

Available online at <http://www.ijims.com>  
ISSN: 2348 – 0343

## Conservation of Indigenous Donkey Breeds of Ethiopia: A Review

Befikadu Zewdie\*, Kiflay Welday, Sanjoy Kumar Pal

School of Animal and Range Sciences, College of Agriculture and Environmental Sciences,  
Post Box: 138, Haramaya University, Dire Dawa, Ethiopia

\*Corresponding Author: Befikadu Zewdie

### Abstract

The donkey is indigenous to the African continent and its wild progenitor is usually considered to be the Nubian wild ass. Domestic donkeys are the least studied and neglected mammals of the world. Ethiopia has one of the largest donkey populations in the world and nearly possesses 40% of Africa's equine population. Ethiopia is also considered as a home to a considerable number of indigenous donkey populations. Livestock is considered to be the backbone of the national economy and donkey plays an important role in it. However, despite of these factors indigenous donkey has received very little scientific attention. This has led to erosion to the indigenous donkey genetic resources of the country. Donkey have been given the least attention and remained marginalized in the national agricultural research systems and livestock development programs in Ethiopia. Moreover, donkeys are still not widely accepted as farm animals. The current state of knowledge on breed level characterization information is inadequate, and generates low level of research interest on conservation of donkey genetic resources. As a result, the loss and/or decline of genetic diversity contributes major problem towards developmental interventions. Donkeys are one of the major sources of draught power, transport, fuel and security for the family in crisis. In Ethiopia there is a saying among farmers that "Without a donkey, my wife and I become the donkeys". This signifies that how heavily rural people had to depend on donkey. Therefore, there is an urgent need to focus attention on proper characterization and serious efforts for the conservation of the indigenous donkey genetic resources.

**Keywords:** Breed, Conservation, Donkey, Ethiopia

### Introduction

The donkey (*Equus asinus*) is indigenous to the African continent and its wild progenitor is usually considered to be the Nubian wild ass<sup>1</sup>. Archaeological evidence and molecular data<sup>1</sup> suggests that donkeys may have been domesticated 5000 years ago in Africa<sup>2</sup>. Ethiopia has an estimated over 5 million donkeys<sup>3,4</sup>, which is the second largest donkey population in the world after China and nearly 40% of Africa's equine population<sup>5</sup>. Thus, it is home to a considerable number of indigenous donkey populations. After human labour, the donkey is the cheapest form of agricultural power and therefore, within reach of the 'poorest of the poor'. Donkeys are essential to the livelihoods of many households in rural and urban areas of Ethiopia, relieving families from repetitive and energy-consuming tasks. Equines are the most important animals in the farming and transport systems of Ethiopia<sup>6</sup>. They are important animals to the resource-poor communities in both rural and urban areas, providing traction power and transport services at low cost, and in the remote areas of Ethiopia<sup>7</sup>. It is estimated that 75 percent of farms in the country are located more than a day and a half's walk from all-weather roads, and animals are therefore, vital for the transportation of farm produce to the market. Studies have shown that apart from help in transport, donkeys play a significant role in helping to empower women in many developing nations<sup>8</sup>. Donkeys' assistance in traditionally time-consuming and arduous domestic chores, such as fetching water and gathering firewood, helps give

women more time and opportunity to earn extra money and for community involvement, both important aspects in raising female status. It also helps in transporting farm produce to homesteads and market places, and agricultural inputs to farms<sup>9,10</sup>.

Domestic donkeys are the least studied and neglected mammals of the world<sup>11</sup> and recent studies<sup>12,13</sup> revealed that domestication events and historical processes of domestic donkeys is still an on-going debate. Despite the fact that donkeys are important in the development of rural economy, however, it generally received very little scientific attention. Donkeys have a generally low social status and this presumably arises from its perceived low productivity as a single purpose animal compared to cattle that may provide milk, power and meat as well as having a social and financial security function<sup>14</sup>. In Ethiopia, 56% of households kept donkeys mainly for pack services (to generate income and homestead use), 26% for cart use (to generate income), and 14% for pack use but exclusively for homestead use and 4% exclusively for renting, breeding or petty trade<sup>15</sup>. In spite of this the knowledge about donkeys and their husbandry is very low. Often in the rural and urban areas, donkeys are not kept properly, because of misplaced love for animals and that they are without any value. Indigenous animal genetic resources, a majority of which are found in developing countries, are believed to preserve much of the current global genetic diversity with millions of people directly depending on them for the livelihood<sup>16</sup>. The long-term effect on global biodiversity, the huge loss of livestock genetic diversity in developing countries will seriously undermine the efforts towards achieving food security and poverty reduction. In Ethiopia, little comprehensive effort has been exerted to systematically conserve and utilize donkey genetic resources. The current state of knowledge on breed level characterization information is inadequate, and generates low level of research interest on conservation of donkey genetic resources. As a result, the loss and/or decline of genetic diversity contributes major problem towards developmental interventions.

### **Ethiopian Donkey Population**

Based phenotypic and physical characteristics like average size and coat colour initially, four types of donkeys were recognised in Ethiopia: Jimma, Abyssinian, Ogaden and Sennar<sup>17</sup>. However, more recent nationwide studies done at molecular level identified six distinct domestic donkey populations namely Abyssinian, Afar, Hararghe, Ogaden, Omo and Sinnar but rejected a previously misidentified Jimma donkey as it failed to meet standard breed identification criteria<sup>18</sup>.

Nationwide exploratory characterizations of Ethiopian donkey populations showed that, most of the variations in the morphological character systems vary with eco-geographical patterns and biophysical resources. However, whether the variations in these morphological traits are caused by adaptive or non-adaptive sources still needed to be further verified by comparing between relative levels of population divergence in quantitative traits and neutral DNA markers. Therefore, other morphometric variables and corporal indices need to be further incorporated and used to fully characterize and describe donkey populations in Ethiopia. Furthermore, like as for other livestock species, a standardized and uniform morphological descriptors and guidelines need to be developed and used at wider scale in equines in general and in donkeys in particular. It was reported that in Ethiopian domestic donkey populations about ninety-two percent of the total variations are attributed to within population variation while only 8% attributed to between population genetic variations<sup>18</sup>. Such within population variations could be used as a raw material for selection and further genetic improvements and the traditional domestic donkey classification systems in Ethiopia. Genetic differentiation estimate based on microsatellite marker loci variation also supports the uniqueness of Sinnar donkey population in Ethiopia.

### **Threats for the Decline of Genetic Diversity**

Genetic diversity is potentially threatened by a variety of factors, whose effects may be felt in a number of ways – undermining the production systems of which Animal Genetic Resources (AnGR) form a part; physically destroying

livestock populations; or provoking responses that are in themselves a threat. Driving forces of genetic erosion are also diverse in terms of the extent to which they are amenable to influence by policy interventions or, if they cannot be prevented, with respect to whether measures can be put in place to lessen their effects on AnGR diversity. In literature, there is broad agreement regarding the general trends and factors threatening AnGR<sup>16</sup> identify the use of exotic germplasm, changes in production systems, changes in producer preference because of socio-economic factors, and a range of disasters (drought, famine, disease epidemics, civil strife/ war) as the major causes of genetic erosion. These factors in relation to decline in genetic diversity of the indigenous donkey population are discussed here:

***i.) Health and disease control measures***

Throughout the world, and in all production systems, livestock diseases lead to mortality and reduced productivity in farm animals, necessitate expenditures for prevention and control, constrain the objectives of livestock keepers, limit economic development, and threaten human public health. Animal health constraints greatly influence decision-making with respect to livestock keeping and the utilization of genetic resources. The diseases in question are, in many cases, transboundary diseases, outbreaks of which have severe consequences for international trade. Serious threats to human health from zoonotic diseases, particularly on an international scale, also motivate strong disease control measures. In recent years, numerous economically disastrous livestock disease epidemics, and particularly the emergence of highly pathogenic avian influenza (HPAI), have focused attention on the need for better control and prevention of transboundary diseases<sup>19</sup>. Epidemics potentially threaten AnGR as a result of livestock deaths from disease or slaughter policies. The impact on genetic resources cannot be quantified simply in terms of the numbers of dead animals. The risk of erosion is likely to be greatest where rare breeds are confined to areas severely affected by a disease outbreak, or where a disease disproportionately affects production systems where rare genetic resources or those with specific adaptations are to be found. African horse sickness is a serious, often fatal, arthropod-borne viral disease of horses, donkeys, zebras and mules. The mortality rate can be as high as 95% in some forms of this disease. A study was conducted with the aims of determining the seroprevalence and risk factors of African Horse Sickness (AHS) in mules and donkeys in selected sites of West Amhara region<sup>3</sup>. The prevalence of AHS was found to 59.3% in donkeys. Of the 100 equine owners interviewed about AHS 75% of the respondents know nothing regarding the disease AHS. Hence, the knowledge of equine owners about AHS was assessed to be at infancy. This suggests the need to implement strict awareness creation among equine owners on vaccination of their animals and methods of insect control in the study area in order to decrease the prevalence of AHS. Parasitic helminthes are one of the most common factors that constrain the health and working performance of donkeys worldwide. Parasites cause various degree of damage depending on the species and number present, nutritional and the immune status of equids. In donkeys, infection by endoparasites is responsible for problems including poor body condition, reduced power output, diarrhea colic, emaciation, impaired growth, poor reproductive performance, short lifespan and predisposition to other infections diseases<sup>20</sup>. A cross sectional study conducted to determine the species composition and prevalence of endoparasites of donkey in Sululta and Gefersa district of central Oromia was done<sup>21</sup>. Coprological examinations showed prevalence of 99.5 strongyles, 53% *Parascaris equorum*, 9.8% Fasciola species, 5.7% *Gastrodiscus aegypticus* and 2.8% Anoplocephala species. Post-mortem examination revealed that all the donkeys were positive for either one or ten different species of parasites. The overall worm count ranged from 266-14112 with mean of 1597 worm per donkey. The results of the current investigation indicates that Ethiopia donkey have a high prevalence of endoparasites. Kumar *et al.*<sup>22</sup> studied the working donkeys in Mekelle city and found that donkeys suffer from various problems like skin diseases, wound

prevalence, external parasites, musculo-skeletal problems etc. They recommended starting a comprehensive donkey health management and welfare promotion program.

### ***ii.) Disasters and emergencies***

Disasters such as droughts, floods, hurricanes, tsunamis, earthquakes, war and civil unrest have devastating impacts on lives and livelihoods around the world. Moreover, the frequency of many types of disaster is increasing. Hydrometeorological and geophysical disasters became, respectively, 68 percent and 62 percent more frequent over the decade between 1994 and 2003<sup>23</sup>. Despite a vast output of literature on disasters, emergencies and recovery efforts, the impact of such events on the livestock sector has received relatively little attention. Accurate data are vital for identifying trends in disaster impacts, and for prioritizing risk reduction strategies<sup>24</sup>. Under such high mortality rates, small populations are at risk if no measures are taken, as the rate of inbreeding increases due to decreases in the effective population size<sup>25</sup>. Livestock species composition can also be affected by disasters that induce modification of existing agricultural production systems. This can occur through direct losses in plant and animal genetic material, as well as changes in the species composition of forages, pastures and other ecosystem components. An example of such composition changes is the fact that camel and goat populations are increasing.

A study is made in access to drinking water and forage, result showed that, limited access to drinking water and forage, recurrent drought and interbreeding with domestic donkey are potential threats to the Somali wild ass in their current habitat in Eritrea and Ethiopia<sup>26</sup>. Useful disaster-related data are increasingly available, but coverage of the livestock sector remains quite limited. Therefore, without external interventions, recovery of the livestock sector is a slow process, with the restoration of herds taking place over many years. Where restocking is undertaken by external agents such as donors and NGOs, recovery of the livestock economy is rapidly accelerated. While farmers generally cannot obtain animals from outside the locality, external agents can. Local livestock economies destroyed by the catastrophe can, thus, be rapidly jump-started. However, the unintentional consequence may be large-scale and irreversible changes to the genetic make-up of local livestock populations<sup>27</sup>.

### ***iii.) Change in natural Environment***

The Millennium Ecosystem Assessment concludes that, the degradation of ecosystems could become significantly worse during the first half of this century, and be a barrier to achieving the Millennium Development Goals. Recent changes in climate, especially warmer regional temperatures, have already affected biodiversity and ecosystems, particularly in dry land environments such as the African Sahel. Global climate change is likely to have significant impact on the world's environment. In general, the faster the changes, the greater will be the risk of adverse effects. A study is made in the effect of climate change on animal genetic diversity, Ethiopia has limited capacity and resources for designing and implementing conservation programs to its domestic animal genetic resources at risk. On the other hand, changes in climate, particularly increase in temperature affects a diverse set of physical and biological systems in many parts of the world in turn breeds often possess unique genetic traits that enable their survival in a diverse range of production environments with intense stresses, such as severe feed and water shortages, and diseases and drought<sup>28</sup>. Nomadism and transhumance in the lower altitude areas have shrunk pastoral land area; and resulted in massive interbreeding between traditionally isolated livestock. This have severely eroded the genetic diversity of indigenous livestock, especially cattle and poultry. Yet not much has been done to document the existing indigenous donkey including other livestock breeds and the impacts of agricultural development, increasing human populations and the booms and bursts in livestock population numbers associated with periodic good years and bad year's populations<sup>29</sup>.

#### *iv.) Livestock Policy*

Public policies can be seen as forces that add to the drivers and influence changes in the sector with the aim of achieving a particular set of societal objectives. Policies are designed and adjusted, taking into account the state of markets, available technologies and natural resources, and the current status of the sector. Experience in both developed and developing countries confirms that a *laissez-faire* approach, simply standing back and allowing market forces to play out, is not a viable option. In the absence of effective policies, many of the hidden costs of expanding livestock production – environmental degradation, disruption of the livelihoods of poor traditional livestock keepers, and threats to veterinary and human public health, are eventually borne by governments and the public. The important known causes of loss of donkey genetic diversity in Ethiopia is neglect, besides, recurrent drought, political instability and weak development interventions. Little comprehensive effort has been exerted to systematically conserve and wisely utilize animal genetic resources in Ethiopia. The only substantive attempts were the establishment of breeding ranches for cattle, sheep and recently goats, however, they are among the least studied mammals of the world, particularly in the developing world where they provide greater ranges of services combating the erosion of animal genetic diversity and at using animal genetic resources sustainably<sup>30</sup>. The perception that the specialized (milk, meat, egg, etc), high-producing (under temperate conditions) European breeds are also ‘best’ for tropical developing countries persists. This notion do not hold good for donkeys.

#### *v.) Socio-economic Factors*

Ethiopia has long been recognized as a center of diversity for domestic animal genetic resources. It appears that the country has served as a gateway to genetic material from Asia to Africa and its diverse ecology gave rise to further diversification and thus contributed to develop the large number of genotypes the country host today. Loss of local breeds will cause cultural erosion and diminish the ability of communities to maintain their cultures and livelihoods<sup>30</sup>. It is a know fact that donkeys generally have low social status and this presumably arises from its perceived low productivity as a single purpose animal compared to cattle<sup>14</sup>. Moreover, donkey have been given the least attention and remained marginalized in the national agricultural research systems and livestock development programs in Ethiopia. Structural changes in the livestock sector may result in a situation where the previous keepers of a breed are no longer in a position to maintain it: in such circumstances, other ways need to be identified to preserve the breed, as part of the country’s and global heritage of animal genetic resources<sup>29</sup>. Recent years have witnessed unprecedented migration of labour force from rural to urban areas in search of employment. Lack of man power has resulted in loss of traditional knowledge associated with livestock keeping<sup>31</sup>. A study on eastern Africa Somali wild ass indicated that it is threatened because it is hunted for food and medicinal purpose; the body parts and soup made from bones are used for treating tuberculosis, constipation, rheumatism, backache and bone ache<sup>32,33</sup>. In Ethiopia donkeys are often left to roam in the night or housed in small wooden huts in rural areas, hyena attack is a common feature. Donkeys often get serious injured from such attacks.

**The Donkey Sanctuary:** A large Devon based charity has set up a clinic in Debre Zeit, a town just south of Addis Ababa. It is having an operating theatre, in patient facilities, radiography equipment and a laboratory. It is manned by Ethiopian veterinarians and animal health assistants who are experts in donkey medicine and surgery. All the treatment given by the Donkey Sanctuary is free of charge. The sanctuary also has a mobile clinic consisting of a four wheel drive vehicle. The team of veterinarians and animal health assistants visits villages and can treat over 500 donkeys in one visit to a site. The most serious cases would be asked to come to the clinic in Debre Zeit to be kept as an in patients, the clinic has a small trailer to transport those from distant areas. The mobile clinic carries the usual set of equine drugs, including phenylbutazone, penstrep, TMPS granules etc., and equipment such as stomach tubes, tooth rasps, hoof knives and basic

surgical equipment for stitch ups. In fact the majority of clinical problems can be treated at the mobile clinic but unfortunately treatment is often limited because follow up visits are not possible unless they are close to Debre Zeit<sup>34</sup>.

### **Conservation of Ethiopian Donkey**

A trans-boundary conservation policy is needed to keep the donkey as a part of the Ethiopian living cultural heritage. Besides the description, the numbers of animals, breeds and strains, also basic information about the recent use and role of the donkey is needed. In a time where everything has to have an economic value, we should remember that the cultural value just cannot be quantified monetarily. The donkey has been used as a working animal for at least 5000 years. In Ethiopia more than 99% of the livestock breeds that are found in the rural sedentary areas of the country are indigenous. This large number of donkeys that found in the country is of great value in terms of the genetic resources. The relative importance of agriculture in total GDP is greatest in developing regions, with the highest proportion being in Africa<sup>30</sup>. The livelihoods of a majority of these people will depend to a greater or lesser extent on livestock; principally they are used as pack animals or for draught work in transport or agriculture. There is increasing interest in use of donkeys as draft animals; however, there is little published information on their biology<sup>35</sup>. The need to improve the reproductive performance of indigenous breeds of donkeys has not received the attention it deserves<sup>36</sup>. The knowledge about donkeys and their husbandry is still very low among the villager

The conservation strategy of Ethiopia (CSE) was developed in 1989, while the Environmental Policy of Ethiopia (EPE) was approved in 1997 with a goal to improve and enhance the health and quality of life of the people and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of the future generations to meet their own needs. In June 1998, the Institute of Biodiversity Conservation and Research (IBCR) was established and the National Policy on Biodiversity Conservation and Research was published in the same year. The idea was to create awareness for the conservation and sustainable utilization of genetic resources. It also urges the group of stakeholders involved in the farm animal genetic resources: farmers and their organizations, governmental organizations, breeding companies, education and research institutions and organization of hobby breeders to adopt the convention. Priorities areas was set in the Global Plan of Action (GPA), strategic focuses on characterization, inventory and monitoring of trends and associated risks with animal genetic resources and sustainable use and development and conservation, respectively<sup>30</sup>.

Although Ethiopia has a large and diverse livestock resource, a clear cut 'National Livestock Breeding Policy' is not yet in place. However, currently the Ethiopian Agricultural Research Organization (EARO), the Ministry of Agriculture (MoA), some Ethiopian universities, the IBCR and other institutions and organizations are making efforts to formulate the National Livestock Breeding Policies<sup>37</sup>. The CSE took a holistic view of the use of natural, human-made and cultural resources. The purpose of the CSE has been to assess the status and trends in the use and management of the resource base of the country, the formulation of a policy and strategy framework and the development of a Federal Action Plan and Investment Programme, including legislative measures and management and operational arrangements for implementation<sup>37</sup>. Until 2003, interventions made in livestock development had overlooked the equine resources. However, the government has now paid due attention to these resources by establishing a Draft and Pack Animals Resources Development Team under the Animal and Fisheries Resources Development Department of MoARD. In addition to these activities, the Donkey Health and Welfare Trust, based at the Faculty of Veterinary Medicine in Debre Zeit, is undertaking surveys and studies related to the utilization and health care of equines in general and of donkey in particular. These activities are currently being

undertaken in Amhara, Oromia and Tigray regions. A series of programs and projects aimed at increasing food and animal production which may affect management of farm animal genetic resources have been undertaken both at institutional and producers level. The overall objective was achieving increased livestock production and productivity, and thereby enhancing its contribution to food security and the national economy.

Demographic data are fundamental to the assessment of the risk status of livestock breeds a key step in the strategic planning of AnGR management. Risk status depends on several factors. First, it is linked to the size and structure of the population. Effective population size is the preferred measure for the assessment of risk status<sup>38</sup>. A study made on the estimation of size and the structure of population, knowing approximated on the basis of the size of both the female and the male breeding populations, it allows the rate of inbreeding, and hence, the loss of genetic diversity within the population, to be inferred. Second, risk status depends on current and predicted future population trends. For instance, a rapid downward trend indicates a high level of risk. The third relevant factor is the geographical distribution of the population<sup>39</sup>. Status of concentration of a given population, as the more concentrated population, there is more vulnerable to localized disasters, such as disease epidemics, than a widespread population. Thus, donkeys need to be protected on both sides: as a species at whole and especially the single occurring donkey breeds. Despite the fact that donkeys seem to no longer fit in modern practices, breed selection was never on a high level. Except breeds for mule production, the interest of breed selection or attempts at breeding at all was relatively low. May be this is also a reason why donkeys are in danger of extinction in long run. Nevertheless, if there is any interest to keep this farm animal species, we should get into action as soon as possible<sup>38</sup>. A national survey and census program to identify and quantify animal breeds is urgently required. Also, a centralized national database information on the classification, description and identification of local breeds/strains of domestic donkey breeds, their main production systems and environments under which they are maintained is needed.

### **Conclusion**

In Ethiopia, donkey is one of the major sources of draught power, transport, fuel and source of financial security. Livestock is considered to be for the backbone of the national economy and donkey in particular has an important role to play in future economic development in Ethiopia. Despite these attributes, the indigenous donkey populations are threatened by irretrievable loss of biodiversity as a result of resource mismanagement and degradation leading to genetic erosion. Many of environmental and genetic factors including increasing human population, natural calamities, major livestock diseases and outbreaks, less attention given to donkey, etc., are the major main cause of genetic erosion which can make some indigenous donkey breed in a critically endangered stage. There is still no national focal point to coordinate or monitor research and development interventions relate to the characterization, documentation and conservation of donkey genetic resources. Status of donkey of this country considered to be either unknown, or believed to be alarming or very few. If immediate scientific attention is not given, indigenous donkey breeds and types, which are adapted to the climatic and farming practices, may gradually disappear. Therefore, urgent steps should be taken to halt and reverse this process and proper conservation strategies should be worked out at the grass-root level to keep the indigenous donkey population healthy.

**Acknowledgement:** Befikadu and Keflay like to extend their sincere appreciation to the Ministry of Education, Ethiopia for providing the fund to sponsored their PhD. research and we all like to thanks the Haramaya University, for facilitating the Internet services.

## References

1. Blench R. Wild asses and donkeys in Africa: interdisciplinary evidence for their biogeography, history and current use. 2013. Accessed from: <http://rogerblench.academia.edu/Departments/Studies/Documents?page=15/www.academia.edu/Documents/in/Donkey>
2. Beja-Pereira A, et al.. African origins of the domestic donkey. *Science* 2004; 304: 1781. Access from: [www.ncbi.nlm.nih.gov/pubmed/15205528](http://www.ncbi.nlm.nih.gov/pubmed/15205528)
3. Teshome M, Addis M, and Temesgen W. Seroprevalence and risk factors of African horse sickness in mules and donkeys in selected sites of West Amhara Region, Ethiopia. *African J Microbiol Res* 2012; 6(19): 4146-4151.
4. CSA (Central Statistical Authority of Ethiopia). Statistical Report on Farm Management Practices, Livestock and Farm Implements, (2009/10). Part II. CSA, Addis Ababa, Ethiopia.
5. Alemu G, Azage T, Alemu Y. Research need of donkey utilization in Africa. In: Fielding D, Starkey P. (Eds.). *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA)*. Technical Center for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands, 2004; 77-81.
6. Biffa D. and Woldemeskel M. Causes and Factors Associated With Occurrence of External Injuries in Working Equines in Ethiopia. *Int J Applied Res Vet Med* 2006; 4: 1-7.
7. Gebreab F. et al. Donkey Utilization and Management in Ethiopia. In: Fielding D, Starkey P. (Eds). *Donkeys, People and Development. A resource book in the Animal Traction Network for Eastern and Southern Africa (ATNESA)*. ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA). Wageningen, Netherlands, 2004; 46-49.
8. Fernando P, Starkey, P. Donkeys and Development: Socio-Economic Aspects of Donkey Use in Africa. In: Fielding D, Starkey P. (Eds). *Donkeys, People and Development. A resource book in the Animal Traction Network for Eastern and Southern Africa (ATNESA)*. ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA). Wageningen, The Netherlands, 2004. pp. 31-41. Available at: [www.atnesa.org/donkeys/donkeys-fernando-socioeconomic.pdf](http://www.atnesa.org/donkeys/donkeys-fernando-socioeconomic.pdf)
9. Mekonnen T. Rural transport systems in Ethiopia. Proceedings of a National Workshop on Food Strategies for Ethiopia held at Alemaya University of Agriculture, 8-12 December 1986, Ethiopia.
10. Fesseha G. Use of equines in Ethiopia. Proceedings of the Fourth National Livestock Improvement Conference held in Addis Ababa, 13-15 November 1991. Ababa, Ethiopia. 1993 pp. 51-58.
11. Blench RM. A history of donkeys, wild asses and mules in Africa. In: R.M Blench and C.K. MacDonald (Eds.) *The origin and development of African livestock: archaeology, genetics, linguistics and ethnography*. UCL Press. 2000, pp. 339–354.  
Access from: [www.esap-ethiopia.org/index.php/proceedings/ejapvolume9-pdf?](http://www.esap-ethiopia.org/index.php/proceedings/ejapvolume9-pdf?)



12. Marshall F. African pastoral perspectives on domestication of the donkey. In: Denham TP., Jriarte J, Vrydaghs L (Eds.). Rethinking agriculture: archaeological and ethno archaeological perspectives. One World Archaeology Series, Walnut Creek, CA, Left Coast Press. 2007, pp. 371–407.
13. Rossel S, Marshall F, Peters J, Pilgram T, Adams MD, O'Connor D. Domestication of the donkey: timing, processes and indicators. Proceedings of the National Academy of Sciences of the United States of America 2008; 105: 3715–3720.
14. Fielding D. A preliminary survey of donkey and horse use in Africa. Mimeo, Edinburg Agriculture, Edinburgh. 1986.
15. Admassu B, Shiferaw Y. Donkeys, horses and mules - their contribution to people's livelihoods in Ethiopia. The Brooke 2011, Addis Ababa, Ethiopia.
16. Rege JEO, Gibson JP. Animal genetic resources and economic development: issues in relation to economic valuation. Ecological Economics 2003; 45(3): 319–330.
17. Dreyfus F. Contribution a l'étude de la zootechnie et de la pathologie des equides domestiques en Ethiopie. These pour le doctorat vet. Ecole Nationale Vétérinaire d'Alfort (ENVA), Paris, France. 1974. 122.
18. Kefena ED. Equine genetic resources of Ethiopia. PhD. dissertation Haramaya University, Dire Dawa. Ethiopia, 2012.
19. FAO (Food and Agricultural Organization), 2004. The global framework for the progressive control of transboundary animal diseases. FAO/OIE. Paris/Rome. ILRI, Nairobi, Kenya. 76.
20. Getachew M, Trawford A, Feseha G, Reid SWJ. Gastrointestinal parasites of working donkeys of Ethiopia. Trop Anim Health Prod 2010; 42: 27-33.
21. Asefa Z, Kumsa B, Endebu B, Gizachew A. Endoparasites of donkey in Sululta and Gefersa district of central Oromia, Ethiopia. J Anim Vet Advances 2011; 10 (14): 1850-1854.
22. Kumar N, Fisseha KK, Shishay N, Hagos Y. Welfare Assessment of Working Donkeys in Mekelle City, Ethiopia. Global Veterinaria 2014; 12 (3): 314-319.
23. IFRC (International Federation of Red Cross and Red Crescent Societies), 2004. World disasters report 2004. Geneva. (<http://www.ifrc.org/PageFiles/89755/WDR2004/58000-WDR2004-LR.pdf>)
24. IFRC (International Federation of Red Cross and Red Crescent Societies), 2005. World disasters report 2005. Geneva. (<http://www.unisdr.org/2005/wcdr/>)
25. Wollny, C. The need to conserve farm animal genetic resources through community-based management in Africa: Should policy makers be concerned? Ecol Economics 2003; 45: 341–351.
26. Moehlman P D, Yohannes H, Teclai R, Kebede F. 2008. *Equus africanus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. ([www.iucnredlist.org](http://www.iucnredlist.org)).
27. FAO (Food and Agricultural Organization), 2007a. Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration. Available at <http://www.fao.org/docrep/010/a1404e/a1404e00.HTM>.
28. McCarthy O. et al. Geographic distribution and frequency of a *Taurine Bos taurus* and an Indicine indicus Y specific allele amongst sub-Saharan Africa cattle breeds. Mol Ecology 2003; 9: 387-396.
29. Rege JEO. Animal Genetic Resources Information (FAO), 1999; 25: 1-25. Access from: <ftp://ftp.fao.org/docrep/fao/012/w2517t/w2517t00.pdf>

30. FAO (Food and Agricultural Organization), 2007b. The State of the Worlds Animal Genetic Resources for Food and Agriculture. FAO, Rome.
31. Daniel V.A.S. Strategies for effective community based biodiversity programs interlocking development and biodiversity mandates. Paper presented at the Global Biodiversity Forum, held 12–14 May 2000, Nairobi, Kenya. Assessed from:  
[www.gbf.ch/Session\\_Administration/upload/paper\\_daniel.pdf#search=%22loss%20migration%20urban%20livestock%20%22loss%20of%20traditional%20knowledge%22%22](http://www.gbf.ch/Session_Administration/upload/paper_daniel.pdf#search=%22loss%20migration%20urban%20livestock%20%22loss%20of%20traditional%20knowledge%22%22).
32. Fanuel K. Ecology and conservation of the African wild ass (*Equus africanus*) in the Danakil, Ethiopia. MSc Dissertation, University of Kent, England, 1999.
33. Moehlman P D. Status and action plan for the African wild ass. In: Moehlman PD (Ed.), Equids: zebras, asses and horses, status survey and conservation action plan. Gland, Switzerland: International Union for the Conservation of Nature (IUCN) 2002; 2–9.
34. Morgan R. The prevalence and causes of lameness in working donkeys; a comparative study of rural and urban donkey populations in Southern Ethiopia. Project Report 2005. Accessed from:  
[http://www.bva.co.uk/public/documents/os\\_grant\\_ruth\\_morgan\\_1.pdf](http://www.bva.co.uk/public/documents/os_grant_ruth_morgan_1.pdf).
35. Blackway I. A global review of the genetic resources of equidae. FAO Animal Production and Health Paper No. 104. Proceedings of an FAO expert consultation. Rome, Italy, April 1992. 1994: 215-226.
36. Leemans R, Eickhout B. Another reason for concern: regional and global impacts on ecosystems for different levels of climate change. Global Environmental Change 2004; 14: 219-228.
37. Institute of Biodiversity Conservation (IBDC). Ethiopian national strategy and plan of action for conservation, sustainable use and development of animal genetic resources draft. Ministry of Agriculture, Addis Ababa, Ethiopia. 2012.
38. FAO (Food and Agriculture Organization of the United Nations), 2008. World watch list for domestic animal diversity. 3rd Edition. FAO, Rome.
39. Kefena E, Beja-Pereira A, Han JL, Haile A, Mohammed YK, Dessie T. Eco-geographical structuring and morphological diversities in Ethiopian donkey populations. Livestock Sci 2011; 141: 232–241.

Thus, conservation of these pig breeds using assisted reproductive techniques is urgent and important. Key words: Conservation, Growth, Meat, Pig, Reproduction, Vietnam. (J. Reprod. In this review, we introduce some information about the genetic diversity, reproductive efficiency, growth potential, meat-producing ability, morphology, and distribution of six Vietnamese indigenous pig breeds, I, Mong Cai, Muong Khuong, Soc, Meo and Co, and review their conservation using artificial reproductive technologies. Genetic Diversity and Conservation of Vietnamese Indigenous Pigs. Using Artificial Reproductive Technologies. Abstract The donkey is indigenous to the African continent and its wild progenitor is usually considered to be the Nubian wild ass. Domestic donkeys are the least studied and neglected mammals of the world. Ethiopia has one of the largest donkey populations in the world and nearly possesses 40% of Africa's equine population. Ethiopia is also considered as a home to a considerable number of indigenous donkey populations. Livestock is considered to be the backbone of the national economy and donkey plays an important role in it. However, despite of these factors indigenous donkey has received ve