



THE ROLE OF INDIGENOUS KNOWLEDGE IN THE RANGE EXTENSION STRATEGIES: CASE STUDY FROM KHARTOUM STATE, SUDAN

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ABSTRACT

The aim of this paper was to assess local peoples' indigenous knowledge systems in three villages on the range lands of East Nile locality, Bahri District of Khartoum State; Sudan; between latitudes (15.8° – 16.45°) North and longitudes (31.36° – 34.25°) East. The data were collected following the case study method within which many other methods and techniques have been used namely: literature study, unstructured interviews, indepth semi-structured interviews with key informants, participant observation and meetings. Thirty respondents were randomly selected for the interview. Data were processed and analyzed using SPSS soft ware version 13. The types of indigenous knowledge respondents have based on the interview with them were summarized. The authors look at the implications of the findings for range extension. The study presents ideas on how extension services could be organized to better make use of herders' indigenous knowledge and capabilities.

KEYWORDS: Indigenous; knowledge; indigenous knowledge; range extension, rangeland; dry lands.

1. INTRODUCTION

The word extension was first used in England about 100 years ago to describe the method developed for the purpose for spreading the formal university knowledge to the great mass of people without university education. This transfer of knowledge system consisted of four major aspects: the knowledge to be transferred, the receivers of this knowledge, the central organization compiling this information and the extension agent to extend it. It assumed a one way flow of information from those of formal education (and therefore with knowledge) to those without (Rolling, 1988). About 1914 the term agricultural extension was used in the USA and referred to the non formal education of the farming community. This education was enforced by a law the purpose of which was to aid the spread of what was considered to be useful and practical information to farmers and their families on subjects relating to agriculture and home economics. Today, in the rural development context the term extension often refers to the work of a "change agent" who is to raise awareness and organize and support information exchange and technology adoption among farmers or other land users (FAO, 1987).

Indigenous or local knowledge can be defined as skills, practices and technologies that are an integral part of the production system in a specific culture. They are area-

specific skills and practices concerning natural resource management, human and animal health, etc. developed by indigenous people over centuries. Therefore, it is important to take advantage of indigenous institutions, environmental knowledge and traditional management practices (Desta, 2009a).

Local people indigenous knowledge is very important issue that needs to be understood, respected and used in efforts to solve existing environmental problems resulting from, excessive browsing overgrazing and farming (Cerenea, 1985; Kobbail and Elmadina, 2013). It is also essential for designing new activities that depends on local people participation and rational behind traditional range and tree management (FAO, 1989; Kobbail, 2005; Glover, 2005). Through the presence of man and his interaction with animals and vegetation cover he has many experiences and knowledge such as knowledge of different plant fodder species, part uses, palatability, toxicity and knowledge on different range activities.

It is worth mentioning that many of these indigenous knowledge are expressed and circulated through popular proverbs, but it is important to realize the fact that local knowledge may not be spread equally in society, for example what women know of knowledge men may not know. Even children, they may have knowledge that

adults do not know, and some individuals may be specialists in some types of knowledge in the society than other people always have.

Despite the general agreement that there is a wealth of local knowledge represented by proverbs and wisdom related to vegetation in Sudan, there are no studies to limit this knowledge and to determine its role in activating extension programs. The research was carried out to provide answers to some important questions about herders' indigenous knowledge of different range activities in the study area. Is there any environmental knowledge embedded as it is in local, social, cultural, moral economic and ecological factors something that needs to be understood, respected and used in efforts to solve existing environmental problems resulting from intensive browsing, overgrazing and other range practices? Are their experiences based as they are on many generations of observations and practices to secure livelihood of value? Hence the study aims to summarize the type of indigenous knowledge herders' have in the study area and to presents some ideas on how extension services could be organized to better make use of herders' knowledge and capabilities.

2. RESEARCH METHODOLOGY

The study was undertaken in East Nile Locality, Bahri district of Khartoum State between latitudes (15.8° – 16.45°) North and longitudes (31.36° – 34.25°) East. The climate of the area is semi-arid; with an average rain fall of 1000-300mm. the main physiognomic vegetation type is woodland savannah which generally reflects the semi-arid climate. The vegetation is dominated by many grasses and several Acacia species of which important multi purposes species. The area is inhabited both by settled and nomadic population, their economy is dominated by traditional rainfed agriculture and animals herding. The area is surrounded by many seasonal valleys (locally called wadies) which attract herders like wadi soba, wadi hawad, wadi alhusini, wadi aboueswaid and wadi elhag. The area was selected because of its extensive rangelands.

Data collection and analysis

The data were collected following the case study method within which many other methods and techniques have been used namely: literature study, unstructured interviews, indepth semi-structured interviews with key informants, participant observation and meetings. Three villages were selected randomly to represent the area. Thirty respondents were interviewed and they were randomly selected to constitute the research population. Data were processed and analyzed using statistical package of social science (SPSS) soft ware version 13

3. RESULTS AND DISCUSSION

3.1 Population characteristics

Thirty respondents (86%) men and (14%) women were interviewed. The study revealed that a relatively low

level of education among respondents in the study area where that 50% of the respondents were illiterate, where as 40% completed basic education level and only 10 % had completed secondary school. It is clear that the situation is a bit strange considering the fact that these people are actually living in the capital of the country. The ages of respondents ranged from 30 to 50 years, with a median age of about 35 years, primarily rural workers (70% herders and farmers, 30% other jobs). They were not government employees and never practiced any form of leadership.

3.2 Respondents' indigenous knowledge system about rangeland and different range activities

The indigenous knowledge systems (IKS) among the herders in the study area are unique and dynamic in nature changing through creativity and innovativeness. This knowledge is usually preserved by adults and passed down to younger generations by word of mouth, practice and informal educational system originating from the elaborate social interaction systems among the members of the community.

3.2.1 Knowledge about different plant species grazed by animals

Local people in the study area (100%) know different grass species and trees that covered the rangelands in the study area (table 1). Herders know which local species are appropriate and important for animal feeding and which one is benefiting animals through its effect on quantity and quality of milk. They know the toxic species and the palatable and unpalatable ones. They also know which part to be eaten by the animals and the time at which the species grazed by animals. They are also knowledgeable about tree species that are browsed (see table 2) and how they affect livestock milk production and health. For example a lactating cow feeding on *Ocimum americanum (rihan)* bush trees produces milk containing an aromatic smell and herders can easily detect whether milk yield is increasing or decreasing. Herders also realized cattle do not eat tree forage unless they do not have enough grass. Most tree forage has a bitter taste and others like the Acacias are thorny and difficult to eat. This is knowledge that has been transmitted from one generation to the next and in the process new ideas and skills have been added no ranger had taught them which plant is edible to animals and which part of it is toxic and they know how it affect animal health they have done it on their own initiative since before colonial time.

Table 1: List of identified plant species which are grazed by livestock.

Species name	Eaten by		Parts eaten		When eaten			Condition			
	Cattle	Goats/sheep	Leaves	Pods/fruits	Whole year	Season		Leaves		Pods	
						wet	dry	wet	dry	wet	dry
<i>Aristida mutabilis</i> (Damblab)	■	■	■	■	■	-	-	■	-	■	-
<i>Impoea spp</i> (Hantoub)	■	■	■	■	■	-	-	■	-	■	-
<i>Tribulus terrestrisn</i> (Draisa)	-	■	■	■	■	-	-	■	-	■	-
<i>Cenchrus spp</i> (Haskneet)	■	■	■	■	■	-	-	■	-	■	-
<i>Carallum vittata</i> (Shrab)	■	■	■	■	■	-	-	■	-	■	-
<i>Glinus lotoides</i> (Turba)	■	■	■	■	■	-	-	■	-	■	-
<i>Chorchorus spp</i> (Khudra)	-	■	■	■	■	-	-	■	■	■	-
<i>Forsetia longisiliqua</i> (Matfair)	-	■	■	■	■	-	-	■	■	■	-
<i>Cullen plicata</i> (Rebel)	-	■	■	■	■	-	-	■	■	■	-
<i>Fogonia indica</i> (Umshwaik)	-	■	■	■	■	-	-	■	■	■	-
<i>Portulaca oleracea</i> (Regla)	-	■	■	■	■	-	-	■	■	■	-
<i>Amaranthus spp</i> (Lisantair)	-	■	■	■	■	-	-	■	■	■	-
<i>Ocimum americanum</i> (Rihan)	-	■	■	■	■	-	-	■	-	■	-
<i>Chloris preieurii</i> (Ummamlh)	■	■	■	■	-	-	■	■	-	■	-
<i>Chorchorus depressus</i> (Setaih)	■	■ goats	■	■	-	-	■	■	-	■	-
<i>Euphorbia spp</i> (Umlabeeb)	-	■	■	■	-	-	■	■	-	■	-
<i>Convolvulus spp</i> (olaif)	-	■	■	■	-	-	■	■	-	■	-
<i>Aristida adscensionis</i> (Hamra)	■	-	■	■	-	-	■	■	-	■	-

Table 2: List of some identified tree species which are browsed by livestock.

Tree name	Eaten by		Parts eaten		When eaten			Condition			
	Cattle	Goats/sheep	Leaves	Pods/fruits	Whole year	Season		Leaves		Pods	
						wet	dry	wet	dry	wet	dry
<i>Combetum abovatum</i>	■	■	■	-	-	-	■	■	-	-	-
<i>Acacia tortilis</i>	■	■	■	■	-	■	-	■	-	■	■
<i>Acacia nilotica</i>	■	■	■	■	■	-	-	■	-	■	■
<i>Acacia drepanolobium</i>	-	■	■	■	-	■	-	■	-	-	■
<i>Acacia mellifera</i>	■	■	■	■goats	-	■	-	■	-	-	-
<i>Capparis tomentosa</i>	■	-	■	-	-	-	■	■	-	-	-
<i>Senna siamea</i>	■	■	■	■	■	-	-	-	■	-	■

3.2.2 Knowledge about rangeland condition

The study found that the rangeland condition in its current situation is poor. This result is confirmed by 100% of the respondents. More than 70% attributed this to the lack of rain or the increase in the number of animals that led to intensive pressure on the range land, which led to its poverty, stripping of the soil and encroachment of sand. This confirms that the herders have local knowledge of the pasture state and the ecological balance.

Almost all interviewees (100%) stated that they look for good pastoral resources outside the area, which is characterized by heavy rains, abundant pastures and water sources, in addition to the ease of movement of animals and the lack of diseases.

The adults play a central role in the assessment of range suitability for grazing. The male and female respondents evaluated the range suitability on the basis of ecological factors, such as forage, water availability, disease incidences, parasite infestation and presence of predators (Table 3). The range suitability attributes are usually set and ranked by the order of their importance by all key players in livestock keeping at village level. These are the husband, wife and the cattle herders known.

Table 3: Herders' criteria of range assessment.

Attribute	Rank
Animal performance	1
Forage availability	2
Water availability	3
Disease incidences	4
Security	5

Both male and female respondents agreed that rainfall is the most important factor affecting livestock production. To them rainfall and drought are the most critical climatic features that have a significant impact on the productivity of their animals. Due to this fact they carefully monitor rainfall behavior using indigenous techniques to forecast bad and good rainfall years, onset of rains, end of rains etc. The herders' movement to other sources is according to the season. However, knowledge of the onset and end of rains makes the elders plan the use of rangelands in order to ensure good performance of their animals. This careful use of rangelands not only ensures survival of their animals, but also ensures the food security for the family members who depend mainly on animal products. Both the male and female respondents indicated that lack of water, invasion of grassland with undesirable woody species and forage shortage reduces animal productivity and increase animal diseases. To them deaths of animals are always attributed to low and unreliable rainfall and prolonged drought. Cattle herders relate rainfall intensity and the type of soils with forage availability. With black soils when the rainfall intensity is high the range becomes unsuitable due to less forage. Red soils are

good with high rain intensity due to its good permeability, which favours fodder production.

Desta (2009b) stated that rangeland should periodically be monitor by assessing the condition of natural resources, mainly vegetation, water, and soil. During the monitoring process positive and/or negative change in the pasture composition and consequently general land condition can be assessed. This information can assist in making proper land management decisions to ensure sustainable land use. Rangeland can be monitored both in traditional and modern ways. The traditional method of rangeland monitoring and evaluation follows changes in indicators of environmental health, enabling herders to adjust their forage management and conservation strategies to the long and short term availabilities of resources.

3.2.3 Knowledge about range activities management

Management systems of range activities inside the family

The study revealed that herders' societies are very keen to train their children on pastoral activities since childhood, as stated by 70% of respondents. They said that children are usually enrolled with tenant herders so that they receive knowledge of how to manage and deal with animals and 30 % stated that children are trained by elders. From this result it is clear that local herders have been keeping animals' long time immemorial and they possess valuable knowledge that transmitted to younger generation which has enabled them to sustain their animals for centuries. Mundy (1992) stated that indigenous knowledge (IK) and skills in animal husbandry, range management and forage plants play a significant role in improving sustainable animal productivity, conservation of biodiversity and household food security.

Water source management

Results of study revealed all the respondents (100%) stated that the sources of water in the study area consist of one water reservoir (dam) owned by the village community. The dam made out of metal. Surface water was said to be available during the rainy period and to usually dry up during the dry season. Despite the variability of water availability, herders have valuable indigenous techniques in predicting water availability in their rangelands. For example, the high soil moisture frequently visited by butterflies is a sign of water availability close to surface soil. Also the presence of the trees known as (*phycus spp*) is a good sign of high water table, while presence of big, tall and green trees (*Acacia spp*) signifies a shallow water table. Due to the scarcity of water, which seems to be a recurrent problem in the months of November and December, The available water is closely monitored and managed for livestock and human consumption. The herds are either split or sent to different distant water points or the animals are watered on alternating days preferably starting with prime herds calves, milkers and pregnant cows. Some respondents

requested government intervention to alleviate recurring shortage of water for both livestock and human use. The splitting of the herds involves dividing animals into smaller groups, which are watered at different water sources. Watering animals on alternate days is a decision usually made by a committee of local elders.

3.2.4 Knowledge of rangeland resources and mobility Decision making

All the respondents (100%) confirmed that the authority tends to be concentrated in older. The head of the family is the one who takes the decision especially in the matters pertaining the movement to areas of good resources because he has extensive knowledge of rangeland resources in the directions to be reached.

At times young married men, who are quite enterprising, can also be allowed to make certain decisions pertaining to livestock production and other community issues. The herders who have already undergone initiation take care of the security of livestock and are sometimes allowed to take minor decisions such as changing direction of grazing when they encounter undesirable species. Usually, the head of the family makes decisions unless communal consent is necessary as in the case of security where decisions by an individual affect the whole community.

Women and children form a central part in animal management and range resources. Although they are not allowed to make a decision, women hold crucial positions in the process of decision-making related to milk production, some range management issues and domestic chores.

Tracking and recognizing of animal routes

With regards to routes tracking 90% of interviewed respondents stated that herders follow specified routes with signs known to them to spend the autumn period outside their areas. They usually prepare their entire supplement and carry them on their animals. While 10 % of the respondents said they are knowledgeable about the existing of known longitude and latitude table 4.

Table 4: Tracking and knowledge of herd routes.

Route tracking	F	%
Existing signs	27	90
Latitude and longitude	3	10
Total	30	100

Herd Mobility

Herders in the East Nile province are semi resident tribes. All the respondents stated that during the rainy seasons they move with their families to the Butana area, central of Sudan where water and pasture are available, particularly they graze in communal grazing land known as General Grazing Area (GGA). The idea behind this movement is to share the resources with (outsiders from Blue Nile state and Sinnar State) in the Butana area.

GGA is opened freely for both local and outsiders to graze during rainy seasons. At the end of the autumn period, and with the lease of pasture, they return to their area following the known animals' routes. During their journey they stop whenever there is a pasture, and then continue walking to their areas. Upon reaching their areas, they benefited from the existing trees, weeds, in addition to using fodder and agricultural residues to spend the summer period. Mobility is considered as a strategy rather than just a kind of movement, therefore, huge task need to be settled before local herders decide to move. When a movement is planned expert herder or in surveillance accepted and trusted by both (people in the area of origin and destination) is sent out to evaluate the condition of rangeland and ensure that it is safe to move. The expert or scout had to be an experienced person, strongest, and intelligent ones who knew to evaluate the conditions of an area and interpreting range conditions (De Jode, 2010). This entails that the observant has ability to measure what is known in the ecological studies as the "carrying capacity" of the rangeland. When they return, an indispensable meeting is held to discuss the followings: evaluate the information, take decision to move, and make division of tasks based on age and gender. When the decision to move is made, they have to follow their traditional animal routes.

Winter (1984) stated that mobility is one of the best adapted and effective means of obtaining what livestock need in an ever-variable environment. In the traditional African context, movement is not chaotic but is regulated by socio-political controls and technical know-how. It requires access to large areas of rangelands which most groups obtain by a combination of territorial rights and alliances with neighbours. General speaking herders in the study area are often knowledgeable about their surrounding environments and capable of regulating the use of grazing resources among local groups as well as with outsiders in a sustainable manner.

Herd Leading

The study confirmed that 83% of the respondents were fully aware of the herd leading on a regular basis, as they emphasized that the leading of the herd is carried out according to animal walks. Based on their local knowledge, herders have come to know that when the animals are speeding the herder will be in front of them riding his horse or on feet. When passing narrow routes and areas where there is agriculture, the herders walk on the sides of the animals, the idea is to control the animal movement and prevent them from entering into agriculture land and in this case there would be more than one herder. On the other hand 17% stated that herder should be behind the herd while moving in a regular way. Table 5.

Table 5: Knowledge of herd leading.

Herd leading	F	%
In front of animals	25	83
Behind animals	5	17
Total	30	100

This strategy helps them to keep their animals and to know which type of grazing animal prefer e.g. camels and goats which are considered as drought resistant prefer browsing while cattle and sheep (sensitive to climate) favour to graze grasses. In the study area, the young always move with smaller animals (sheep and goats) while adults move with high number and large animals (camel and cattle); even women help in taking care of the small and milking animals.

Identification of herds when mixing

Respondents' in the study area (47%) stated that when the herds are lost or mixed with another herds during grazing and movement, they are recognized by the presence of special signs for animals. These signs vary from tribe to another and sometimes are coloured to distinguish the tribe to which animals belong. About 43% said that they have calling names to their animals and they also used when milking and provide fodder for their animals. Parts of these local names are hemaira, gebisha, gwaher, dura etc....

Prohibiting of breast feeding during mobility

In the group discussion with the community the author realized that herders possess greater capabilities and local knowledge when dealing with animals during mobility. They said that during mobility breastfeeding is prevented in several ways, the most common of which is isolating calves away from mothers, or by using dung in the udder or tied it up. This prohibition is done mainly to avoid animals stopping by the calves from grazing or movement and also to preserve amount of milk that will be used to generate income for their living and to buy manufactured fodder. Therefore, calves are prevented from mothers.

3.2.5 Knowledge of animal policy and breeding

Animal age

During the discussion an old man continue saying that communities in the study area have local knowledge to know the age of the animal by opening the mouth. This knowledge is gained from tracking the animals from childhood through the different age stages of the animal. The age is identified through the number of teeth present in each age stage. Another way of determining the age is through animals feeding where big animals regurgitate the forage, but the small ones are not regurgitate. Mathias (1995) stated that the generation, adaptation and use of indigenous knowledge are greatly influenced by the culture. Economic, social, political and geographical contexts also contribute to generate indigenous knowledge, but to a lesser extent. Therefore, indigenous

knowledge systems show great diversity not only among ethnic groups but among locations also.

Treatment of animal disease (Ethno veterinary knowledge)

Rangelands are the places where local medicinal herbs can be found. The knowledge of using local herbs is usually shared by all members of community and transferred from one generation to another. The herders are traditionally educated from village elders. The interviewed herders (100%) argued that their knowledge is embedded in the community practice, relationships and rituals and that it is a part of everyday life to practice herbal ethno medicinal therapies to cure their livestock. Discussion with respondents also indicated that they have a great local knowledge dealing with animal treatment. They provided many examples on how to treat disease by using plants products such as oil, seeds of *Nigella sativa* (Habt albraka), *Acacia nilotica* pods, salt, and seeds of *Melaleuca alternifolia* (habshai) to treat some disease locally known as abu genet, abu demiaa, and kalsam these names are linked with the animal behavior.

The ethno veterinary knowledge is well documented by Minja *et al.* (2001), Codel (1994) and Mundy (1992) who asserted that such knowledge is usually held in adults and passed over to younger generations by word of mouth through an education system emanating from social interactions to share cultural knowledge. Husbands teach their wives about traditional treatment of animals. The senior wife is responsible for imparting knowledge on the whereabouts of medicinal herbs and how to prepare concoctions. Young women gain knowledge on the use of herbs for treating livestock diseases through observation, discussion, consultation and exposure with their mothers.

Animals' replacement

The results of this research indicated that 80% of the herders confirmed that the animals are replaced when the animal gets old and they will no longer benefit from them. While 20% stated that they replace animals when they do not reproduce. They do not tend to slaughter these animals and benefit from their meat, but to find a way to retrieve this animal by replacing them. Herders' societies depend on abundance without quality as a manifestation of the ostentation of customs and traditions. Sometimes these animals are used in the form of exchange on occasions to help each other. Another important element in having large herds is that they strengthen group solidarity by allowing, for example, those who have large herds to lend some animals to those who have smaller herds or no herd at all, or to those who lost their due to drought or epidemics and civil wars in order to keep them moving with the group.

Babiker (2011) mentioned that livestock is the main source of food in the domestic arena. It provides milk and meat for families' local consumption, for households

or for the camp unit, depending on the way the ethnic group organizes itself. Hides, wool, and other animal products are part of the daily use of the pastoral household and are carefully looked after. Moreover, Behnke and Kerven (1995) added that pastoralists use their small ruminants as means of exchange to satisfy needs for goods they do not produce. They are also used by almost all pastoral ethnic groups in Sudan for sacrifices during circumcision, marriage, and other social occasions. Some of the animals, such as camels or the oxen of the Baggara of Kordofan and Darfur and the pastoral Fulani in the Blue Nile, are used as means of transport especially during these groups' annual movements in search of better grazing areas for their herds.

Continuity of milk production

In the group discussion with local herders they stated that when the newborn calves die, mothers are treated by providing concentrated feeds and this is attributed to its effect on milk production and allow preserving the quantity and quality of milk. They also mentioned that there are types of cows that continue producing milk and are locally called Hanin, and those whom they cannot obtain milk from are locally called dry.

3.2.7 Knowledge about various uses of animal products

For smallholder and herders societies, livestock are important for well-being, not just from the perspective of providing cash income, but as a comprehensive livelihood-support system. During the discussion respondents' mentioned different and useful uses of animal products among these are: Dairy products are sold in order to save money to meet their basic needs, such as buying fodder and their household needs. However herders are fully aware of the uses of leather. When slaughtering small animals from sheep or large animals from cows their skins are used in local industries such as leather upholstery locally called farwa used for praying. And some of them are used in the manufacture of yogurt. Others used for water cooling. Moreover, there is little indigenous processing of wool occurring in the study area. The goat wool is locally used to produce upholstery locally called shamla this is a rather specialized activity and women are engaged in the trading of this product.

3.3 Direction of future action: basing our extension work on what herders know

The results of this research demonstrated that there is a strong base of indigenous ecological knowledge among herders in the study area and this knowledge can also be used as basis for solving environmental problems. They also illustrate that this knowledge is gained through a contentious process resulting from practical experience, observation, experimentation, local culture and traditions. This fact raises two important issues that need to be considered. One is that herders' knowledge is different from the knowledge of scientists. Herders know

things that scientists do not know and vice-versa. The challenge is to find a means to bridge this gap so that knowledge can be shared for benefit of both. Also if the factors that support this "knowledge development process" are disrupted or suppressed by external forces such as governmental efforts, herders' knowledge bases are disrupted.

However this does not mean that herders have not been using scientific knowledge nor does it mean that they are not willing to listen to us as extensionists. They are quite willing to make use of the information we extensionists can provide, when it is relevant. What it means is that we need to create a network of herders-cum-extensionists/environmentalists through which we harmoniously interact and share knowledge. This will require that new approaches are to be taken by extension staff. The following approaches are suggested as a guide to redirecting the efforts of the range extension services in the area.

- Extensionists should treat herders as people with valuable information and knowledge about the local environment. This knowledge is vital for providing insights on how the needs of people can be met, which includes maintaining sound environmental conditions. This means that range managers must actively search for the positive contribution that local people can make in utilizing and managing range resources. The relevance of services being provided will depend on our ability to treat herders as colleagues-colleagues with valuable information about local conditions that can be used to guide us in our design of our interventions.

- This in turn requires that range extensionists develop a two way communication system with herders instead of classical top-down approach. Any good ideas they have to improve range and livestock conditions must be shared with herders so they can present their views and make their own analyses in light of their knowledge. They are in the end, responsible for the actual implementation even though they may be able to support them in this. They also need to encourage herders to share their good ideas with them so that we can support their initiatives and develop village extension plans based on these.

- Range extensionists should be facilitator and help herders to forage a head with their own development. This means empowering them through information sharing and discussions. Extensionists have often have access to the information about experiences, techniques, etc. from other areas that may be useful. Herders will listen to them if they see that they can improve their understanding and assist them to develop or adopt technologies suitable to their own environmental and cultural conditions.

- Organization of study visits for herders within and outside regional boundaries is suggested. Herders from different

localities can exchange visits to learn from each others' experiences. This will broaden their scope and improve their innovative skills.

- Like everyone else, Herders' efforts need to be acknowledged and rewarded. For examples innovative herder can be given a certificate of appreciation at a public ceremony. This will encourage other herders to carry out and inform others about their own efforts.

- It is also a good idea to establish a rural news bulletin through which local herders can share ideas and discuss the development initiatives and innovations can be acknowledged and made known to a wider spectrum of the community.

- Adoption of an interdisciplinary approach in rural extension is inevitable. Livestock, forestry, agriculture, community development, education, health, sanitation and nutrition sectors must act as a team and avoid giving conflicting and confusing messages to the herding communities. Extension officers from these sectors could meet to discuss how best to interact with herders and share any knowledge gained from them.

- Range resources research and development strategies should take into consideration indigenous ecological knowledge and involve herders in the research and development programmes particularly in range management, soil and water conservation.

- Range extension agents must be trained to perceive the advantage to their programmes of sounder ecological approach including the appropriate use of the range resource.

- It would be a good idea as part of government policy that herders knowledge bases are taken into account when designing extension services. The selection of range extension workers should be partly based on the ability to interact and listen well. Also senior range officers at district, regional or national levels could have a rural attachment period ranging from 3 to 6 months which they spend with herders. This would give such officers an opportunity to research herders' knowledge and management systems and expose them to rural conditions so they would be in a better position to plan government programme as effectively.

4. CONCLUSION

In this research it is clear that the main emphasis of extension services should not be awareness raising activities. The importance of indigenous knowledge as a basis for practical rural range extension cannot be over emphasized. One important reason for lack of progress in range resource management has been our attitudes. For quite a long time, we as technocrats have pushed our ideas on herders, thinking that we know better than they. Taking into account indigenous knowledge will allow range extension staff to complement rather than to try

and replace the knowledge and efforts of herders. By trusting people and placing value on what they are doing, they will in turn trust and value our technical advice. By anchoring our technical knowledge and inputs on the existing local knowledge bases of a particular group of people in a particular locality, by accepting herders as a resource rather than a problem, many new opportunities for supporting sustainable range resource management will become apparent.

5. REFERENCE

1. Babiker, M. Mobile pastoralism and land grabbing in Sudan: impact and responses. paper presented at the future of pastoralism, 2011.
2. Behnke, R. H., & Kerven, C. Redesigning risk: tracking and buffering environmental variability in Africa's rangelands. In S. E. R. T. Wilson, and S. Mack (Ed.), *Lives-tock development strategies for low income countries*. Rome Italy: Food and Agriculture Organization of the United Nations (FAO), 1995.
3. Cerenea, M. M. *Putting People First: Sociological variables in rural development*. Oxford Univ. Press. New York, 1985.
4. Codel, A. Fusion of traditional wisdom and modern technology in natural resource management. *Convention on Biological Diversity Rio de Janeiro*, 1994.
5. Desta, H. Management for proper range use: Technical Bulletin no.25. ESGPIP, Ethiopia's Sheep and Goat Productivity Improvement Program, Ethiopia, 2009.
6. Desta, H. Rangeland resource monitoring and vegetation conditions scoring: Technical Bulletin no.26. ESGPIP, Ethiopia's Sheep and Goat Productivity Improvement Program, Ethiopia, 2009.
7. De Jode, H. (Ed.). *Modern and Mobile: The future of livestock production in Africa's drylands*: International Institute for Environment & Development (IIED) and SOS Sahel International UK, 2010.
8. FAO. *Forestry Extension Methods*. FAO Forestry Paper No.80. FAO, Rome, 1987.
9. FAO *Women in Community Forestry. A field guide for project design and implementation*. FAO, Rome, 1989; 42.
10. Glover, E. K. *Tropical dryland rehabilitation: case study on participatory forest management in Gedaref, Sudan*. Ph.D thesis. University of Helsinki. Finland, 2005.
11. Kobbail, A. A. *Towards a participatory management of forest reserves in Sudan: a case Study of ElRawashda and Elain natural forests*. PhD thesis. University of Khartoum. Sudan, 2005.
12. Kobbail A. A. and Elmadina A.M. 2013. Social Aspects of community forestry in the Semi-arid Zone of the Sudan: A case of Kosti Province. *Journal of Science and Technology in Agriculture and Veterinary Sciences Vol.14 (JAVS)(2)*. Sudan University of Science and Technology, 2013.

13. Mathias, E. Framework for enhancing the use of indigenous knowledge, indigenous Knowledge & Development Monitor, 1995; 3: 3-4.
14. Minja, M.M.J; Allport,R.R Editors: In the Ethno veterinary knowledge-The Ministry of Water and Livestock Development/VETAID Manual, 2001.
15. Mundy, P. Indigenous knowledge and communication: Current approaches. Development Journal of SIDA, 1992.
16. Rolling, N. Extension Science: Information systems in agricultural development. Cambridge University Press, 1988.
17. Winter, M. The Twareg. Swift, J J (ed) Pastoral Development in Central Niger: report of the Niger Range and Livestock Project USAID/Ministry of Rural Development, Niamey, 1984; 531-620.