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Research Article

Conservation and Improvement Strategy for Fogera Cattle: A Lesson for Ethiopia Ingenious Cattle Breed Resource

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The paper is initiated to design appropriate conservation strategies and breeding scheme for Fogera cattle breed that will be used as a guide for other Ethiopian indigenous cattle breed. Two types of data, on-farm and on-station, were used; the on-farm data was collected from three districts, namely, Fogera, Dera, and Bahir Dar Zuria; those are expected as the home of the breed. A total of 150 farmers, which are knowledgeable and having at least one cattle of Fogera phenotype in their herd, were purposively selected and interviewed. Additionally, farmer's focus group discussion (FGD) was conducted to capture the historical background, population, and distribution of the breed. SPSS (version 16) and index method was used to analyze the quantitative and scoring data's, respectively. A meeting at national and regional level was also conducted to evaluate the existing conservation strategy and to identify the major stakeholders for the strategy. 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 like feed development, animal health interventions, market linkage, and development of cooperatives will be implemented to improve the working environment. The stakeholders that are identified as an actor in the strategy should realize their honest participation for the sustainability of conservation and improvement of the breed.

1. Introduction

The conservation of local breeds should be considered whenever the development of animal production systems is discussed [1]. Conservation of genetic diversity is essential to the long-term survival of any species, particularly in light of changing environmental conditions [2], and is essential for management of threatened and endangered species [3] for sustainable use [4]. In the context of setting priorities for conservation, Barker [5] and Zárate and Markemann [6] suggested that the only rational criteria are the likelihood of extinction of a breed and the degree to which it possesses unique genes and threats the breed faces and farming shift in the production area.

In Ethiopia, four cattle ranches are operating ex situ conservation measures of indigenous cattle breeds of the country. These ranches are Goba ranch that conserves Arsi cattle breed; Abernossa ranch that conserve Ethiopian Boran cattle; and Metekel and Andassa ranch that conserve Fogera cattle breed [7, 8]. But it is also clearly indicated that the success of these conservation efforts had shortcomings of political instability and/or inconsistency of development policies, limited stakeholder participation, and limitation of interventions in scope and scale that underestimates the conservation efforts [9].

Today, a large number of indigenous breeds or varieties in the developing world are at risk of becoming extinct [10]; likewise, at the moment breeds like Sheko cattle are highly threatened as a result of interbreeding; others like Fogera, Begayit, Ogaden, and Borena cattle breeds are also facing various degrees of threat [11]. The total population number of Fogera cattle had declined from time to time and it had

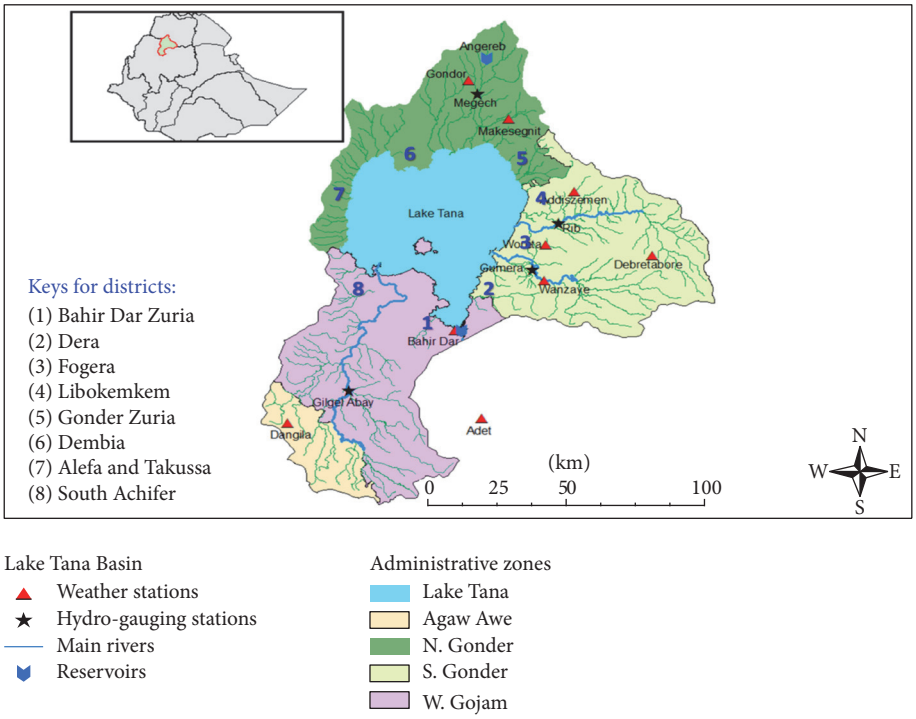

Figure 1: Districts of Fogera cattle breed distribution.

declined in alarming rate from 1980's [12] to 2000's [13] that need conservation effort for future potential use of the breed. The main threatening problems that lower both the productivity and population are genetic admixture, shift of production system, shrinkage of grazing land, and poor management practices. These problems coupled with absence of sustainable conservation strategies for indigenous cattle breed resources of the country leads to the extinction of these breeds. Therefore, this paper is initiated to identify the grassroots problems and to design appropriate conservation strategies and breeding scheme for Fogera cattle breed that will be used as a lesson for other Ethiopian indigenous cattle breed resources.

2. Material and Methods

2.1. Distribution of Fogera Cattle Breed. Fogera cattle breed is among the 27 [14] recognized indigenous cattle breeds of Ethiopia. The breed is reared in districts surrounding Lake Tana and is one of the main populated and productive breed in Amhara region [15] and in the country [16]. Additionally, the breed is found and conserved at Andassa Livestock Research Center (ALRC) and Metekel Fogera Cattle Conservation Ranch (MFCCR) and their surrounding kebeles. Figure 1 indicates the districts where the breed is distributed.

2.2. Description of Nucleus Herd at ALRC. Currently the center had 332 breeding females and 101 breeding males in various age groups (Table 1); the first group is 0–8 months which is the weaning age of the breed, 8–19 months where females run with bull and males are distributed to famers and community-based conservations, 19 months and above where females continue to be included with nucleus herd and males for natural mating based on their pedigree. The total Fogera herd is grouped to six (four natural mating herd, one AI herd, and one bull herd). Breeding bulls used for the herd are sourced from two centers namely, Metekel Ranch and the center among the farm born male stock with maximum birth weight, weaning and yearling weight, good morphological conformation, unrelated pedigree, and better health condition of the testis and scrotum.

Table 1: Current Fogera cattle nucleus herd population at ALRC.

Sex	Age group (month)				
	0–8	8–19	19–32	>32	Total
Male	50	46	0	5	101
Female	58	76	85	113	332
Total	108	122	85	118	433

2.2.1. Herd Management. All animals of the farm are subjected to graze during the day for eight hours in their herd and kept by individual day watchmen. During night time, the herds are yarded separately in their respective barn designed as loose housing system and guarded by guards. In addition to grazing, all the herds also feed conserved hay collected from the center; milking cows are supplemented with concentrate feed, which consists mainly of mixture of maize (*Zea mays*) and nuge (*Guitozia abyssinica*) seed cake. The animals were watered from Andassa river and spring water during wet season for young and sick animals which stayed at barn.

The center is water logged area; though to prevent internal and external parasites, strategic mass treatment against internal parasites was conducted twice a year, at the start and end of the rainy season. Animals were treated for ectoparasites fortnightly in peak season and monthly when the infestation level was low [17]. The prevention scheme focused on vaccination against anthrax, blackleg, and pasteurellosis once in every six to eight months and once per year for CBPP.

2.3. Breeding Program. In the breeding program both natural mating with Fogera bulls and artificial insemination with Holstein Friesian semen were used to produce Fogera and F1 calves, respectively. The pure breed herds are kept with selected bulls (45–50 breeding cows with one breeding bull) and mating was done at the field and registration is done by watchmen. The F1 herds of crossbreeding unit (CBU) are kept and breeding is done by AI for rising of F1 and F2 generations for distributing to the farmers after pregnancy has been confirmed with a subsidized cost. Calves born at the farm are registered, weighed before first suckling, and tagged immediately after birth. Sex of the calf, sires, and dams ID are all also recorded in the field record book and these pieces of information are then transferred to the individual cow's record card and century book; and a new card is entered for each calf. All calves are allowed to run and suckle their dams until they wean. After weaning the best heifers from the pure Fogera breeding unit (FBU), through their performance data (birth and weaning weight, body conformations), were kept as a replacement herd.

2.4. On-Farm Data Source. Primary data was collected from three districts, namely. Fogera, Dera, and Bahir Dar Zuria; those are expected as the source of the breed. From Bahir Dar and Dera districts two Peasant Associations (PAs) and one PA from Fogera district (where Fogera cattle breed conservation and improvement are practiced) were purposively selected based on the distributions of the breed. A total of 150 farmers (30 farmers from each PA), which are knowledgeable and having at least one cattle of Fogera phenotype in their herd, were purposively selected and interviewed. Additionally, farmer's focus group discussion (FGD) was conducted to capture the historical background, population trend, and distribution of the breed.

The questioner data were screened and cross-checked for reliability and consistency; questions which were not clearly addressed were removed. The purpose of livestock keeping, major constraints of the breed, merits and demerits of the breed, and conservation necessities were analyzed and summarized by SPSS [18] and index method. Index was computed with the principle of weighted average according to the following formula:

$$\text{Index} = R_n * C_1 + R_{n-1} * C_2 \cdots R_1 * \frac{C_n}{\sum R_n * C_1 + R_{n-1} * C_2 \cdots R_1}, \quad (1)$$

where R_n is value given for the least ranked level (e.g., if the least rank is 5th rank, then R_{n-5}, $R_{n-1} = 4$, and... $R_1 = 1$). C_n is counts of the least ranked level (in the above example, the count of the 5th rank is C_n, and the counts of the 1st rank are C_1).

2.5. Method to Design Conservation Strategies. To design appropriate conservation strategy and develop a feasible breeding scheme to support and update the existing conservation strategy adopted by ALRC and Metekel sites for Fogera breed [7, 8], detailed evaluations of the existing once were done with the participation of various stakeholders. Two meetings (one national and one regional) were conducted in two rounds to evaluate the existing strategy and to develop feasible strategy based on the current situation of the breed. The stakeholders which were identified as actors on the conservation and improvement plan were Ethiopian Institute of Agricultural Research (EIAR), International Livestock Research Institute (ILRI), Ethiopian Society of Animal Production (ESAP), Ethiopian Institute of Biodiversity (EIB), universities (Bahir Dar and Debre Tabor university), collaborative projects, livestock agency (zone to district level), agriculture bureau and offices, and farmers. The result obtained from the meeting was used to design the conservation strategy and breeding scheme for the breed.

3. Result and Discussion

3.1. The Need for Conservation of Fogera Cattle Breed. Conservation of genetic resources is mainly due to keeping potentially useful genes and gene combinations; providing an insurance policy against climate change; spread of disease; and availability of feedstuffs and cultural reasons [19, 20] so as to properly utilize their potential. Conservation of Fogera cattle breed at Andassa and Metekel ranches had been underway for the past 52 and 28 years, respectively. With unique and preferred characters of the breed, its population and productivity are declined from year to year which bells intervention for conservation and improvement of the breed. The major points for the need of conservation and improvement efforts on the breed are discussed below.

3.1.1. Interrelated Constraints Facing the Breed. The major constraints for genetic conservation and improvement were absence of workable agricultural sector policy, lack of infrastructure, absence of well-defined breeding programs, poor selection strategy, and genetic gain [19, 21, 22].

The survey result summarizes (Table 2) the major constraints that contribute to the decrements of the population as well as its productivity of Fogera cattle at its production environment. Shortage of grazing land/feed which is due to shrinkage of the grazing land for crop diversification and intensification (as Yitaferu [23] indicated from 1982 to 2003, the cropland expanded from 53% to 61%, while grazing lands decreased from 21.2 to 12.6% in some kebeles around Lake Tana of Fogera district); fluctuations of the minimum temperature and increasing trends of the maximum temperature across years (Figure 2) that had an effect on feed quality production and outbreak of disease; and diseases and parasite burden related to the seasonal water load of the grazing land

Table 2: Major constraints for the decreasing performance and population status of Fogera cattle.

Major constraints	Respondents (N = 150)				Score	Index	Rank
	1	2	3	4			
Shrinkage of grazing land	52	14	10	8	278	0.33	1
Shortage of land for feed development and rearing of the breed	32	4	6	2	154	0.18	2
Absence of health follow-up and clinic	2	26	4	2	96	0.11	3
Lack of better breeding bull	4	12	8	0	68	0.08	4
Flood on grazing land and extinction of adaptive grasses	4	10	8	0	62	0.07	5
Lack of family labour to manage the breeds	0	16	4	0	56	0.066	6
Poor management adopted for the breed	4	12	0	0	52	0.061	7
Crossbreeding to upgrade the local breeds	6	4	6	2	50	0.05	8
Admixture of the breed with other highland breeds	2	4	2	0	24	0.02	9

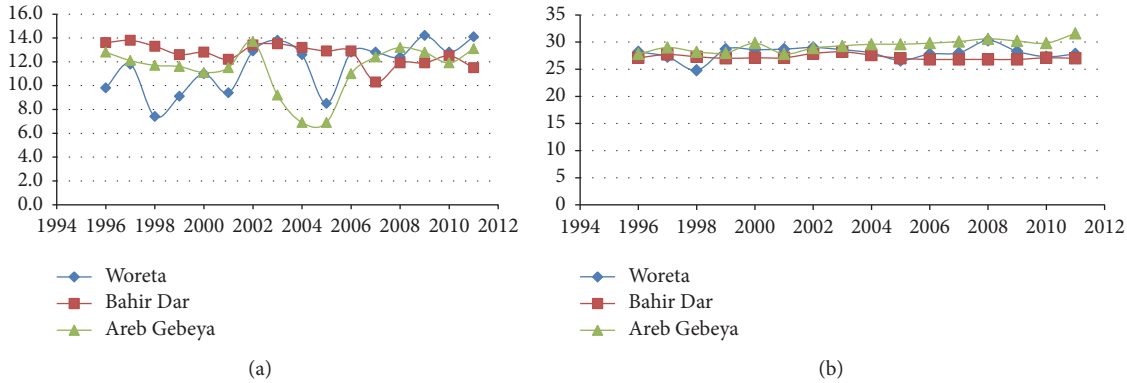

Figure 2: Temperature distribution across years of the working districts city: (a) minimum temperature (b) maximum temperature.

coupled with absence of health clinic (particularly at Fogera district) that were the major ones.

The focus group discussion result indicated that the major constraints were genetic admixture with highland breeds due to movement of the breed from their native areas to adjacent districts to escape the overflooding of Lake Tana and lack of better breeding bull in their production environment. Similar results on major threatening problems of Fogera breed were reported by [13, 15, 24–26]; depletion of genetic resource of Boran breed with similar threats was also reported [27, 28]. Additionally, cattle production constraints, namely. shortage of grazing land (mainly by land degradation), disease prevalence, and lack of veterinary services, were reported [29–31].

3.1.2. Presence of Unique Traits of the Breed. From the survey result and the continuous farmers' discussions, it was indicated that there is preference for Fogera cattle over other breeds due to presence of desired traits in the breed like better milk production, better selling price, better traction power, adaptability to the local environments, ability to disease resistance, and drought resistance. Advantageous and disadvantageous traits of the breed were summarized in Table 3. Additionally, respondents indicated the merits of Fogera cattle breed (Table 4).

3.1.3. Better Attitude of Farmers to Keep the Breed. The result of the survey indicates that interviewed farmers volunteered to continue and expand keeping of Fogera cattle breed (Table 5). Farmers of Fogera district (50%) were confidential to continue in keeping of the breed while farmers (43.33%) of Bahir Dar Zuria district indicated that they were ready to sell and change their production type which might be due to the fact that selected PAs of the district had intensified in irrigation activities and keeping of small number of crossbreeds for milk production.

3.1.4. Decreasing Population Trend of the Breed. From the total respondents used for this study, 86% of them reported that the populations of Fogera breed decrease from time to time. The respondents, 87% of Bahir Dar Zuria district, all of Fogera district, and 78% of Dera district reports, the population of Fogera breed, had declined due to dominancy of small sized zebu breeds through crossbreeding and flock change due to lack of feed and feed staffs.

The population size of the breed had decreased at an alarming rate from 800,000 in 1981 [12], to 86,800 [32], and then to 15,000 [13] based on one working district (Fogera district). Simianer et al. [33] indicated 0.43 as an extinction probability for Fogera cattle, whereas Reist-Marti et al. [34] reported that the extinction probability of the breed had increased to 0.70 and based on this rapid declining of the population, the breed can be regarded as insecure, based on the six domestic populations' risk status level [22]. The populations of Fogera breed also showed a decreased trend at

Table 3: Advantageous and disadvantageous traits of Fogera cattle breed.

Traits	Score	Index	Rank
Advantages			
Better milk production	56	0.23	1
Better selling price	42	0.17	2
Better traction power	39	0.16	3
For fattening	15	0.06	5
Hide	13	0.054	6
Long living	0	0	
Low feed consumption	0	0	
Light heavy for mud	0	0	
Manure source	11	0.049	7
Fast growing	15	0.06	5
Disease resistance ability	13	0.05	6
Better butter production	6	0.03	8
Adaptability	26	0.11	4
Drought resistance	3	0.01	9
High fertility	1	0.004	10
Total	240		
Disadvantages			
Short living	12	0.18	2
High feed consumption	42	0.63	1
Heavy for mud	2	0.03	4
Low milk production	0	0	
Low selling price	0	0	
Low traction power	0	0	
Low growth for traction	0	0	
Not safe for fattening	0	0	
Low milk production than exotic	1	0.015	5
Low adaptability	0	0	
Low fertility	9	0.136	3
Total	66		

the two ex situ conservation sites (Figure 3) due to shrinkage of the center's total land holding for crop seed multiplications and less attention given for the conservation of indigenous livestock resources.

3.2. Community-Based In Situ Conservation for Fogera Cattle Breed. The failure of conservation strategies in many African countries was due to the implementation of the strategy without clear policies, regulatory frameworks, resulting in indiscriminate, uncoordinated or uncontrolled crossbreeding activities and with limited involvement of farmers who are the final beneficiaries [35, 36]. To overcome this failure, community-based conservation has received increasing attention from the realization that most creative and productive activities of individuals or groups in society take place in communities [37].

In the implementation of community-based in situ conservation, different steps had been followed to ensure the

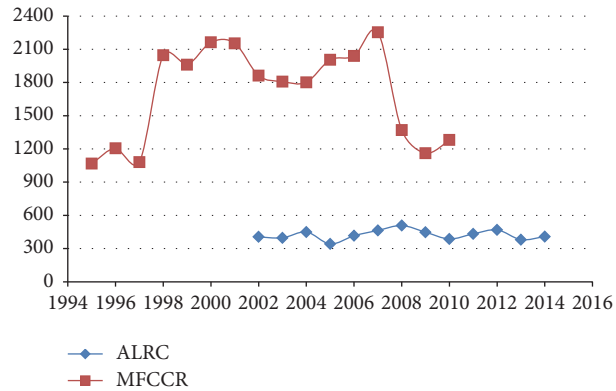

Figure 3: Total population trend of Fogera cattle at Andassa Livestock Research Center (ALRC) and Metekel Fogera cattle conservation ranch (MFCCR).

sustainability of the conservation as well as improvement strategy. From the beginning, documentation of the available resources and major livelihood of the community should be well analyzed. Finally, the impact of the strategy on the improvement of the livelihood of the community via the improvement of the local breeds under threat had been analyzed and extension and/or terminations will be followed. Figure 4 summarizes steps for the implementation of community-based conservation programme for local cattle breeds to sustainable rural livelihoods.

Community-based in situ conservation strategy helps to establish a linkage between ex situ and in situ conservation strategies. This benefits developing a continuous linkage between the nucleus herd at ALRC and village herds. In situ and ex situ conservations are seen as complementary in a way that maximizes the retention and continued evolution of the genetic qualities of farmers' varieties [38]. They also aim to avoid the loss of variation during rejuvenation and maintenance in formal gene banks. For the realization and maintenance of the breed property and pureness, breeding scheme that integrates the merits of station-based nucleus herd and village (community-based) breeding is designed; the scheme and its application are discussed below.

3.3. Closed Breeding Scheme: For the Conservation Strategy of Fogera Cattle Breed. There was one-way gene flow, downward from top to bottom. This means that the only source of collective genetic progress in the commercial at the top of the pyramid in the nucleus populations [39]. The breeding scheme designed and implemented for Fogera cattle at Andassa Livestock Research Center was open breeding scheme since 2007 [40]. Due to lack of identification of the pure line of the Fogera breed through molecular evidences, level of genetic admixture of the pure line with the highland zebu breeds, and inbreeding between relatives at the village herd due to lack/absence of selected breeding bull, the open nucleus breeding scheme will not be implementable. Therefore, to cope with these problems and based on the current situation of the breed, closed breeding scheme is designed (Figure 5).

Table 4: Functional traits played by Fogera cattle for the community.

Functions	Component traits
Traction/draft power	(i) Long leg for the black soil and waterlogging areas, strength to hold the harness device, docile temperament
Milk production	(ii) Total milk yield, lactation length, persistency, relatively short calving interval, mothering ability, calf crop production, good fertility
Adaptation	(iii) Adaptation on water logged areas, disease resistance and tolerance to parasite load, walking ability
Beef production	(iv) Better birth and weaning weight, weight gain, weaning age, body conformation, relatively voracious feeding habit, disease resistance, ease of calving and better milk production

Source: focus group discussion of farmers and district experts.

Table 5: Attitude of farmers in keeping of Fogera cattle breed.

Districts	Attitude of the interviewed farmers				
	Confidential to keep	Certain to keep	Ready to sell and change	Need to expand	Hard to judge
Overall	15.35	24.66	20	32.66	7.33
Fogera	50	20	6.66	23.34	0
Bahir Dar Zuria	13.33	33.34	43.33	10	0
Dera	0	18.33	3.34	60	18.33

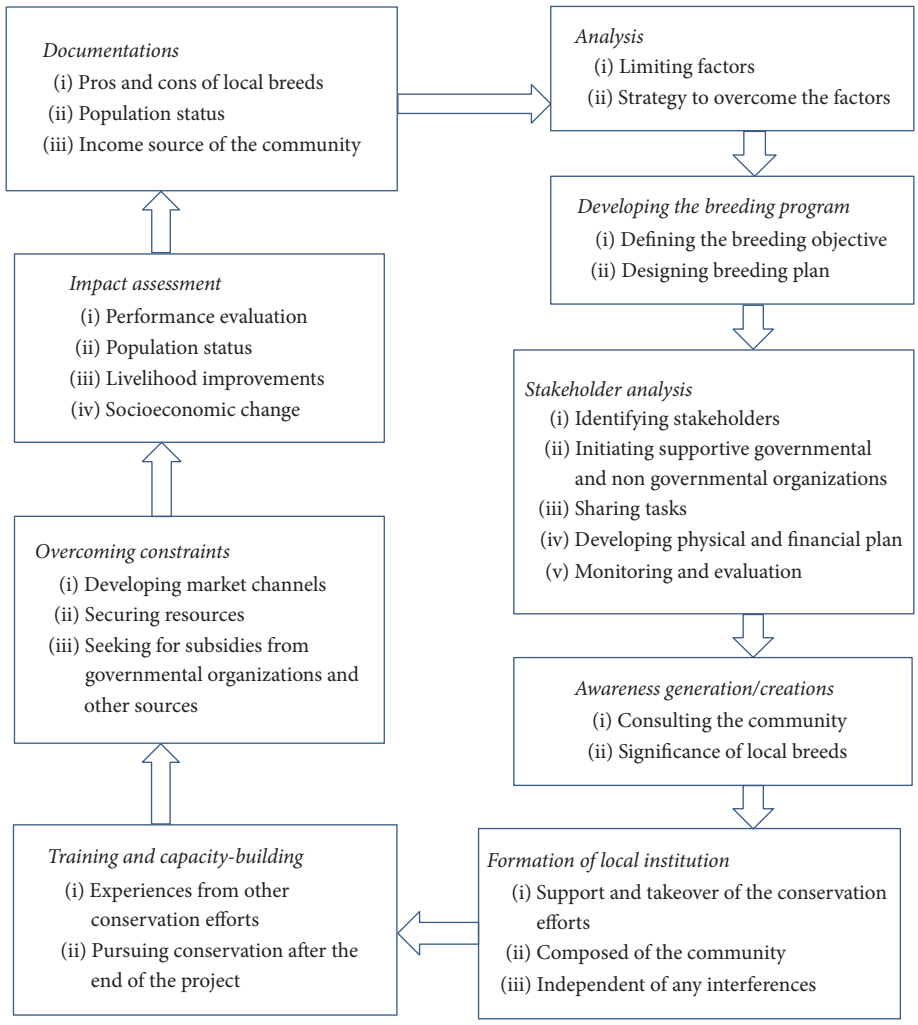

Figure 4: Steps for the implementation of community-based conservation program for local cattle breeds for sustainable rural livelihoods.

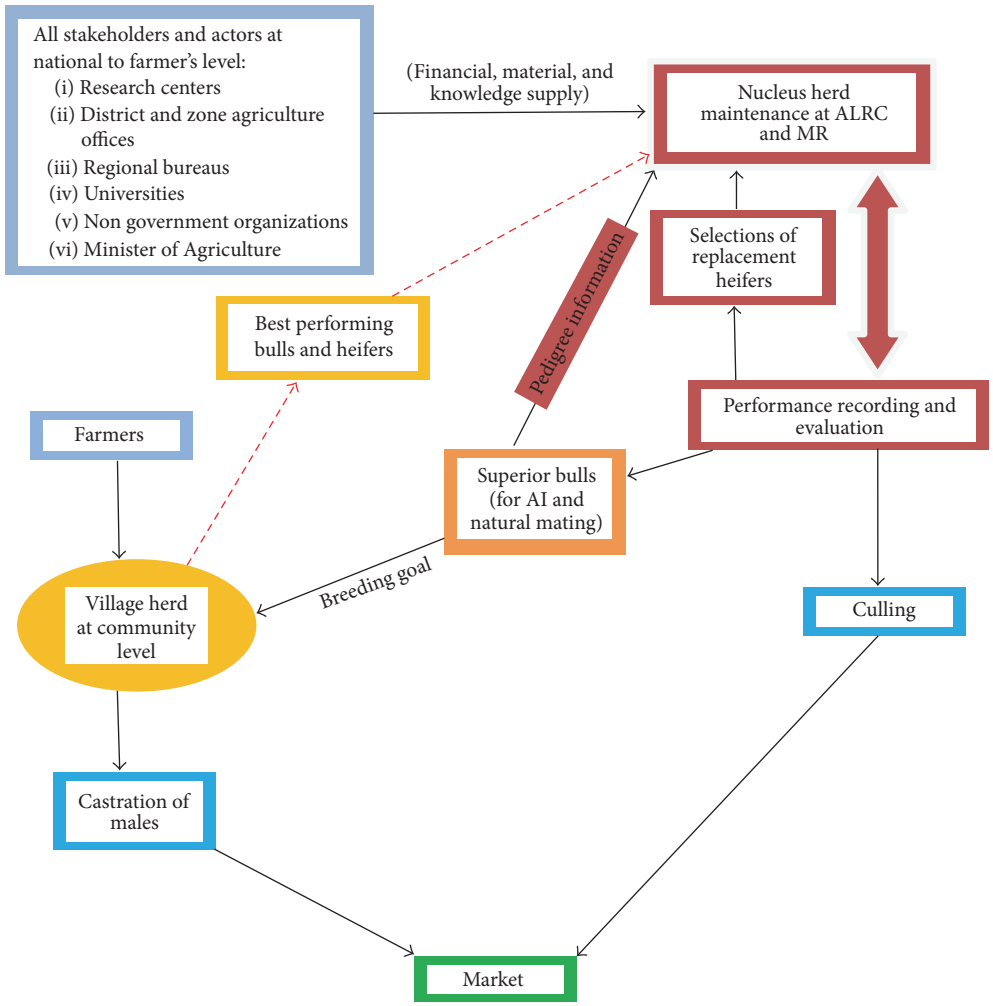

Figure 5: Closed breeding scheme for conservation and sustainable use of Fogera cattle breed.

3.3.1. Nucleus Herd Maintenance. A typical breed structure consists of 3 tiers in the shape of pyramid. Nucleus tier consists of herds that breed their own male and female replacement [39]. Maintaining of nucleus herd has an advantage of utilization as conservation technique for genetic resources, improved accuracy of testing and recording due to a better controlled environment, recording of additional and secondary traits easier, reduction of generation interval, and higher reproduction rate of superior dams [19]. The available herd at Andassa and Metekel ranch will be used as a nucleus herd and superior pure bull source for the village herd at the community level after performance evaluation. Heifers and bulls will be selected based on their pedigree, milk production of their dams, birth and weaning weight, breed characteristics, and general body conformation or morphology [27, 40]. The heifers selected from the performance record will be used as a replacement herd of the nucleus herd, whereas the better performing young bulls will be used as (1) breeding bull for the nucleus herd based on the pedigree and (2) breeding bull for the village herders at the community-based conservation site.

3.3.2. Village Herds. The village herds will be selected from the typical kebele where the pure breed is expected to be available [13]. Willing farmers with Fogera cattle herd will be selected and breeding associations will be built for the use of the selected breeding bull. There will be legal participation rule to subsidize their role in protecting environments and landscapes by maintaining low-input breeds instead of switching to more profitable high-input and high-residue production systems [38]. As the breeding scheme is closed, there will not be a heifer selection for the nucleus herd. But in case, if the nucleus herd will be affected by natural of artificial (human made) problems, there will be a probability of the strategy (Figure 5, broken lines) to introduce better Fogera phenotypes at expected native site of the breed. Performance record will be kept for the evaluations of improvement of the program. In the village herders, the male animals will be castrated for fattening and/or traction power.

3.4. Stakeholders and Their Role in the Conservation and Improvement Program. For better utilization and conservation of AnGR, a well-coordinated institutional arrangement

Table 6: Major stakeholders and their role in the conservation strategy of Fogera cattle.

Stakeholders	Mandates in the conservation measure
Andassa Livestock Research Center (ARARI)	(i) Collaborating, leading, and managing the conservation and improvement measures
	(ii) Maintaining a nucleus herd at the center and following implementations of the strategy
	(iii) Developing data base; analysis and organizing reports
Regional Livestock Agency	(i) Delivering training for the experts and local farmers at the conservation areas
	(ii) Delivering inputs for the conservation measures, namely, medicaments, Fogera breed semen, breeding bulls for breeding strategy for restocking, and genetic improvement measures
	(iii) Coordinating the zonal and district level officials on the participation of the conservation strategies
	(iv) Expanding the strategy to other districts, which are expected to be the native areas of the breed
	(v)Developing and applying the Fogera cattle usage modality
Institute of Biodiversity Conservation	(i) Community initiation, mobilization, and budget support for the conservation strategy
	(ii) Participating in the conservation strategies side with ALRC (e.g., working at Man-Endaba monastery)
	(iii) Sharing the practices, knowledge, and materials with the research center
Universities and international research institutes	(i) Working side line activities for the conservation strategy
	(ii) Working on knowledge based activities that support the strategy
	(iii) Training for proactive community members on further tasks related to the conservation strategy
Zonal agricultural offices	(i) Developing income generating activities for the selected farmers together with the research center
	(ii) Expanding the model works initiated by the research center to neighboring PAs and selected native districts of the breed
	(iii) Coordinating district and PAs extension workers to work on the conservation effort via developing a monitoring modality

is a key issue. The arrangement should include dissemination of information and networking at regional and international level [24]. The number, type, and role of stakeholders participating in the conservation strategy may vary depending on the number and type of activities shared by the conservation measure. The basic points in stakeholder analysis are identifying the direct participants in contact with breed and defining their role [20, 27] and accountability of them for their role in the conservation program.

To develop the conservation and improvement strategy and to identify the stakeholders participating in the strategy of Fogera breed, workshop with a theme of *"Fogera cattle conservation and improvement program stakeholders meeting"* was held by the coordinating effort of ALRC with a finance support of Ethiopian Nile Irrigation and Drainage Project (ENIDP) that participate in various stakeholders at national, regional, and zone to district levels. Two meetings were held in two rounds; the first meeting was a national meeting held at Andassa Livestock Research Center in November 17, 2013, and the second was regional meeting done at Woreta and Gondar towns in June 10-11, 2014. Based on the reports of the meetings, the target actors and their mandates in the conservation measures were summarized in Table 6.

3.5. Related Activities with the Community-Based In Situ Conservation Strategy. Conservation of Farm Animal Genetic Resources (FAnGR) refers to all human activities including strategies, plans, polices, and actions undertaken to ensure that the diversity of FAnGR is maintained to contribute to food and agricultural production and productivity, now and in the future [37]. The conservation and improvement strategy beyond the ideal breeding program need other interventions, notably, access to improved and affordable health services, market information and market services, improved infrastructure, as well as supportive policies, adequate and quality feed resources, and supply all year round [19, 41]. The strategy under implementation should also adopt an integrated approach; that is, the program should include improvement of the production environment, mainly where in situ conservation had been conducted [42]. For the improvement of the production environment, the following strategies will be adopted prior to and side to side with the conservation and improvement strategy developed for Fogera cattle breed.

3.5.1. Feed Development Interventions. A major constraint to livestock production in developing countries is the scarcity

(a) (b)

Figure 6: Assendabo (*Phalaris paradoxa*) (a) and Amekela (*Asteracantha longifolia*) invaded grazing land (b).

and fluctuating quantity and quality of the year-round feed supply [43]. Livestock feed is the major constraint for the failure of conservation as well as productivity of a breed [33, 37].

As the survey result indicates, feed shortage occurs during April, May, and June of each year based on their severity, and majorly feed development intervention strategies need to be implemented in these months. Fogera district is a potential producer of rice straw for animal feed which is low in its nutritive value and palatability; so urea treatment to improve the nutritive value of the rice straw will be implemented; as the conservation site where the community participation was implemented is water logged area, adaptive grass like the native grass of the area (Figure 6(a)) and other water loving grass cultivars (e.g., *densho*, and *brackia* species) will be demonstrated and expanded. Additionally, grazing management (weeding and eradication of unpalatable weeds) (Figure 6(b)) will be conducted for the potential use of the available grazing land. On top of this, backyard forage development with sesbania (*Sesbania sesban*), elephant grass (*Pennisetum purpureum*), and other forage trees will be implemented.

3.5.2. Community-Based Animal Health Workers (CAHWs). CAHWs are trained farmers on animal health with closed follow-up by veterinarians to serve the community with low cost per treatment. They have served to fill a large gap in extension services and have enabled more people to access vital information and services to protect the livestock which the formal veterinary services often do not reach. In addition paravets were also considered as more flexible in charging and providing services on credit in emergencies [44]. This intervention has being adopted for 10 years in many African countries to help the pastoralists where the government health workers are unreachable [44, 45]. The strategy was also evaluated and adopted by Andassa Livestock Research Center for selected watershed areas of Amhara region during 2012/13, and the paravets still serve the farmers. The strategy ensures the work of selected farmers from the villagers after they got practical and theoretical training from ALRC with a least cost per animal. The technicians will be based on AU [46] policy on community-based animal health worker. Adopting this strategy for Fogera cattle conservation and improvement strategy ensures a day to day treatment as well as control of major diseases occurring at the conservation area.

3.5.3. Market Linkage. Field studies in different parts of the highland of Ethiopia show that livestock account for 37–87% of total farm cash income of farmers, indicating the importance of livestock in rural livelihood [47]. Market provides the mechanism whereby producers exchange their livestock and livestock products for cash [48]. The major livestock marketing constraints are categorized in infrastructural, policy-related, and institutional constraints that include lack of access to formal financial systems and credit, onerous and nontransparent taxation systems, limited investment in communication and infrastructure, poor market supply, and poor forward and backward linkages [47, 49].

The area where conservation was implemented is 30 kms far from Woreta town, capital of Fogera district; this needs a market linkage for the animal products produced from the site. In the market line, fattened bulls which will be culled from the village herd as well as additional milk and dairy product need a market and this will be adopted as a strategy for improving the production environments. Additionally, cooperatives will be developed for marketing their products and to purchase livestock and other agricultural technology.

4. Conclusion and Recommendations

Interrelated problems that web the production system of the breed favor the decrement of the population and productivity of Fogera cattle breed. This coupled with availability of unique traits of the breed at the production system seeks for conservation measure; and community-based in situ conservation measure to ensure the participation of the owner of the breeds was designed. For the adoption of the new conservation measure, closed breeding scheme that integrated the two ex situ conservation sites (ALRC and MFCCR) and the village (community) conservation site was developed. To realize the conservation of Fogera cattle, stakeholders like regional livestock agency for assurance of required input, IBC for both financial and knowledge participations, universities and international research institutes for knowledge support, and

zone and district agriculture offices for direct involvement in the conservation and improvement strategy were analyzed and tasks were shared.

(i) The involvement of stakeholders in the conservation of the breed during the previous years was limited. But now meetings that indicate the participation and support of various stakeholders were done and each stakeholder that had been analyzed and promised to participate in the strategy should honestly and accountably participate to safeguard the asset of the country.

(ii) In many conservation strategies, failure because of lack of community participation and absence of supportive policy and lack of budget was reported and the previous conservation strategies of Fogera breed did not result as expected as the history of the center considered due to similar reasons. Therefore, incentives and subsidies for the community participants (which could be directly or indirectly to create income generating activities) and continuous budgeting system for the research center and the ranch should better be designed and government support towards the strategy should be boldly realized.

Competing Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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