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# WILDLIFE AND BIODIVERSITY: NATURAL RESOURCE CONCEPTS VERSUS LIVESTOCK-BASED EXPERIENCES

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***ABSTRACT***

***An investigation was conducted to understand the meaning of wildlife and biodiversity in livestock-based agriculture and their relationship to those in natural resource sector. Review was conducted on literatures related to wildlife, biodiversity and food animals. Others include origin of livestock, livestock breeds and meat production statistics. Results show that 5 wild food animals; aurochs, bezoar, wild boar, mouflon and red jungle fowl were the earliest to be domesticated and their domestic forms account for 93.4% of global meat production. Populations of only one species from among several species of a particular food animal was tamed and transformed into a domestic form. Domestic chicken and pig were the top contributors to global meat supply with 34.7% and 34.5% respectively. Goat has the highest proportion of extant breeds (97.1%) while pig has the least (82.2%). The precise meaning of wildlife and biodiversity in the natural resource sector were changed in livestock-based agriculture due to the changes associated with animal domestication. Findings would be beneficial in curriculum development and educational projects aimed at greater consciousness on the environment.***

**Keywords:** breeds, domestication, wild progenitors, wild relatives, selective breeding

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## INTRODUCTION

Wildlife and Biodiversity are terms that are used frequently as a society becomes more environmentally conscious. "Wildlife" appears 39 times while "biodiversity" was used in 1463 instances (Secretariat of the CBD, 2020), in reference to different categories of undomesticated plants and animals in an environment which was closely associated with varied life forms in terrestrial, arboreal and aquatic ecosystems. Both terms are frequent in discussions of scientists and policy experts concerning abundance of life forms on the planet, their economic importance, and management strategies (Egwumah and Egwumah, 2014; IUCN, 2024). In addition, identification of major terrestrial animals, aquatic animals, feeding habits, life cycles, natural habitats conservation and sustainable exploitation as components of "Wild and Biodiversity" in Agriculture Higher Education draws extensively from the Natural Resource sector in terms of explanations.

The use of wildlife and biodiversity also feature prominently in human-animal interactions and livestock-based agriculture. Wildlife was used 31 instances to refer mostly to undomesticated animals or habitats, sanctuary, parks, conservation measures, scientist and surveys that are related to them (FAO, 2015). In the same document, biodiversity appeared 197 times in relation to wild genetic resources, animal genetic

conservation, food, nutrition, livestock, farm animal and agriculture. The frequency of these terms shows the complex pathways to the domestication of modern livestock that recognise, sometimes through the application of molecular genetics, aurochs, bezoar, wild boar, mouflon and red jungle fowl as the progenitors of their respective modern livestock (Lari *et al*., 2011; Demirci *et al*., 2013; Miao *et al*., 2013; FAO, 2015). Furthermore, the use of both terminologies indicate the desire to domesticate food animal resources, conserve domestic animal resources, develop conservation standards for livestock as well as investigate the relationship between wildlife and pastoralism (Huntsinger *et al*., 2012).

The experiences in livestock-based agriculture are yet to be purposefully considered as common concepts in the design of training programmes. How are human-like apes, dangerous reptiles and flesh-eating mammals understood as wildlife and biodiversity (in common concepts) related to mammalian livestock or poultry? What is the role of these strange animals to the development of livestock-based agriculture? Clearly, there is a need to understand the meaning of "wildlife and biodiversity" within human-animal interactions that led to the emergence of modern livestock. An understanding of how these terms are different from those in Natural Resource sector will prove valuable to educators entrusted with the task of developing curriculum for "Food Animal Resources" and "Biodiversity in Livestock". The study investigates the meaning of both terms in natural ecosystems and in human-animal interactions.

*Literatures Review on Animal resource*

Documents and published articles on different aspects of farm animals were reviewed. They include those on wild progenitors of livestock, wild relatives of livestock; national and transboundary breeds of livestock and meat production statistics (FAO, 2015; IUCN, 2024; FAO.2024).

## METHODOLOGY

### *Selection of study samples*

Fourteen farm animals whose native species were hunted and used as food animals were identified. They include 8 mammalian species; buffaloes, cattle, goat, pigs, reindeer, rabbits, sheep, yaks and 6 avian species; chickens, domestic ducks, geese, guinea fowl, Muscovy ducks and turkeys. The identified farm animals were profiled using the following criteria: time of domestication (to ascertain whether the animal were among the earliest domesticates) and percent contribution to global meat production. Grading scales were developed for domestication date as: <100 Before Present (BP)= 0 point; 100-1999BP= 1 point, 2000-3999 BP= 2 points, 4000-5999 BP= 3 points, 6000-7999BP= 4 points, 8000BP and above= 5 points; scale on contribution to global meat production: <1%= 0 point; 1-19.9%= 1 point, 20-39.9%= 2 points, 40-59.9%= 3 points, 60-79.9%= 4 points, 80% and above= 5 points. Cumulative score (domestication date and percent meat contribution for each of the animal) was obtained and used in ranking the animals to select study samples.

### *Descriptive analysis of wildlife and biodiversity*

A five-step process was undertaken to describe the wildlife and biodiversity of selected livestock. First, wild relatives of each selected livestock were identified and their status- extant or extinct- was confirmed from Reports on Animal Genetic Resources for Food and Agriculture (FAO, 2015) and the Red List of Threatened Species (IUCN, 2024). Second, the wild progenitor of each selected livestock was identified and their status- extant or extinct- was confirmed from the above named sources. From the total number of breeds (T) and extinct breeds (E), the number of extant breeds of selected livestock was calculated (T-E). Fourth, the proportions of a wild progenitor/transformed species (TS) to its relative/native species (NS) as well as the proportions of extant breeds to extinct breeds were expressed using descriptive statistics. Lastly, discussion on results was undertaken to explain the meaning of wildlife and biodiversity in natural resource and livestock sectors.

**RESULTS**

The earliest food animals to be domesticated were mostly herbivorous, gregarious mammals. Table 1 shows that with regards to the date of domestication, four mammalian food animals, wild cattle, goat, pig and sheep scored the maximum 5 points indicating that the animals were tamed at least 8,000 years before present (BP).

**Table 1: Date of domestication and contribution of selected food animals**

| Livestock | Date (BP | Meat Production^ | | Scores | | |
|---|---|---|---|---|---|---|
| | | MT(355.74) | (%) | D.Date^^ (5) | Meat (5) | Total(10) |
| Buffaloes (River) | 4500 | 6.9 | 1.9 | 3 | 1 | 4 |
| Cattle (Taurine) | 10250 | 69.3 | 19.5 | 5 | 1 | 6 |
| Goats | 9750 | 6.4 | 1.8 | 5 | 1 | 6 |
| Pigs | 10000 | 122.6 | 34.5 | 5 | 2 | 7 |
| Rabbits | 1400 | 0.8 | 0.2 | 1 | 0 | 1 |
| Reindeer | 2500 | n.a | n.a | 2 | 0 | 2 |
| Sheep | 9750 | 10.3 | 2.9 | 5 | 1 | 6 |
| Yaks | 5000 | n.a | n.a | 3 | 0 | 3 |
| Chickens | 8000 | 123.6 | 34.7 | 5 | 2 | 7 |
| Domestic ducks | 1000 | 6.1 | 1.7 | 1 | 1 | 2 |
| Geese | n.a | 4.4 | 1.2 | - | 1 | 1 |
| Guinea fowl | 2000 | n.a | n.a | 1 | - | 1 |
| Muscovy ducks | 4000 | n.a | n.a | 3 | - | 3 |
| Turkey | 2000 | 5.1 | 1.4 | 2 | 1 | 3 |
| * | n.a | 0.24 | 0.07 | - | - | - |

*^Quantities produced in 2022; ^^Domestication date; *others: asses, camels, camelids, rodents, pigeons and mules (0.25MT); n.a = not available*

Chicken was the only avian species with 5 points in terms of domestication date. Table 1 also reveals that chicken and pig scored 2 points (20-39.99%) on their contribution to global meat production; the highest quantity of meat produced were those of chicken (123.6 million tonnes (MT)) and pig (122.6 MT). Overall, five animals scored the highest points with pig and chicken having 7 points each while cattle, goat and sheep earned 6 points each. The scores mean that the successive generations of these once wild food animals are now the dominant modern livestock.

Food animals of the same genera were distinct species and populations. Table 2 indicate that the major food animals had between 4-9 species. In all cases, only one species in a genus was successfully transformed into a domestic form, and translate to 11-25% of the total number of species in a genus.

**Table 2: Native and transformed species of study samples**

| Livestock | Genus | Native species (NS | Transformed species (TS) | NS – TS NS (%) | TS/NS (%) |
|---|---|---|---|---|---|
| Cattle | *Bos*[1] | 05 | 01 | 80.0 | 20.0 |
| Goat | *Capra*[2] | 09 | 01 | 88.9 | 11.1 |
| Pig | *Sus*[3] | 08 | 01 | 87.5 | 12.5 |
| Sheep | *Ovis*[4] | 06 | 01 | 83.3 | 16.7 |
| Chicken | *Gallus*[5] | 04 | 01 | 75.0 | 25.0 |

1. *Bos gaurus, B. javanicus B. mutus, B. primigenius, B. sauveli*
2. *Capra aegagrus, C. caucasica, C. cylindricornis, C. falconeri, C. ibex, C. nubiana, C. pyrenaica, C. sibirica, C. walie*
3. *Sus ahoenobarbus, S. barbatus, S. bucculentus, S. cebifrons, S. celebensis, S. oliveri, S. philippensis,*
4. *S. scrofa, S. verrucosus,*
5. *Ovis ammon, O. Canadensis, O. dalli, O. orientalis, O. nivicola, O. vignei*
6. *Gallus gallus, G. lafeyettei, G. sonneratii, G. varius*

Several sub-groups of each livestock emerged from the earliest tamed population due to dispersal to different regions and selection for beneficial traits. Table 3 shows livestock with the highest number of breeds. Chicken with 1669 breeds has the highest number of breeds followed by sheep 1382 breeds and cattle 1224 breeds. The proportion of extinct breeds in goat is 2.87% and in chicken 3.59% making them livestock with the least number of extinct breeds.

**Table 3: Numbers of reported livestock breeds globally**

| Livestock | Total* (T) | Extinct (E) | Extant (T-E) | Extant (%) | Extinct (%) |
|---|---|---|---|---|---|
| Cattle | 1224 | 184 | 1040 | 85.0 | 15.0 |
| Goat | 662 | 19 | 643 | 97.1 | 2.9 |
| Pig | 602 | 107 | 495 | 82.2 | 17.8 |
| Sheep | 1382 | 160 | 1222 | 88.4 | 11.6 |
| Chicken | 1669 | 60 | 1609 | 96.4 | 3.6 |

**sum of local and transboundary breeds*

## DISCUSSION

Human-animal interactions have been in existence prior to modern livestock husbandry. There were 148 non-carnivore terrestrial mammalian species weighing more than 45 kg and 10 000 avian species, which could be used as a source of food (FAO, 2015). Certain groups of animals were attracted to settlements, habituate and formed a commensal relationship with humans while another group especially medium to large sized herbivores were hunted for food and managed as captive population (Larson and Burger, 2013). Hunting of food animals was gradually replaced with their husbandry. The transition to husbandry may have been triggered by changes in climatic conditions, distribution pattern of food organisms and human population size. Red jungle fowl (*Gallus gallus*) from the 4 wild species of chicken proved to be the most successful in terms of habituation to human settlement and captive breeding which resulted in its transformation into the domestic fowl (*Gallus domesticus*). Domestication of food animals is still present in human society as evident in attempts to tame the cane rat (*Thryonomys swinderianus*) (Annor, *et al*., 2012). The successful domestication of the wild progenitor of modern livestock compare to their other wild relatives is likely due to one or a combination of these factors: a favourable behavioural trait such as non-aggressive behaviour towards humans, stable reproductive activities in captivity as well as faster growth rate. Populations of tamed food animals were further selected for specific traits after their supply have been secured. Selection for meat, milk and wool through intensive breeding lead to thousands of breeds of chicken, sheep and cattle as well as hundreds of goat and pig breeds. With progress in intensive breeding to produce breeds, less attention was paid to their wild counterparts. Presently, the ancestors and wild relatives of major livestock are either extinct or highly endangered as a result of hunting and changes to their habitats. The exception is the wild boar (*Sus scrofa*). In the case of the wild red jungle fowl, intensive cross-breeding with the domestic chicken has altered its integrity.

Generally, the ecological function of an animal changes as it makes the transition into becoming a livestock. Some animals attract human attention as source of food but only very few of them are confirmed to be of value in terms of meat quality and quantity. With the onset of

exploitation, an animal *is* valued not just as a mere zoological entity functioning within an ecosystem but an animal resource, that is, a *"utility animal" or* an animal of direct value to humans. The function of an animal resource is partially enhanced at the later stage of exploitation which involves herd management and extensive breeding of captive populations. The function of an animal resource now transcends the "ecosystem-based" dimension of its primitive state to include a "utility-based" aspect but still remains outside the strict control of humans. In the course of human-animal interaction, an animal resource undergoes further development through relocation from its natural habitat to human-controlled environment, experiences characteristic changes to their external morphology and genetic materials under the influence of selective pressures inherent in the domestication process (FAO, 2015). Under steady influence of selection, an animal resource is progressively transformed into a domestic variant (livestock) whose external features are partially modified and its growth significantly enhanced. So a trend emerges, exploitable animals evolve from their primitive state through an intermediate state of animal resource (utility animals) to the advance state of livestock and their breeds.

The meaning of wildlife and biodiversity can be deduced from the events of human-animal interactions. Wildlife refers to an animal living in its natural habitat; it is primitive and undomesticated in the present circumstance. This version of wildlife is a Natural Resource concept. In livestock-based agriculture, wildlife is used in reference to progenitors/ancestors of modern livestock making it a "past tense" in relation to the forward-moving principle of the domestication event. Another level of distinction in the use of wildlife is when it is applied in a generic sense to include all undomesticated life forms: from the smallest aquatic invertebrate to the largest terrestrial mammal (Secretariat of the CBD, 2020). Therefore, wildlife is an integral part of biodiversity within the natural resource sector. In contrast, the use of wildlife in livestock-based agriculture does not extend beyond its meaning, namely, ancestor/progenitor, to include livestock biodiversity. Livestock biodiversity refers solely to the variabilities of a domestic animal resulting from selective breeding. The term "biodiversity" in the livestock sector is synonymous with and subsumed by the term "breeds" as evident in the 870 instances of its use in FAO (2015). The breed-biodiversity fusion as well as the wildlife-breed dichotomy is the result of the forward-moving/ progress principle of the domestication process. When this principle is not taken into consideration, there is a tendency to categorize wildlife, wild relatives of a livestock and livestock breeds as "biodiversity" as proposed by Uchola (2016). The present affirmation that breeds equate to biodiversity in livestock-based agriculture is in line with the FAO (2015), which acknowledged the complexity of the term as several definitions have been proposed including: "animals which share a common pattern of use in agriculture, a degree of uniformity of phenotype, and a common gene pool".

## CONCLUSION

The use of the terms wildlife and biodiversity is increasingly becoming frequent in contemporary society especially in the natural resource and agriculture sectors. A common denominator is the acknowledgement of the existence of "animal resources" and "biodiversity" in the wild and in human-controlled environments. Nevertheless, each term has very precise meaning in Natural Resources and Livestock-based Agriculture. The dichotomy between these terms in Natural Resources and Livestock-based Agriculture need to be emphasized and expressed through courses and curriculum development. Notwithstanding the dichotomy, there is need for continuous collaboration between both sectors in scientific research and educational programmes to make society more environmentally-conscious.

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