ETHIOPIAN INDIGENOUS CATTLEBREED'S DIVERSITY, DISTRIBUTION, PURPOSE OF KEEPING,AND THEIR POTENTIALTHREATS

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ABSTRACT

The current review is aimed at assessing the existing information on cattle breed diversity, distribution, purposes of keeping and their potential threats and disseminates information to stakeholders who can work to fill the gaps identified. Thus the review tried to identify some facts about the origin, the economic, social and ecological values;diversity, population status and their potential threats as well as efforts made so far on the characterization and identification of different aspects of cattle genetic resources in the country.The reviewed informationrevealed thatEthiopia is the home of diversecattle genetic resources due to its diversified agro-ecology, topography and its nearness to the get of Asia which were potential origin of most domesticated animals for Africa. Thus, currently, 28 breeds of cattle have been recognized in Ethiopia with an estimated total number of 59.5 million, of which 98.2% of areindigenous cattle. Indigenous cattle breeds have diverse functions ranging from provision of food and income to society, and support many social and cultural functions in addition to theirecological roles. Indigenous cattle breed have adaptive traits to drought, ticks and tick borne diseases, and diseases like of trypanosomiases in case Sheko breed and adaptive to thrive in waterloggedareas in case of Fogera breed. However, the genetic distinctiveness among most Ethiopian local cattle breeds, are largely unknown and unidentified. The purity of indigenous cattle breeds is under threat due to crossbreeding, inbreeding, lack of institutional capacities and policies which support the use of imported breeds for crossbreeding purposes. There are many stakeholders identified to be involved, however, efforts made by all the stakeholders lack synergies that should be improved in the future to get comprehensive results in the sector. The phenotypic and on farm characterization activities so far carried out were in a limited areas of the northern, southern and central highlands of the country that could not give full images about the country's cattle genetic resources. The conservation and improvement programs implemented on few breeds' lacks deployment of enough investment and full participation of local communitiesthat ends up in limited success.

Key words: Indigenous, Cattle, Phenotypic Characteristics, Threats

Introduction

Ethiopia is rich in animal genetic resource,both in diversity and population. The agricultural sample survey report of (CSA, 2016/17) revealed that about 59.5 million head of cattle, 60.90 million, sheep and goats population,2.16 million horses, 8.44 donkeys, 0.41 million Mules and 1.21 million camel population are playing a big role for food and agriculture in the country. Moreover, of 59.5 and 5.92 million estimated population of poultry and honey bee hives respectively are registered to be found in thecountry.Cattle contribute a lot to improve the wellbeing of the farm family through food supply, balancing nutrition, family income, savings, insurance, ritual and other social purposes. Moreover, cattlesupports rural livelihood by increasing soil productivity, transport, traction and agricultural diversification.

The existence of both *Bostaurus* and B. *indicus* cattle in Ethiopia are evidences of cattle diversity in the country. Even though Zebu type (*indicine*) or humped cattle are dominantly found, the first African cattle were humplessBostaurus animals that they were initially distributed north, as well as south to the borders of the tropical rainforests. Today, the only remaining descendants of these indigenous African *taurine* cattle in East Africa are the trypanotolerantSheko breed (FAO, 2015). Ethiopia is the home of diversified cattle breeds due to its diversified agro-ecology, topography and its nearness to Asia where most domesticated animals in Africa (EBI, 2016) were originated. Since then cattle population were exposed to different climatic and environmental conditions that were resulted in possessing different adaptive and productive characters. Diversified human needs also have necessitated selection of different types of population for a variety of purposes helps to have diversified animal genetic resource in the country.

Through characterization and identification of cattle genetic resources in the country are not exhaustive, currently, 28indigenous breeds of cattle have been recognized to exist in Ethiopia(EBI, 2016).Most of the breeds (98.2%) are indigenous to the country (CSA, 2015), evolved over centuries, managed by small holder farmers in a remarkable diverse ecosystems (highland, dry mountain, lowlands, arid and forest) and they are often said to possess unique genetic traits.These enable their survival in those diverse ranges of production environments and developed specific necessary features to deal with such severe feed and water scarcity, diseases challenge, extreme hot and cold environments and unpredictable long drought periods etc.

Thus, the objective of this review is to provide an overview of efforts made to characterize, conserve and improve indigenous cattle genetic resources in Ethiopia.

The economic and socio-cultural values of indigenous cattle

Livestock plays multiple roles in the Ethiopian economy by providing food, input for crop production and improve soil fertility, raw material for industry, cash and promoting saving for the family, source of fuel, provision ofother social functions, and employment. Various estimates from different sources show that the livestock sub-sector contributes a lot to the agricultural GDP, among which IGAD livestock initiative is one which estimates the value of livestock to agricultural GDP up to 45%, if the value ploughing service is added (IGAD, 2010). In terms of livestock species contribution, cattle are by far the most important ruminant species. The same source also indicated that Ethiopia has one of the largest livestock inventories in Africa with livestock ownership currently supporting and sustaining livelihood of an estimated more than 80 percent of rural poor.Rural households depend on cattle for meat and milk as sources of food and income through sales and for by-products such as horns and hides (Musemwa, 2010). Livestock products including live animals, meat, and leather goods are a major source of foreign exchange, about birr 1.08 billion or 6.4 percent of total exports. Meat, eggs, dairy, and other livestock products together account for about 12 percent of the value of total household consumption (Gelane*etal.*, 2012).

Livestock is an important foreign currency earning resource for the national economy through export of meat and live animals (Behnke, 2011). Hides are further processed to make carpets, seat covers, harnessing ropes, drumbeats and hats for the spirit mediums (Mapiye, 2007). Cattle also provide dung for manure, floor polish/seal and fuel either in the form of dried dung cakes or via the production of biogas. Cattle are an inflation-free form of banking for resource-poor people and can be sold to meet family financial needs such as school fees, medical bills, village taxes and household expenses. They are a source of employment, collateral and insurance against natural calamities. More importantly, indigenous cattle are valuable reservoirs of genes for adaptive and economic traits, providing diversified genetic pool, which can help in meeting future challenges resulting from changes in production sources and market requirements in the future (Terefe*etal.*, 2015).

Livestock has social functions correspond to the symbolic values associated to each species and the use of animals for the fulfillment of a set of rituals and social obligations of families and communities. Livestock gives social status to its owners once it is considered a common mean of demonstrating wealth and provides economic status as it facilitates the access to informal credits and loans to the households. Livestock is also used in traditional rituals, ceremonies and festivities and is given as a gift in worships (e.g. installation of ancestral spirits, ritual slaughter and bride wealth). Cattle have spiritual and cultural roles in rural society in bride wealth payments as Ethiopian local language sitota /tilosh (gift). They consume crop leftovers and other crop

wastes/residues as inputs to livestock production to produce valuable products.

Ecological values of indigenous cattle in Ethiopia

Livestock, particularly adapted cattle genetic resources are an important element in the livelihood of many resource-poor farmers living in wide arrays of production systems and contribute more than marketable products that are considered in economic statistics (Kefena*etal*.,2011). The same author explained that indigenous cattle have special adaptive traits to harsh climates, resistance to local disease, heat tolerance, ability to utilize poor quality feeds and the multipurpose roles they play multi-range of production systems are some of evidences explained on their inherent genetic attributes. Fragmentation of farm lands and depletion of soil fertility are among the top most important limiting factors those constraining subsistence farmers in maintaining sustainable crop production in the central highlands of Ethiopia. More than sixty and over a third of the total farm households in the country make their livings on less than a hectare and half a hectare, respectively. Due to increasing trends of price for inorganic fertilizers, subsistent farmers tried to exploit other options available to them like the use of organic fertilizer in maintaining soil fertility for sustainable cropping sourced from animal and plant byproducts (Kumsa*etal*, 2004). The major sources of making manure for fertilizing soil are from cattle, even though few farmers also keep sheep, goats, donkeys and horse.

According to the report made by (Aboude*tal*.,2012),many rangelands have suffered soil compaction and erosion as a result of livestock grazing. However, appropriately managed grazing can also contribute to improving soil health. This author also explained that in many countries, grazing livestock play a significant role in the creation and maintenance of fire breaks and hence in reducing the spread of wildfires. Cattle play an important role in biodiversity conservation such as weed and fire control, maintenance of biodiversity and carbon sequestration. It is important to note that the use of livestock is properly managed and regularly monitored in order to make sure both the cattle and the ecosystem are healthy and live friendly. Livestock make their most important contribution to total food availability when they use feed sources that cannot directly be eaten by humans. Food production clearly falls within the provisioning category of ecosystem services. However, in some cases, the removal of unwanted plant material also constitutes a service. In grazing systems, the benefits concerned may relate to the removal of plant material that creates a fire hazard or the control of invasive species. In mixed crop and livestock systems, livestock may be used to control weeds (e.g. on fallow land) and in the management of crop residues.

Cattle breed diversity, distribution,population status and their threats

Ethiopia is the home of diversified cattle breeds. This is due to its diversified agro-ecology, topography and nearness to Asia where most domesticated animals in Africa (EBI, 2016) were originated. A breed is a homogenous group of livestock which are phenotypically unique from other groups or subpopulations of the same species (Halimanietal, 2010). There are 28 indigenous breeds/types of cattle that have been recognized to exist in Ethiopia (EBI, 2016). These are grouped in to five major cattle types, large and small East African Zebu, Sanga, Zenga (a bred between Sanga and Zenga) and tourine types that are distributed to be found in all agroecological zones depending on their merit to a particular production system from arid tropical to afroalpine ecosystems. However, the genetic distinctiveness among most Ethiopian local cattle breeds, are largely unknown and unidentified. The purity of indigenous cattle breeds is under threat due to crossbreeding, inbreeding, lack of institutional capacities and policies which support the use of imported breeds for crossbreeding purposes. On the other hand, some authors mentioned thatbreed improvement programs of Ethiopian indigenous cattle remain too few while the demand of livestock products is continually increasing (BerhaneHagos, 2015). Other major constraints that limit cattle production in the country are, shortage of feed, water, diseases treatment and prevention, and poor housing (AndualemTonamo, 2016).The situation is aggravated by lack of records and uncontrolled mating systems practiced in the smallholder production system (Rege, 1999). This is definitely true in Ethiopia where in most cases, the breeding practice is both unplanned and indiscriminate crossbreeding between indigenous and exotic breeds that produce non-descript/crossbred cattle, which are now dominating in urban and per urban areas of the central highlands.Identification and characterization activities conducted on livestock resources of Ethiopia are not exhaustive. As a result, there is no complete and up-to-date breed level population data for most of the breeds, and this makes determination of the status and trends difficult. There are, however, some indigenous breeds which are known to be found at different threat levels. Sheko (the only taurine breed in east Africa) and Fogera cattle appear to be highly threatened as a result of interbreeding with other local breeds and changes in the production systems. In addition, Begait, Irob, Ogaden, Afar and Borana cattle breeds are also facing various degrees of threats (EBI, 2016). Thus, characterization and identification of indigenous cattle breeds, including their unique traits, should be given high priority. That should be a precondition in designing conservation and sustainable utilization programs to help indigenous breeds to compete in changing production environments with limited production resources such as land, feed, labour and capital in the future.

Table 1: summarizes breed name, distribution, breed group, population status and purposes of keeping cattle(EBI, 2016)

Breed name	distribution	Purpose of keeping and measurable traits	Phenotypic and genetic characteristic	Current population status	improvementand conservation activity
AbergelleCattle	Tigray and adjacent districts of Amhara region of North EthiopiaZenga type	Drought power, Meat and Milk, Adult male 234±13kg, 153±15kg and1-1.5lts of milk yield per day with 150 days lactation length.	Tolerant to heat, disease and parasite, ability to cope feed shortage, female long thin horn, male short thick horn, Small hump, dewlap, naval flaps, Black and mix of black with White color	unknown	conventionally practiced by farmers
AnuakCattle	Maintained by the Anuak people of Gambela, Sanga type	Work, Meat and milk purpose, 155kg, daily milk yield of 3-5 liter	Relatively resists flies and ticks light in shade, white with red or black patches coat color, 24 - 30cm long and 20cm depth dewlap	unknown but Limited by trypanosomiasis	conventionally practiced by farmers
AdwaCattle	Central zone of Tigrai region, small East African Zebu type,	Dual purpose mainly for draught, meat and milk	higher altitude, red, chestnut, black, roan and white Coat colour	Unknown	conventionally practiced by farmers
AfarCattle	Maintained by Afar people in eastern and north Ethiopia(Tigrai and Wollo)	average daily milk yield 4±1 lts with 271±22 days of lactation length , ranges from 250-375 kg	resistant and adapted to the harsh conditions, Large and slender body, small humps and moderate dewlap, Ash-grey, white smooth, red and shiny coat colour	Increases population due to vaccination regardless of recurrent drought	conventionally practiced by farmers
AmboCattle	western Shewa, small east African zebu type	Dual purpose mainly used for draught.	Short horned Zebu inhabits the higher altitude, compact conformation, larger than the adjacent Guraghe breed	Increase in number but risk of dilution with exotic breeds	improvement activity crossing with exotics
AradoCattle	northern Ethiopia particularly in Tigrai, zenga type	work, meat and milk 205 days-wieght of 430kg, and 192-350	.high altitude and feed shortage plain and patchy well	Unknown	conventionally practiced by farmers

		kg of male and female respectively, milk yield per day is1.8±0.4 liters with lactation length of 242±20 days	developed hump and dewlap		
ArsiCattle	large East African Zebu, central highlands of Ethiopia; Arsi, Shewa, Bale, Sidamo and Harar	Dual purpose mainly for work Milk, ranges 149-809 liters and average of 278.04litres/ lactation period. average mature weight is 236kg	Habituates highland of Ethiopia Small short horns,dominantly black	Unknown	Dilution is very high with exotic breed
Bale Cattle	small East African Zebu type, high plateau of the Bale zone, in areas adjacent to the habitat of the Jem-Jem	Dual purpose mainly for work	inhabits the higher altitude black, chestnut, white and roan color	Unknown	conventionally practiced by farmers
BegaitCattle	North West Ethiopia like Tahtayadiabo, Kaftahumera, Welqait, Asgedetsimbla districts, Large east African zebu type	well-developed udder, long teats and higher milk, production,,5±0.5litres /day, male and female is 333±51kg and 278±41kg	Adaptive in hot and shortage of water, tacking long distance to find feeds and water,active disposition, long legs and large humps that tend to be cervico-thoracic	decreasing due to,shortage of feed, conflict and uncontrolled breeding are potential causes of risk	some improvement activity with ranch and exsitu conservation
Begaria	Guba district, Metekel Zone BenishangulGumz Regional State.	Dual purpose	Adapted in hot environment, uniform and dominantly white and grey body coat color	unknown	some community based conservation programs implemented
BoranaCattle	distributed in the southern rangelands of Ethiopia, around Liben, Mega and Arero plains kept by Borana pastoralists,large East African Zebu type	Dual purpose Mainlyfor milk and meat, best feed converter produces 2.4 litres milk/day,	long distance walking ability, drought resistance, reasonable conception, excellent mothering ability, well developed herd instinct, more docile and resistance, heat	Risk with high destockingyoung and productive bulls before replacing themselves from	In-situ conservation and selection with ranch and ex-situ conservation with cryoconservation.

	breed	ranges 300-385 kg male and 250-350 kg female	tolerance, longevity Short horned, mainly white, fawn or brown with darker shading color on the head, neck and shoulders.	stock	
FogeraCattle	Fogera plains around Lake Tana, Southern Gonder and adjoining areas of Gojam, zenga type breed	work, meat and milk purposes	Adaptive to seasonal flooding and the swampy conditions of the area. Tolerate tick and flies bitts relatively better than other breed in surrounding Black-and-white or black and grey coat color.Well-developed dewlap and naval flap and is docile.	Dilution risk with other small breed like smada small sized cattle, grazing lands have taken over by emerged cereal crops which is rice.	In-situ conservation and selection with ranch and ex-situ conservation with cryoconservation
Gofa	Small East African Zebu type breeds and distributed in Goffa area, principally around Sawla in South Omo.	draught, milk and meat	higher altitude, wetter agricultural areas, red coat colour, small hump and small to medium horn	unknown	conventionally practiced by farmers
Guraghe	small East African Zebu and distributed in the Guraghe and Hadiya areas in close totsetse-infested valleys of the Gibe valley	Mainly used for work, meat, milk	inhabits the higher altitude, wetter agricultural areas,small short horned, red, chestnut and roan color	Risk to tsetse's flies infested which is less trypano tolerant	conventionally practiced by farmers
Gojam High Land Zebu	Zebu type, distributed in Awi, East and West Gojjam	work, milk and meat	Horned and humped zebu	Uncontrolled breeding with others	conventionally practiced by farmers
Hammer Cattle	Small East African Zebu type, distributed in Hammer area of South Omo and maintained by the Hammer and neighboring pastoralist tribes.	milk, work and meat	Adaptive in lowland and humid environment white or grey, but there are also some chestnut and roan animalsHorns are short to medium; humps are prominent;	Risk is unknown	conventionally practiced by farmers

HararCattle	eastern and western Hararghe plateau,small Abyssinian Short horned Zebu, small east African zebu type	Dual purpose	Adaptive in higher altitude, wetter agricultural areas Black, roan and red.	Shortage of grazing land causes shortage of feed	conventionally practiced by farmers
HorroCattle	Distributed in HorroGudru of Eastern Welega; also in Western Shewa, and adjoining areas of Illubabora and Shewa, Zenga type	work, Meat and milk, 100-1550 kg per lactation of 3-8 months and also adult male and females have range of , 320-480 kg and 210-400 kg respectively	Adaptive in to humid and wetter agricultural area Dominantly brown or reddish brown coat color thin skin; horns moderate but larger than the common zebu	Risk not clearly identified but number is not decreasing currently	Ranches and community breeding activities being carried out
IrobCattle	Zenga type, Distributed inIrob and GuloMekeda districts of the Tigray region	Work, milk meat, 120-150 day's lactation length and 1 litter per day, average mature weights 245±36kg male and200±36kg.female of	adapted to a mountainous production environment and thrive to thorny plants like cactus light red with white spot color on the face	Threatened due to lack of awareness, feedand conflict	some *exsitu*cry conservation has been carried out
Jem-JemCattle	small East African Zebu, distributed in highlands of Jem-Jem, Sidamo and Bale in southern Ethiopia	work, meat and milk with average milk 2liters/day	Adapted to the wet and cold climate above 2500mas, short horns and ears, slender legs, small to medium humped andsolid black, black with a white face or white patches	Unknown	conventionally practiced by farmers
KereyuCattle	Sanga type breed and distributed in the Kereyu area of Eastern Shewa	mainly for milk, dowry and 463.1litres, average body weight of 300.4 kg and 249.9 kg male and female respectively	well adapted to the hot environmental situation straight profile, long thin legs and long horns plain, patchy and spotty	Unknown	conventionally practiced by farmers

JijigaCattle	small East African Zebu , distributed in Somali region of jijiga	Multipurpose breed, work and meat	occupies the mid-altitude zone between the Ogaden rangelands and the Hararghe highlands, wetter to somewhat drier areaschestnut, black, white or red coat color	Unknown	conventionally practiced by farmers
MedenesCattle	cross of the Begait and Arado breeds distributed in the hot to warm semi-arid low lands of Welqite	Milk, work and meat.2.5±2 liters per dayand ,260±23kg , male, 248±21kg female	adapted to extreme feed shortage, mostly black and white colour	conflict, and uncontrolled breeding are potential risks	conventionally practiced by farmers
MursiCattle	small East African Zebu, distributed in Maintained by the Mursi and neighboring pastoral communityof South Omo	milk, meat and work	Adaptive in humid environments Grey, white, black, chestnut, roan, pied with spots and striped. And horns are mainly large, usually curved inwards; hump is prominent and well-developed	unknown	conventionally practiced by farmers.
OgadenZebu Cattle	Lowland Zebu under small east African zebu distributed in the Ogaden area of the Somali region and bordering Eastern Hararghe	Milk, meat and work, averageWeight of 248.5kg (female), 285.7kg (male)	Adaptive to hot environments,uniform plain white, black shade around face and humped and in most cases polled	Draught and conflict are dominant threat	some activities of cryoconservation being carried out
Raya	Sanga type, distributed in east of lake Ashange of Tigray region and the bordering areas of Wello	3±1litrs/day with lactation length of 210±17 days and body weight of male and females are 281±41kg, and219±26kg respectively.	Has a trait of adaptive importance for the production system where the breed exists. mainly used for work, meat amd milk	Dilution with other indigenous breeds	conventionally practiced by farmers
Sheko	the only hump less short-horned taurine breed in east Africa and it is distributed in the humid parts of south-western Ethiopia around	Milk, meat,work Average milk yield ranges 1-2 liters/dayand adult live weights 194.4kg	Relatively better adaptive withtrypan tolerance polled or has floating type of horn and brown or black and white colour and glossy-red	Dilution with other zebu cattle and change in production system	Comparing with other breeds in the country better attention has been given to breeding and conservation both *insitu and exsitu*

	Bench-Maji zone		hair		methodsPopulation census conducted by mizan-TepiUniversity in collaboration with EBI and population number is showing an increasing trend
Smada	small East African Zebu, distributedin Gayint, and Smada in south Gondar	Mainly used for work, meat and milk purposes	inhabits the higher altitude, wetter agricultural areas Mainly black, but other colors are in combinations of red, black and white.	Shortage of feed and uncontrolled breeding practice with other breed like Fogera cattle	conventionally practiced by farmers

Efforts on Characterization,Conservation and improvement of indigenous cattle genetic resources

Some efforts have been made to characterize and identify cattle genetic resources in the country. However, those efforts were made on limited areas of the northern, southern and central highlands of the country that could not give full images about the country's cattle genetic resources. The characterization efforts mostly focused on farm and on phenotypic characters of the genetic resources and their products like meat and milk among others things. Moreover, few studies were made identifying adaptability traits like heat, feed shortage, drought tolerance and resistance to ticks and tick born disease.

There were some efforts that have been made to improve cattle production and productivity with different objectives. The major objectives were to improve dairy production through distribution of cross bred heifers and frozen semen.To realize these objectives, different institutions have been established for the last 55 years with limited success.

Well-designed cattle crossbreeding programs may lead to exploit heterosis for traits of economic relevance. Exotic dairy cattle breeds were introduced six decades back to upgrade indigenous zebu cattle in Ethiopia (Chebo C. and Alemayehu K. 2012). But, there are limited efforts made to improve pure indigenous breeds through selection programs. The only improvement program that has to be noted is the effort that have been made to improve small scale dairy sector through artificial insemination (AI), and by distributing crossbred F1 heifers and bulls particularly in urban and peri-urban areas as indicated. *In situ* and *ex situ* conservation method are the most popular methods that have been applied to conserve and keep animal genetic resources from depletion and extinction with participation and engagements of different stakeholder including stallholders farmers (FAO, 2013). There were some efforts made to conserve cattle breeds both *in situ* and *ex situ* conservation techniques by Ethiopian biodiversity institute together with other stakeholder (EBI, 2016). Basically, these are focused on cryo conservation of semen from some selected bulls, in addition to implementation of community based conservation and sustainable utilization of few threatened breeds. Some Universities and research institutes have tried to establish nucleus farms which could be used as a source of bull for serving community based breeding and development program. Thus, ranches have been established in different parts of the country for Begait, Borena, Horro and Fogera cattle breeds. Furthermore, semen from Fogera, Begait, Sheko and Irob indigenous cattle breeds has been collected and cryo-conserved. Sheko, IrobBegait, Afar and Begaria cattle breeds have been conserved *in situ*.

Table 2: Summarizes some characterization studies carried out so far

Title	Breed (s)	findings and suggestions	Sources
On farm characterization of Horro cattle breed production systems in western Oromia	Horro cattle	Sole source of draught power and milk. They have potential for greater contribution through better feeding, health management and genetic improvement.	(Mekonnen*et al*., 2012)
Genetic variability of five indigenous Ethiopian cattle breeds using RAPD markers	Horro, Sheko, Arsi, Abigar and Guraghe highland	Guraghe highland and Arsi are zebu type, shekohumpless and abigarsnegatype,horrozenga type, Analysis of Molecular Variance revealed that within breed genetic variation is much higher than that between breeds.	(Fedlu etal.2007)
Characterization of cattle milk and meat production, processing and marketing system in Metema District	Cattle type (Zebu) locally called Agew, Simada and Fogera, and introduced ruthana breed	The average cattle herd size of households was 15.53 heads, but it varied significantly ($P<0.05$) among the three areas. Cows (30.45%) and calves (32.29%) mainly dominate the herd composition, while heifers (13.90%), oxen (12.02%) and bullocks (10.30%) represented minor proportions	(Mengistie*eta l*., 2007)
The status of cattle genetic resources in North Ethiopia: On-farm characterization of six major cattle breeds	Afar, Arado, Begait, Fogera, Medenes and Raya	Performance of pastoral production system (Afar and Begait) was higher than the Raya and Medenes, and Arado and Fogera breeds of the agro-pastoral and mixed crop/livestock production systems respectively.Extinction probability for most of the breeds was high, the highest (0.67) being for the Begait breed. On the other hand, except for the initiative taken to evaluate, improve and conserve the Fogera breed at the Metekel and Andasa cattle breeding ranches, there are no institutionalized attempts towards improving and/or conserving the other breeds.	(Zerabruk*etal*., 2007)
Characterization of Gofa Cattle Population, Production System, Production and Reproduction Performance in Southern Ethiopia	Gofa cattle	Average cattle herd size was found to be 10 ± 0.44 heads per household. (60.6%) respondent say increasing trend while about 33.3% respondent say decreasing trend. Main trait preference is Gofa cattle were drought power. The major animal production threats were animal health problem or disease and, seasonal feed shortage. Trypanosomosis, Anthrax, foot and mouth, pasthrolosis and black leg were reported as first ranked cattle production problem cause huge cattle loss in the area.	(Kebede*etal*., 2017)

Conservation and Improvement Strategy for Fogera Cattle	Foger cattle	The main reasons to conserve Fogera breed are due to presence of interrelated constraints, presence of unique traits of the breed, better attitude of farmers, and decreasing population trend of the breed. Community-based in situ conservation strategy, to ensure the participation of the community, was designed for the breed. With the conservation strategy, related activities	(Assemu*etal.*, 2017)
Genetic diversity, population structure and relationships in indigenous cattle populations of Ethiopia and Korean Hanwoo breeds using SNP markers.	Ambo Borana, Arsi, Horro and Danakil were genotyped for 8773 single nucleotide polymorphism (SNP) markers	Assessed genetic diversity, population structure, and relationships. Ethiopian cattle populations are genetically distinct from the Hanwoo breed. Genetic distance was greatest between Hanwoo and Ethiopian cattle populations, with average values of 17.62 and 18.50, respectively.	(Zewdu*etal.*, 2013)
On-Farm Phenotypic Characterization of Indigenous Begait Cattle in Western Tigray, Northern Ethiopia	Begait cattle	Identified phenotypic characteristics, cattle production system, trait preferences, breeding practices, constraints in efficient utilization of the breed. Begait cattle were: height at wither (131. 48±0.25cm), body length (128.13±0.16cm) heart girth (159.55±0.24).Threats were seasonal feed shortage, diseases and drinking water scarcity of major ones. Farmers perceived that Begait cattle population decreased over the years and it is on the verge of extinction. It is concluded that appropriate breeding strategies and conservation models should be designed for overall breed improvement that consider the important traits of Begait cattle under proper feeding and management practices	(Ftiwi M. and Tamir B. 2015)
Genetic diversity in north Ethiopian cattle breeds	Afar, Begait Raya, and Abergelle, Arado, Fogera and Irob	Agro-pastoral cattle of Afar, Begait Raya better perform than crop/livestock mixed production system cattle of Abergelle, Arado, Fogera and Irob. The overall extinction probability of the breeds was high and about half of the breeds may be extinct in the next 20-50 years.The proportion of total genetic diversity lost in the same period can be minimized by prioritizing and allocating conservation funds to breeds with high marginal diversity and conservation potential.	(MerhaZerabrukFeseha, (2007
Phenotypic Characterization of Indigenous Cattle Populations in GamoGofa Zone South Western Ethiopia	Cattle in GamoGofa zone	Reported that Former local cattle bred that were identified in GamoGofa zone were different from current population characters. body lengths of male and female populations were 108.05+1.03cm and 107.15+0.62 cm respectively .Therefore suggested further characterization of local cattle in the area with specially emphasis on highland area of the zone at molecular level should be required	(Belay *etal.*, 2017)
Ethiopian Cattle Genetic Resource and Unique Characteristics under a Rapidly Changing	A Review	Summarizes the cattle genetic resourcesFound a variety of genetically diverse population from Bostaurus to Bosindicus species with unique adaptation characteristics in country which found all across from the rift valley highlands as well as below sea level in the Afar depression. However, despite the potentials of these diversified genetic resources, their	(BerhaneHagos 2015)

Production Environment.		unique genetic features, these cattle breeds are at risk to disappear rapidly following uncontrolled cross breeding, breed replacements with exotic breeds and other challenges. Breed improvement programs of Ethiopian indigenous cattle remain too few while the demand of livestock products is continually increasing. This situation therefore demands the need to devise strategies to conserve and improve the cattle breeds based on the challenges that threatens them. Use of genomic study is also imperative to facilitate the genetic restoration process. Besides, uses of new information technologies which can enhance the conservation and improvement program are very crucial. Strict regulations and bylaws should also be in place for illegal movement of breeding cattle to the neighboring countries	

Table 3. Some efforts made in improving cattle productivities in Ethiopia

Program	Purpose of the program	Sources
Cattle Genetic Improvement Started In Ethiopia 1963	To develop commercial dairy farm	(Chebo C. and Alemayehu K. 2012)
Chilalo Agricultural Development Unit(CADU) 1667	to develop small scale dairy farm	(Fekadu, G. 1999)
Walaita Agricultural Development Unit (WADU) 1971	to develop small scale dairy	(Kiwuwa et al., 1983)
CADU And WADU Targeted In Semen Production 1973	to produce deep frozen semen and distribution for (AI)	(HaileMariam, 1994)
Ministry of Agriculture Established Selele Dairy Development Piolet Program (SDDPP) 1987	to introduce cross breed heifers and improve livelihood of small holder farmers	(Kelay, 2002)
Established National Artificial Insemination Center 1981	servicing semen collection from cross and indigenous cattle breeds	(NAIC, 1999)
Animal Biodiversity Directorate In Ethiopian Biodiversity Institute (EBI) Early 1990s	to work characterize, conserve and sustainable improvements and utilize of animal genetic resources in the country	(EBI, 2018)
More Than 39 Higher Learning Agricultural Colleges And Universities And Institution (Early 1930s-Update)	to teach and research on improvement of agricultural resources for maximize benefit of nation and the country from the sector	(MengistuHulluka , 2013)

Stakeholder's engagementin the sector

There are manystakeholdersthat are engaging in the characterization, identification, conservation and improvement of cattle genetic resources in the country.The major stakeholders listed by Ethiopian biodiversity institute (EBI) (2018)include farmers, pastoralists, associations, ministries, educational and research institutions, development organizations and None Governmental Organizations.Stakeholder is a person, group or organization that has intereston a given animal genetic resourceor breed. Stakeholders can affect or be affected by implementation of the strategy, objectives and policiesconcerned with the cattle genetic resources. While Customer is an individual or group that receives or consumes products (goods or services) from the breed and has the ability to choose between different products and suppliers.Thus, customers in this case are breed owner farmers, urban dwellers, and breeder's cooperatives. While Stakeholders areRegional, zonal and district administration bodies, house of peoples representatives and council of ministers, ministry of finance and economic development, ministry of agriculture and Livestock development,ministry of Environment, Forest and Climate Change and its subsidiary bodies up to district level,Ethiopian Biodiversity Institute and universities, agricultural research centers,national animal improvementcenter, International Research Centerslike International center for agricultural Research in the Dry land Areas (ICARDA)and International Livestock Research Institute (ILRI). All these stakeholders have tried their level best to improve the sector but with limited success. Efforts made by all the stakeholders lack synergies that should be improved in the future to get comprehensive results in the sector.

Conclusion and recommendation

Ethiopia has huge head of livestock populations which are estimated about59.5, 30.70, 30.20, 2.16, 8.49, and 0.41, 1.21 millions of cattle, sheep, goats, horse, donkey, mules and camel respectively.Although indigenous cattle genetic resources are hardy, their productivity has been hindered by several constraints includinglimited feed availability, high prevalence of diseases, parasites, poor market integration and uncontrolled breeding. There are also limited characterization and improvement activities carried out so far that intern limits the development of the sector. The conservation programs so far implemented are also limited as compared to the breed diversity we have.Thehithertoattempts to improve cattle genetic resources using cross breeding and replacement has delivered insufficient outcome. Thus, a comprehensive characterization, conservation and improvement programshave to be designed in order to utilize the genetic resource sustainably. Moreover, the future direction for the development of this sector should better be geared towards selection and improvement of local breeds, while cross breeding and replacement can be used in the urban and peri urban areas applying controlled cross breeding strategy. This

requires the identification of important traits and estimation of thebreed's population status periodicallywhich helps to maximizes their utility. Allocating proper budget and building capacities in terms of personnel and infrastructure should be given more emphasis. There are stakeholders directly or indirectly have a stake in the development of cattle genetic resources in the country. The stakeholders' efforts need synergy that could avoid duplication of efforts and to utilize resources efficiently.

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