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Conservation of Farm Animal Genetic Resources: A Necessary Tool for Sustainable Rural Livelihood

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Abstract:

This paper reviews the challenge of conservation of Farm Animal Genetic Resources (AnGR) and the significant role it played in preserving animal biodiversity. There seem to be a complex interaction between AnGR, poverty alleviation and livelihood of rural communities. Livestock serves not only as the source of income but also used in fulfilling socio-cultural obligations in the community. Conscious effort must be made to preserve locally adapted breeds within the production systems that prevail in the various communities of its origin that is, community- based management of indigenous breeds. The vast majority of livestock genetic resources will continue to be maintained in living herds and flocks controlled mainly by farmers in rural communities especially in developing nations of the world. Locally adapted animal genetic resources also play vital role in the live of rural dwellers hence the need for its conservation.

Keywords: *community- based management, animal biodiversity, locally adapted breeds*

1. Introduction

The challenge to achieve food security for all is greater now than ever before, with one out of six people in the world currently being underfed (FAO, 2007). More than 1.2 billion people in the world live in extreme poverty and are found mainly in sub – Saharan Africa and South and East Asia (ILRI, 2005). In order to solve the problem of hunger in these countries, the Millennium Development Goals (MDG) of the United Nations (UN, 2004) set up the overall objective of reducing the proportion of poor and hungry people by 50% by the year 2015. Development and sustainable use of Animal Genetic Resources (AnGR) especially if targeted to the poor, provides a pathway to achieving the goals. Livestock production serves as a major supplier of dietary protein needs of people both in the developed and developing nations of the world. They are especially relevant in developing countries like Nigeria as majority of the populace lives in rural set up and depend mainly on livestock keeping for their sustenance. From small householder who keeps few chickens at the backyard to the nomadic Fulani pastoralists that have to trek long distances in search of pasture and water, animals provide meat, eggs, milk, hides and skin for the populace. They also serve as source of power to pull ploughs, source of income and prestige and their wastes is used as manure for crop production.

Animal genetic diversity is very critical for food security and rural development in developing nations of the world including Nigeria. For instance, the Nigerian indigenous breeds of livestock for many decades have been tagged unproductive and inferior to high-performance or improved breeds and consequently subjected to cross breeding or even replacement by exotic breeds. Adebambo (2005), however reported that the locally adapted breeds of livestock produce over 90% of the nation's meat, less than 30% milk products and just about 10% eggs whereas the remaining portions are from high performing introduced breeds. It is pertinent to know that these indigenous breeds are endangered and some have even gone into extinction (FAO, 2005).

A lot of reasons have been identified for the loss of indigenous gene pool which include but not limited to indiscriminate crossbreeding with high input and output exotic breeds, extensive agricultural practices, establishment of protective areas, lack of market demand, loss of indigenous knowledge institutions and loss of traditional livelihood due to urban rural migration. For instance, in Nigeria, migration and urbanization brought the percentage of rural population to about 49.7% in 2010 (World Bank, 2011). About one-third of the more than 7,000 livestock breeds (including poultry) registered in the FAO global database are regarded as threatened by extinction (Scherf, 2000). The purpose of this review is to emphasize the need for identification, characterization and conservation of Farm Animal Genetic Resources that will assist future breeding programmes of modern agriculture and also help in sustaining rural livelihood.

2. Livestock Production Systems and Rural Livelihoods

Recent World Bank estimate asserted that the bulk of the poor, about three-quarters, lives in rural areas where they draw their livelihoods from agriculture and related activities (Korte, 2003). Indigenous livestock is considered as an important contributor to rural welfare and poverty alleviation (Livestock in Development, 1999; Anderson, 2000). About 70% of the world's rural poor depend on livestock for their livelihood (FAO, 2005).

Livestock production by these poor families is for multipurpose and multi-faceted roles which improved breeds cannot fit into (Drucker *et al.*, 2001). FAO (1997) also concluded that “conservation and sustainable development of animal genetic resources (AnGR) requires a shift towards a broad focus on the many ‘adaptive’ breeds that survive well in the low external input agriculture typical of developing countries”. It is therefore imperative to assist these rural poor to enhance their livelihoods and food security in a sustainable manner. Sustainability therefore is dependent on maintaining a high level of biodiversity especially within and between indigenous livestock species in the tropics and the surrounding environment.

Four major types of livestock keeping systems have been identified (Anderson, 2003). They are:

- full-time livestock keepers who depend primarily on livestock for their livelihoods (they may be nomadic, sedentary or transhumant);
- livestock-keepers who do some cropping but livestock remain their main means of living (may be transhumant or settled);
- crop farmers who also keep animals and usually stay in one place all year round (mixed farming); and
- the landless that keep some livestock often as a subsidiary activity and live on the edge of villages, towns or cities.

Women livestock keepers often fall into the small stock keeper or the landless livestock keeper categories depending upon their land endowment and right of use within the household. These smallholder subsistence farmers and especially women livestock keepers, substantially contribute to national agricultural production and food security (Ajayi and Agaviezor, 2012). Apart from financial resources derived from the sales of livestock, they also nurture their children and fulfil their socio-cultural needs through animals. The number of people who depend on livestock for livelihood has been estimated to be 987 million (Livestock in Development, 1999) and about 70 percent of the world’s 1.4 billion extreme poor has been broken down by agro-ecological zone and type of farming (Table 1).

Agro-ecological zone	Extensive graziers	Poor rainfed mixed farmers	Landless livestock keepers ¹
Arid and semi arid	87	336	ns
Temperate (including tropical highlands)	107	158	107
Humid, subhumid and subtropical	ns	192	ns

Table 1: Number and location of poor livestock keepers by category and agro-ecological zone

¹People in landless households keeping livestock; not industrial landless production systems

Note: ns = not significant. Source: Livestock in Development, 1999

3. Farm Animal Genetic Resources and Rural Livelihoods

Farm animal genetic resources (AnGR) refer to those animals that are used, or may be used, for production of food and agriculture. These animals- cattle, sheep, goats, pigs, chickens and horses, for example, are the raw material that farmers rely on in order to adapt to production conditions and cope with harsh weather conditions and disease outbreaks prevalent in the tropics. Farm animal genetic resources have a particular role to play in managing the rural environment and assisting in maintaining wild biological diversity. Our indigenous livestock breeds are of great economic, social and cultural importance. Knowledge of the genetic structure of these species is essential for the conservation of indigenous germplasm. In order to maintain and conserve these AnGR, effort must be geared towards ability of communities to decide on and implement appropriate breeding strategies, that is, community-based management of these resources is required.

The vast majority of livestock genetic resources will continue to be maintained in living herds and flocks many owned mainly by farmers in rural communities especially in developing nations of the world. For large breeding populations, directed conservation efforts may not be required because the population will keep on increasing as there will be opportunity for selection within living herds and flocks. For small breeding populations which is prevalent among Fulani herders for example will require periodic inventories of animal populations which may warn against any production or use that may alter the diversity of the indigenous breeds. The high rates of genetic loss of indigenous species together with inadequate use and management of AnGR has negative impact on the livelihood options for the poor families in the developing countries.

4. The Need to Conserve Livestock Genetic Resources

Genetic erosion occurs through the loss of within breed diversity and complete loss of breeds. The need for conserving livestock genetic resources is to prevent the different populations of these species of domestic animal that have distinct characteristics and occupy different environmental niches from going into extinction. Reports also revealed that somewhere in the world at least one breed of traditional livestock dies out every week (FAO, 2005; Cardellino, 2003).

Many traditional breeds have disappeared as farmers focus on new breeds of cattle, pigs, sheep, and chickens. Of the 3,831 breeds of cattle, water buffalo, goats, pigs, sheep, horses, and donkeys believed to have existed in this century, 16 percent have become extinct, and a further 15 percent are rare. Some 474 of extant livestock breeds can be regarded as rare. A further 617 have become extinct since 1892. Over 80 breeds of cattle are found in Africa, and some are being replaced by exotic breeds. These losses weaken the potential of breeding programs that could improve hardiness of livestock. Indigenous chicken has been reported to possess phenotypic variations that played significant role in their adaptability in the environment where they are found (Ajayi *et al.*, 2010). The range of genetic diversity in livestock species must be saved as a foundation for future improvements and adjustments to changing production conditions. Indigenous AnGR also possess genetic traits that could be explored for disease resistance through application of functional genomics as an emerging trend for disease control in livestock species (Sansthan and Kohler-Rollefson, 2005). Table 2 shows the level of risk status of different livestock breeds. Pigs and cattle seem to have the highest rate of breeds that has gone into extinct

(Table 2). According to Gibson and Bishop (2005) these genetic resources are being eroded as a result of changing agricultural practices, economic and environmental factors. Table 3 shows the level of risk status of eight species of birds in global database where about 40% of the breeds are not yet characterized and about 2.5% has gone into extinct.

Species	Unknown	At risk	No risk	Extinct	No of breeds
Ass	58.6	16.7	21.0	3.7	162
Buffalo	35.0	8.0	56.9	0.0	137
Cattle	30.0	16.0	38.1	15.9	1311
Goat	33.8	13.6	49.5	3.1	618
Horse	34.6	23.0	31.3	11.1	786
Pig	30.4	15.0	32.6	18.9	739
Rabbit	31.6	20.3	7.3	0.9	232
Sheep	29.6	12.7	44.9	12.8	1409
Total	33.8	16.2	38.1	11.9	5394

Table 2: Assessment of risk of extinction in the main eight species of mammals in the global database

Source: DAD-IS, 2008

Species	Unknown	At risk	No risk	Extinct	No of breeds
Chicken	38.7	32.9	25.2	3.1	1273
Duck	43.0	26.5	29.1	1.3	233
Goose	36.3	30.2	33.5	0.0	179
Guinea	59.3	9.3	27.8	3.7	54
Pigeon	47.1	32.4	20.6	0.0	68
Turkey	39.8	34.0	24.3	1.9	103
Total	39.9	31.3	26.3	2.5	1900

Table 3: Assessment of risk of extinction in the main eight species of birds in the global database

Source: DAD-IS, 2008

5. What is Conservation?

Conservation is an action undertaken to ensure that the diversity of farm animal genetic material is being maintained for contribution to food production, agricultural production and productivity through planning, strategies and policies for future purposes. Animal breeders have recognized over the years that selection objectives change over time depending on the purpose of breeding and the assumption that sufficient genetic diversity is available to permit such changes. Effective conservation of genetic resources is possible only if the breeds are identified and documented adequately, and there is a full participation towards conservation efforts of communities keeping the animals.

The conservation and sustainable use of genetic resources for food and agriculture is a widely supported international objective contributing to efforts to eliminate global poverty and achieve world food security. Conservation of animal genetic resources is not an end in itself but rather, it is a means to an end. Conservation helps in making sure that unique genetic resources are available to farmers and breeders. Thus, conservation is part of an overall strategy to use animal genetic resources in a sustainable manner to meet current and future human needs and to ensure of rural dwellers that depend on them for livelihood.

There are basically two ways to conserve Animal Genetic Diversity *viz: in situ* and *ex situ*.

In-situ conservation: This is the preservation of the different breeds, lines and strains of livestock in the original production environment and habitat. This can be done in two ways: *viz.* on-farm or community-based conservation. Community-based conservation combines the sustainable use of a breed with the empowerment of rural people who keep it.

Ex-situ conservation: This means preservation of genetic material outside its original production context. This is done in two ways: cryopreservation (dip-freezing) of genetic material, e.g. semen, oocytes, embryo and DNA, or as live populations where animals are kept in zoos and experimental or show farms.

6. Maintaining Rural Livelihood through Animal Genetic Resources

There is a complex interaction between AnGR, poverty and livelihood of rural communities. Livestock not only function as household assets but also serve other purposes such as income generation, non-income and socio-cultural purposes to the people investing in them (Sansthan and Kohler-Rollefson, 2005). An understanding of the genetic traits required for meeting these purposes is necessary for sustainable production. The sustainable intensification of animal production systems is the manipulation of inputs to, and outputs from, livestock production systems aimed at increasing production and/or productivity and/or changing product quality, while maintaining the long-term integrity of the systems and their surrounding environment, so as to meet the needs of both present and future generations.

For animal, genetic resources to be put in a sustainable way for rural livelihood there must be adequate development of policies that favours its conservation and also implementation and maintenance of programmes that will promote its course. Whatever the policies and programmes put in place must first and foremost respect the needs and aspirations of indigenous people especially farmers and

rural communities who are involved directly with the on-farm or community-based conservation of AnGR. There is also need for an understanding of the roles and values of these locally adapted animal genetic resources play in the live of rural dwellers. According to FAO report (1999), the most rational and sustainable way to conserve animal genetic resources is to ensure that locally adapted breeds remain a functional part of production systems. This requires identification of their economically important and unique attributes. Conscious effort must be made to preserve these attributes within the production systems that prevail among rural dwellers in Nigeria and other developing countries of the world.

7. Conclusion

The erosion of AnGR diversity represents a major threat to agro biodiversity, agricultural sustainability and the livelihoods of many resource-poor farming families. Sustaining livestock genetic diversity requires that attention be given to indigenous livestock resources especially those managed by smallholders' producers throughout developing countries. One major advantage of keeping live herds and flocks by rural smallholders' is opportunity for selection, thereby allowing the indigenous breeds to adapt to shifting environmental conditions. Building on local knowledge and institutions will ensure conservation and development of these breeds through changing production systems adapted by these farmers.

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