestock Identification through Brands and Earmarks

Elders and *moran*s were responsible for branding livestock. The animals were branded on different parts of their body, such as the face, neck, belly, or legs, once they were physically old enough for day-trip herding. Ear marking begins as early as the juvenile period. It was not necessary for children to use brands or earmarks to identify the livestock. However, because these brands and earmarks also differentiate between clans and owners when the livestock are mixed together, it is probably easier to determine ownership using brands and marks as evidence. In P's homestead, whenever an elder began to brand the livestock near the corral, the children always gathered together to observe the process. The elder would sometimes give instructions to the boys watching (normally the older ones) to bring the goats and sheep to brand, or to collect the materials that he needed for branding. The children also observed the entire process of castration, sometimes taking on tasks from the elder conducting the castration.

In P's homestead, boys mentioned the use of livestock brands and earmarks for locating lost animals. Sto, Md, Sy, and Lm were boys of about 7 to 8 years old. They always went goat and sheep herding together, and were responsible for checking the goats and sheep after herding day trips. During the survey period, they were twice sent to search for lost livestock in the evening. They told me that they went to the neighbor's corral and checked quietly and quickly. They were easily able to distinguish lost animals from others, based on their physical appearance and their brands and earmarks, and to bring any missing ones back home. They not only knew their own brands and earmarks, but also those of their neighbors. For instance, when they went herding and found lost animals that were not their own, they knew to whom they belonged. Using what they learned from this chore curriculum, the children were able to inform the owners, and return livestock to their own homestead.

VI. Livestock Reproduction Control

Castration is the main method for controlling livestock reproduction in Maasai communities. Usually the task of castrating male animals in a homestead is the responsibility of the elders and *moran*s in the family. During castration, other family members came to watch and hold the animal during the difficult process. In P's homestead, with the exception of girls over 11 years old, who were at school, I observed that all children younger than the fourth grade watched the

entire process of goat and sheep castration. During the process, older boys were observed to help, under instruction, capture the goats and sheep and bring them from the corral to the elder.

Children also participated in livestock reproduction control during herding. Following the instructions of the elders, boys frequently checked breeding male goats and sheep, observing the state of the plastic board tied to their bellies with a belt, which prevented them from inseminating the females during herding. Among approximately 30 head of livestock, there was one reproducing ram.

VII. Livestock Health Management

Children checked the health of livestock, especially during milking and herding. When boys went on herding day trips, they observed the physical conditions of the animals, and were expected to report their findings to their fathers, including the symptoms if any animals were sick. The information they provided helped the elders decide what care to provide. During milking, the amount and color of milk given were carefully checked as an indicator of a female's health. Girls told me, "If the amount of milk is observed to be reduced, this means the goat/sheep is sick or it did not eat enough. You should not take all of the milk from sick and weak animals." They told their parents when they observed something abnormal. When a boy, Sy, was checking the nostril of a sheep, I asked him what he was checking and why. He said, "Ticks like to inhabit the inside of the nostril of an animal. They suck its blood and make it weak." The children also frequently checked the ears, hair, and skin of the animals when they were with them. When an animal became sick, borrowing medicine was very common. Borrowing here refers to the behavior of sharing, where the return of the borrowed item was not strictly expected. This sharing behavior is commonly found in many pastoral societies in Africa (e.g., for the Turkana: Ohta, 1986; for the Rendille: Sun, 2012), including the Maasai. When elders had confirmed symptoms in the livestock, they usually asked the children (usually older children) to go to a neighbor's house. For P's homestead, for instance, most of the neighbors were brothers of the elder. Children were required to tell the father's brothers of the symptoms of the observed or perceived sickness and stipulate preferred medicines. During treatment, they communicated information on treatment times, the amount of medicine used, and the condition of the animals, to both their own parents and those who lent medicines.

PATTERNS OF CHILDREN'S PARTICIPATION IN THE PASTORAL CHORE CURRICULUM

I. Variation in and Frequencies of Children's Day-to-Day Chore Curricula

The type and frequency of the different chores that the 18 children in P's homestead participated in were collected through observation and informal inter-

Table 2. Frequency of children's participation in subsistence-related chores during the 28-day period

Chores	Frequency (times/week/person)*	
	Girls (10 girls in total)	**Boys (8 boys in total)**
Herding	0.1 (0%)	5.3 (33%)
Milking	6.5 (28%)	3.8 (24%)
Taking care of livestock	0.5 (2%)	5.4 (34%)
Firewood collection	0.7 (3%)	-
Fetching water	1.1 (5%)	-
House construction	0.2 (1%)	-
Sub total (IEK-related chores)	**9.1 (39%)**	**14.5 (91%)**
Helping cooking	3.2 (14%)	0.1 (1%)
Baby sitting	4.4 (19%)	0.7 (4%)
Washing clothes	2.0 (8%)	0.3 (2%)
Washing dishes	1.3 (6%)	0.1 (1%)
Cleaning house	3.2 (14%)	0.2 (1%)
Sub total (domestic duties)	**14.1 (61%)**	**1.4 (8%)**
Total	**23.2 (100%)**	**15.9 (100%)**

* Frequency = times/week/child, research carried out during rainy season in 2013.

views over 28 days (Table 2). I counted a child as participating in a certain pastoral chore only when he/she had gone through the whole process of that chore during participant observation. I also confirmed the activities that the children conducted in the daytime through informal interviews at night: when each of them came to my house, they told me what they had done, with whom they had gone, and how the work had been completed, i.e., with instruction or without. I crosschecked the information from informal interviews by conducting other interviews with children who were mentioned as chore partners. Participations that were observed or mentioned as being halted in the middle or disrupted were not counted. Thus, the actual frequencies of children's participation in different pastoral chores would have been higher than those given in Table 2. These chores were analyzed on a weekly basis. Pastoral IEK accumulation is strongly related to livestock management and the direct interactions between pastoralists and their natural environment. Therefore, I categorized the daily chores of children related to livestock management and direct use of natural resources as IEK-related chores.

Children participated in different daily chores showing the gender-age division of labor. In P's homestead, based on 28-day observations, boys participated in livestock-related daily chores (i.e., herding more than 5 times per week, milking more than 3 times per week, and taking care of animals more than 5 times per week). Taking care of animals involved a daily health-condition checkup through observation, touching, and salt distribution to goats and sheep. Compared to the boys, girls participated more in milking (more than 6 times per week), firewood collection (about once per week), and domestic chores (more than 60% of the total activities), such as helping with cooking, taking care of babies, washing clothes and dishes, and cleaning the house.[(2)]

II. Developmental Stage and Participation in Pastoral Chores

Depending on their developmental stage, children participated in pastoral chores in numerous ways, which I classified into indirect and direct participation. Indirect participation refers to observation of chores conducted by others or participation in a chore following others' instructions (i.e., when children do not yet have the ability to make their own decisions when carrying out a chore). Direct participation is defined as a child managing activities by him/herself, from making decisions to taking actions. This process can also be performed in tandem with other children. For all the pastoral chores listed in Table 2, I further analyzed children's participation patterns according to their ages. Children of different ages participate in pastoral chores either through indirect participation or direct participation. Their participation patterns also reflect local gender-age roles (Tables 3 & 4).

I observed that a 2-year-old boy (Kp) already participated in juvenile and adult herd separation and reunion before and after milking. Following instructions from his older peers, he helped release the juveniles from the hut and lead them back. Once all the juveniles were confirmed to be outside or inside the hut, he was responsible for closing the entrance. A 3-year-old boy (La) participated in more pastoral activities with older boys. Day-trip herding of adult goats and sheep was conducted by boys older than 5 years old, such as the case of Bb accompanying other boys.

Girls began milking at age 5. I also found significant differences between two 5-year-old girls, Rn and Mf, in their participation in pastoral chores. Rn spent most of her time with her baby sister, who was just beginning to walk, instead of participating in chores related to livestock management. However, she also observed branding and castration while carrying her youngest sister on her back. In comparison, Mf participated in milking more and spent more time taking care of livestock.

Apart from herding, the participation pattern in pastoral chores was very similar between boys 6 to 8 years old and girls 6 to 10 years old. In the gender-age division of pastoral activities among the Maasai, branding, ear marking, castration, and treatment of illnesses are chores to be performed by a *moran* or an elder. Thus, children only participated in these activities indirectly. Children older than 6 years old were able to accomplish the chores of milking and day-trip herding of goats and sheep with peer cooperation. Girls participated in pastoral chores at an older age than boys.

As the children developed, they also expanded their mobility through participation in pastoral chores. In P's homestead, except for the youngest three boys (Kp, La, and Bb) and four girls (Rn, Mf, Nt, and Nn), who said that they did not have any experience leaving the homestead, the rest of the 11 children above 7 years old mentioned that they had visited places more than 15 km away from their homestead while performing different pastoral chores. Boys (N = 5) participated mostly in herding, whereas girls (N = 6) participated in multiple chores such as firewood collection, herding, and grass collection. The purpose of grass

Table 3. Boys' participation in pastoral chores according to their development stages (N = 8)

Livestock management	Daily chore	Participation in each chore (with approximate age indicated in parentheses)							
		Kp (2)	La (3)	Bb (5)	Ky (6)	Sy (7)	Lm (7)	Md (8)	Sto (8)
Taking care of livestock	Naming goats and sheep	-	△	△	○	○	○	○	○
	Branding and earmarking	-	△	△	△	△	△	△	△
	Herds separation/gathering	△	○	○	○	○	○	○	○
	Castration	△	△	△	△	△	△	△	△
	Checking health condition	-	△	△	○	○	○	○	○
Milking	Milking	△	△	○	○	○	○	○	○
Herding	Goats and sheep (infant)	△	○	○	△	△	△	△	△
	Goats and sheep (adult)	-	-	△	○	○	○	○	○

Table 4. Girls' participation in pastoral chores according to their developmental stages (N = 10)

Livestock management	Daily chore	Participation in each chore (with approximate age indicated in parentheses)									
		Rn (5)	Mf (5)	Nt (6)	Nn (7)	Ml (8)	Sd (10)	Ln (11)	Tn (11)	Nk (14)	Si (15)
Taking care of livestock	Naming goats and sheep	-	△	○	○	○	○	○	○	-	-
	Branding and earmarking	△	△	△	△	△	△	△	△	-	-
	Herds separation/gathering	-	○	○	○	○	○	○	○	○	○
	Castration	△	△	△	△	△	△	-	-	-	-
	Checking health condition	-	-	○	○	○	○	○	○	○	○
Milking	Milking	○	○	○	○	○	○	○	○	○	○
Herding	Goats and sheep (infant)	-	-	-	-	-	-	-	-	-	-
	Goats and sheep (adult)	-	-	-	-	-	○	-	-	-	-

○: direct participation, △: indirect participation, - : participation has not been observed.

Table 5. Children's companions in visiting places more than 5 km away from their homestead (N = 11, 6 girls and 5 boys)

Girls' companions	Number of instances (ratio)	Boys' companions	Number of instances (ratio)
Sisters & brothers*	14 (30%)	Brothers	43 (61%)
Friends	12 (26%)	Big boys	13 (20%)
Sisters	6 (13%)	Brothers & big boys	1 (1%)
Big boys** & sisters	2 (4%)	Sisters, brothers & big boys	1 (1%)
Brothers	1 (2%)		
School mates	1 (2%)		
Sub total (with children only)	**36 (77%)**		**58 (83%)**
Mothers	5 (11%)	Fathers & brothers	10 (14%)
Fathers, sisters & visitors***	3 (6%)	Fathers	2 (3%)
Mothers & sisters	2 (4%)		
Fathers	1 (2%)		
Sub total (with adults)	**11 (23%)**		**12 (17%)**
Total	**47 (100%)**		**70 (100%)**

*Sisters & brothers: refer to the children in P's homestead.
**Big boys: refer to the older boys in neighborhood.
***Visitors: refer to friends of an adult man in P's homestead.
Data was collected through informal interviews with 11 children, about their companions in different places that they have been visited, with regard to different activities that they have conducted outside their homestead. The number of instances is counted following children's answers.

collection varied seasonally and, in particular, grass was collected for small or sick livestock in the dry season, when they were unable to travel to the herding camp. During the rainy season, grass was collected for the maintenance of house roofs, to prevent rainwater from leaking inside. Destinations for these activities included lava areas and bush lands.

The children also mentioned that they ventured far from their homestead, usually accompanied by other children, or children and adults together (Table 5). Peers, such as brothers, sisters, and friends, were mentioned most frequently by both girls and boys (more than 75% of total responses). On certain occasions, children were also accompanied by their parents or other adults.

SCHOOL AND PASTORAL SUBSISTENCE PARTICIPATION

Notwithstanding their attendance at primary school, the daily chores of the Maasai children reveal their participation in pastoral activities. Grandin (1991) conducted research on the labor inputs of the Maasai in livestock management. He found that Maasai children began to be involved in management around their homestead at around 3 or 4 years old, and that at age 6 or 7, boys became herders of small animals. Similarly, I found that even though they attend formal primary education, present-day Maasai boys also start to participate in pastoral chores at an early age (2 years old, when they started to walk), and they also

go herding small stock in day trips at age 6 or 7. Through involvement in the daily pastoral chores curriculum, the school children also learned and mastered livestock management skills gradually and according to their developmental stage.

Although I rarely observed adults intervening in children's pastoral chores during my field survey, it was mentioned by both school children and herding boys that parents, especially fathers, played an important role in their acquisition of skills. I discussed with parents how children's attendance in formal education influenced their participation in pastoral chores. Most of them positively evaluated formal education. Some parents made the following comments: "It can make the children competitive" and "We hope the children will become doctors or teachers serving our own community." Moreover, they believed that "educated children can bring cash to the family and increase livestock" and "live a better life as educated people." The increasing awareness of the importance of formal education can also be found in Grandin's study (1991), which describes how Maasai adults believed "children need the ability to cope with the wider environment" and "formal education gives hope of employment."

On the other hand, when conversation shifted to children's participation in pastoral chores, many parents hesitated to further discuss children's daily pastoral activities, and their comments were sometimes puzzling. This was possibly because they were aware that outsiders judged children's hard work in school positively but viewed their hard work in subsistence activities negatively, as a "waste of time" or even as "child labor." For instance, when discussing their children's future plan as *moran*s, many parents told me, "I do not want my son to be a *moran*; it is a waste of time." However, they also said, "Livestock is important for the Maasai and I (parent) try to teach my children the [knowledge of] livestock when they are at home." One elder said, "children choose to do other work; this is good. They want to keep livestock; this is also good. Because they have knowledge [of both science and IEK], they have a choice." With regard to the differing opinions among adults, children's participation in both school and pastoral chores was valued. These daily practices were believed to help children learn more and improve their ability to create a better pastoral way of life.

The children have their own opinions of what is good and what is bad, both as Maasai and as students. When I asked Sy and Md about their future dreams, Sy said that he wanted to be a doctor, who could afford to buy 8 thousand cows for his family and hire a good *moran* to look after them. Md said that he wanted to be a *moran* who could sing and dance well. When I suggested to Sy that, perhaps, he could hire Md to look after his cows, Sy shook his head vigorously and said, "I will never let Md look after my cows as he always loses the livestock." Md appeared angry with his words, saying, "I would never lose even one cow. I would definitely take them all back with full stomachs!" The conversation soon became a small fight between the two boys. When Sy shouted, "You *moran*! I know you will be the one who only knows *miraa*,"[3] Md replied, "You doctor! I know you will be the one to waste all your fortune on cocaine!" It may be difficult for a child to explain how deeply he/she wants to be competent in his/her own society. However, as the conversation above shows, children value *moran*s who can take good care of livestock, and they also value those who become doc-

tors, because they have the ability to increase the livestock for the family. At the same time, they have their own opinions of bad behaviors in Maasai society and the extended world.

CONCLUSIONS AND FUTURE PERSPECTIVES

In this paper, I have presented and discussed how children in a pastoral Maasai community accumulate IEK through daily participation in different pastoral chores, within their current social and natural environmental contexts. Adopting Lancy's (2012: 42) "chore curriculum" concept, I examined pastoral IEK through children's participation in seven pastoral chores in their daily routines. Apart from attending school, children participated in these pastoral chores frequently. Lancy stated that "[t]he chore curriculum is remarkably successful in moving children from a state of dependency to one where they are both self-sufficient and contributors to the domestic economy." Through participation in pastoral chores in various ways and at different levels, in line with their developmental stages, the Maasai children gradually accumulate pastoral IEK in their daily routine.

As my results do not match those of previous work as Kiringe (2005) and Gemedo-Dalle et al. (2006), it is worth noting the differences in the age groups of the target informants and the methods of these studies. In Kiringe's study, the attitude of youth towards IEK, and Maasai culture in general, was viewed through the comments of elders rather than those of youth or children. It is possible that children have their own attitudes towards Maasai IEK. Moreover, as Galaty (1989: 229) points out, "[knowledges] are not evenly or randomly distributed throughout pastoral communities, although there are always those known for their cognitive skills or lack of them." He further indicates, "[the competence of pastoral cognition] depends not just on passive participation but also on the sort of motivation and high valuation of pastoralism."

Similar to these arguments, Lancy (2012: 40) mentions there are "[t]wo central principles of the chore curriculum," namely, "the motivation of the child[ren], which propels them up the learning gradient, and the nature of the task environment, which reduces the severity of that gradient by offering 'steps' or stages." Although the motivations of children were not the main focus of this study, the high frequency of children's participation in different pastoral chores and the gender-age division of roles they followed clearly demonstrated the children's willingness to become qualified adults in Maasai society. Moreover, not limited to daily pastoral chore participation, day-to-day conversations among the children also showed their willingness to become competent in the terms of current Maasai society. For the nature of the task environment illustrated by Lancy (2012), Maasai children take steps to master pastoral chores from an early age, by undertaking simple tasks in such activities as milking or herd grouping. They gradually develop their skills by conducting different tasks. By age 8, boys are qualified to herd at greater distances. By age 10, girls are able to go to far-away

places for firewood collection.

Taken together, the results of this study suggest that participation in formal education does not necessarily undermine Maasai children's IEK accumulation, as long as they actively participate in pastoral chores as part of their daily routine. On the other hand, potential changes in the social and natural environment that decrease participation in pastoral chores may consequently influence IEK accumulation, and this should be further examined in future studies.

NOTES

(1) P's homestead was chosen as the sample for this case study because it shows two important representative features of households in the study area. One is its diversification of subsistence activities, including both cash income generation and livestock husbandry. Another is that all the school-age children are attending school (including both girls and boys), and at the same time, they are involved in daily pastoral chores.

(2) Because the data were focused on boys under 8 years old, the participation of boys in herding, including afternoon herding near the homestead, was as high as five or more times per week. The frequency of herding was predicted to be lower among the boys above Grade 4 (older than 8), who spent more time at school.

(3) *Miraa* (*Catha edulis*, or khat) is an addictive drug, taken by chewing. It is consumed mostly by *moran*s in the study area. However, taking *miraa* has gradually come to be considered bad behavior by local Maasai, under the influence of the church and modern sanitary education.

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