# Buffalo in Borneo, Sarawak: A Review of the Current Status of the Indigenous Buffalo Industry

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**Abstract:** The Malaysian water buffalo, *Bubalus bubalis*, has traditionally been important livestock for the local people of Sarawak. Buffalo, other ruminants, and non-ruminants are essential for the livestock industry as they supply the largest source of protein for the entire nation. Cattle provide the largest production in the livestock industry at 0.2%, followed by other ruminants, including goats (0.1%), sheep (0.04%) and buffalo (0.03%). Water buffalo, or 'kerbau sawah' as it is locally known, is an overlooked animal compared to other livestock. Amidst the growing demand for beef within the domestic consumer market, the buffalo population in Sarawak has risen over the past 5 years from 5,396 to 6,205 heads in 2019. However, the self-sufficiency level (SSL) of cattle and buffalo beef has dropped from 26% in 2013 to 21.6% in 2019 despite the rising demand for local produce. Malaysia continues to import frozen buffalo beef from India and live bovine from other countries in order to meet domestic demands and support the growth of the local buffalo industry. Due to this, the Department of Veterinary Services (DVS) Sarawak introduced a buffalo yard program ('Natad Kerbau') to assist the state smallholder farmers in managing their buffaloes better. This paper focuses on describing the current status of buffalo production in Sarawak, its important functions (including provision for food security) and future prospects of *B. bubalis* in the livestock industry of Malaysia and Sarawak in particular.

**Keywords:** East Malaysia, buffalo, population, domestic demands, traditional practices.

## INTRODUCTION

The livestock industry is a key contributor to agricultural production in Asia, which in recent decades has been rising at an unparalleled pace [1]. The exponential growth in demand for food of animal origin is rapidly growing, fuelled by growing incomes, expanding urbanization and population growth. Livestock products for different countries depend on socio-economic factors such as human health concerns, changing of socio-cultural values and religious beliefs [2]. In Malaysia, religion plays an influential role in animal protein food choice. Muslims make up 60% of the population, and the remaining 40% comprise practitioners of Christianity, Hinduism and Buddhism. This multi-faith society has contributed to the availability of a wide range of livestock meat as animal protein sources in the country. The major components of Malaysia's livestock industry are comprised of the non-ruminants; chickens (95.8%), ducks (3.2%) and swine (0.6%). According to the annual statistics report from the Department of Veterinary Services [3], the current state of the ruminant sector is far less significant compared to the poultry section. Meat production from cattle (0.2%), goats (0.1%), sheep (0.04%) and buffalo (0.03%) contributes only a small percentage to the industry total.

Amongst commercially farmed ruminants, buffalo is the least popular and is considerably neglected compared to cattle. According to Food and Agriculture Organization [4], buffalo is an important asset but 'an undervalued commodity. The passive buffalo production in Malaysia and Sarawak, especially in recent years, has impacted the overall population size. In 2019, it was estimated that the number of buffaloes in Malaysia was approximately 101,695 heads distributed throughout both the western and eastern regions of Sarawak and Sabah, in Malaysian Borneo [3]. Overall, of Malaysia's total buffalo population, the population in Sabah accounted for 46.7% of the total population, whereas Sarawak comprised only 6.4% of that figure. The high concentration of buffaloes in these

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ISSN: 1927-5196 / E-ISSN: 1927-520X/21 

east Malaysian states is mainly due to the long-standing traditional practice of breeding buffaloes as an additional source of income. Buffaloes were used to plough rice fields in West Malaysia and still play a major role in traditional culture, especially in Sarawak. This paper focuses on describing the current status of water buffalo production in Sarawak as well as its future prospects within the livestock industry of Sarawak.

## DOMESTICATION OF THE WATER BUFFALO

The domestic Asian water buffalo, *Bubalus bubalis*, is a very calm and articulate beast, tame yet bucolic, obedient and friendly, rich in history. The positive attributes of this animal have contributed to its spread across many countries. The domestic water buffalo can be classified into two different breeds: swamp ('kerbau sawah') and river buffalo. Both swamp and river buffalo (of the Murrah strain) can be found in Sarawak; they differ genetically and morphologically as well as in usage [5]. Swamp buffaloes are mainly used as beasts of burden, including draught power in paddy fields, transportation and meat production [6]. Murrah buffaloes are known for their high-quality milk production, yielding 8 to 10 l of milk per day and 2500 l per lactation on average [7]. Comparisons from a cytogenetic perspective of the swamp and Murrah buffalo showed that they have 48 and 50 chromosomes, respectively, whereas their crossbreed has 49 chromosomes [8]. Further investigations from Malaysia, Thailand, the Philippines, and Brazil have confirmed that swamp buffaloes have 48 chromosomes [9, 10, 11, 12].

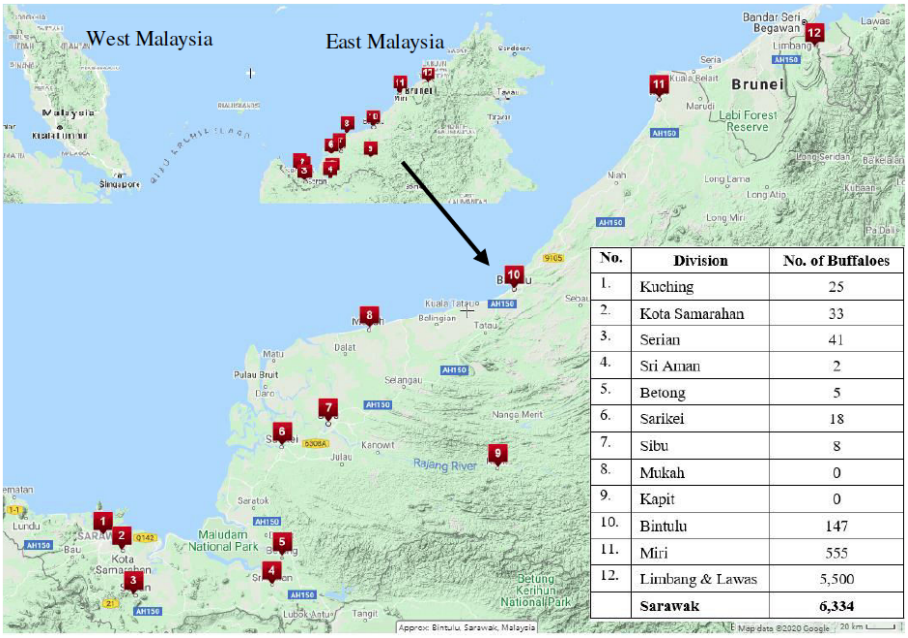
Asian buffalo is generally recognized to comprise three species: *Bubalus depressicornis* or Anoa from Indonesia, *B. mindorensis* from the Philippines and *B. bubalis*, which is a derivative from the domestication of *B. arnee*, the Indian wild buffalo [13]. The species *B. arnee* is presumed to be the closest representation of the ancestors of the domestic water buffaloes of Southeast Asia, which occurred some 5000 years ago and was distributed from Mesopotamia to Indo-China, covering what is now South and Southeast Asia. However, this species is believed to be extinct in the regions of Bangladesh, West Malaysia, the islands of Sumatera, Java and Borneo. Archaeological, anatomical, and historical evidence ratifies the debate that both swamp and river buffalo originated from the same lineage, *B. arnee*. However, the swamp buffalo is morphologically more akin to their ancestral species as reviewed by [13].

In Borneo, the origin and domestication of *B. bubalis* are poorly understood and is still a keenly debated subject. Genetic data indicates that the domestication of swamp buffaloes centralized in an area to the far south of China and northern Thailand, including Indochina [5]. This domestication practice advanced south through West Malaysia to the islands of Indonesia, which includes Sumatera, Java, and Sulawesi, north and northeast to central China, and then via the eastern island route of Taiwan, the Philippines and Borneo [14]. It has also been hypothesized that the water buffalo may have been brought in by the traders of the Hindu empire from Sumatra during the 12$^{th}$ and 13$^{th}$ centuries. However, it is more likely to be an indigenous species [15].

A more widely accepted theory is that water buffaloes were part of the indigenous fauna of the island [16]. A study of animal remains from the Niah cave complex in Sarawak are indicative of the Stone Age presence of buffaloes [17]. Interestingly, there are reports from an archaeological study that believes that one of the mammalian fossils unearthed from the Niah caves was a water buffalo, implying that this species has inhabited Borneo as far back as the late Pleistocene [18]. Various other studies consider it probable that *B. bubalis* was part of the original fauna of the island with north-west Borneo as its current distribution [14, 19]. Feral and semi-feral buffaloes used to be populous throughout Borneo, but the current status of these wild populations are poorly known.

## THE CURRENT STATUS OF BUFFALO POPULATIONS IN MALAYSIA AND SARAWAK

Buffalo, alongside cattle, are both used in beef production to support the local demand for red meat in the country. The population of buffaloes in Sarawak is estimated to number 6,334 heads, with 86% (5,500) of this figure is found in the north-eastern region of the state, in the Limbang and Lawas Divisions (pers. comm.) (Figure **1**). These divisions are recognized for their buffalo breeding farms, with approximately 41 farmers practising buffalo farming as their primary source of livelihood. In Sarawak, the buffalo population has been showing a declining rate over the past decade, decreasing from 8,459 heads in 2010 to only 6,446 heads in 2020 [3]. This fall has been attributed to decreases in the buffalo population (number of stock), low reproduction rates, high mortality, the slaughter of livestock, diminishing grazing areas and a decreasing number of farmers (pers. comm.). Although there has been some increase in the population size over the




| No. | Division | No. of Buffaloes |
|---|---|---|
| 1. | Kuching | 25 |
| 2. | Kota Samarahan | 33 |
| 3. | Serian | 41 |
| 4. | Sri Aman | 2 |
| 5. | Betong | 5 |
| 6. | Sarikei | 18 |
| 7. | Sibu | 8 |
| 8. | Mukah | 0 |
| 9. | Kapit | 0 |
| 10. | Bintulu | 147 |
| 11. | Miri | 555 |
| 12. | Limbang & Lawas | 5,500 |
| | **Sarawak** | **6,334** |

**Figure 1:** Distribution of buffalo in Borneo Sarawak, East Malaysia, in 2020 (Source: Department of Veterinary Services, DVS).

past five years, the rate is still low at an approximate growth rate of 3.8% annually. As for the dairy Murrah, to date, only 22 heads are known to remain in Sarawak, and they are bred exclusively at the Batu Danau Buffalo Station in Limbang, Sarawak.

Nevertheless, the trends in population numbers of this livestock (including the cattle industry) could be related to the high domestic demand for beef (both cattle and buffalo red meat) (Figure **2**). Unfortunately, Malaysia is experiencing a shortage in beef production in contrast to the soaring demand from local consumers. This will be discussed further in the following section.

## INSIGHTS INTO BEEF PRODUCTION AND DEMAND IN SARAWAK

Red meat is a popular meat choice as it is both delicious and highly nutritious regarding protein quality, vitamins and minerals [20]. In Malaysia, the production of fresh beef is inadequate to meet the needs of the local population. It must be noted that in this review, fresh beef is classified as both cattle and buffalo meat. A major concern is that Malaysia's beef sub-sector remains uncommercialized due to the low production capacity and the inconsequential participation of the private sector in its economic development [21]. The trend of beef demand, the output and per capita consumption basis from 2013 to 2019 are shown in Figure **2**. There was a marked decline in the production output of the beef industry in recent years from 51,715 metric tonnes (MT) in 2013 to 45,352 MT in 2019. As Malaysia's cattle population continues to grow slowly, the national beef production cannot meet local demands. Therefore, it is unsurprising that poultry meat is the primary driver for the growth of total meat production in Malaysia. The gap between red meat and white meat consumption varies greatly from individuals,

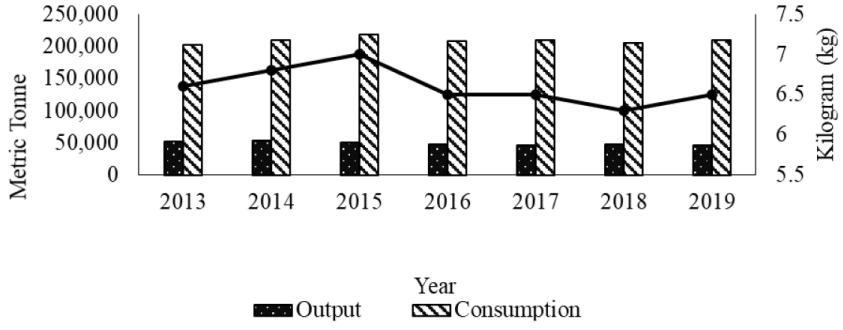



**Figure 2:** Estimated output, consumption, and per capita consumption of beef in kilograms (cattle/buffalo) in Malaysia, 2013-2019 (Source: Department of Veterinary Services, DVS).

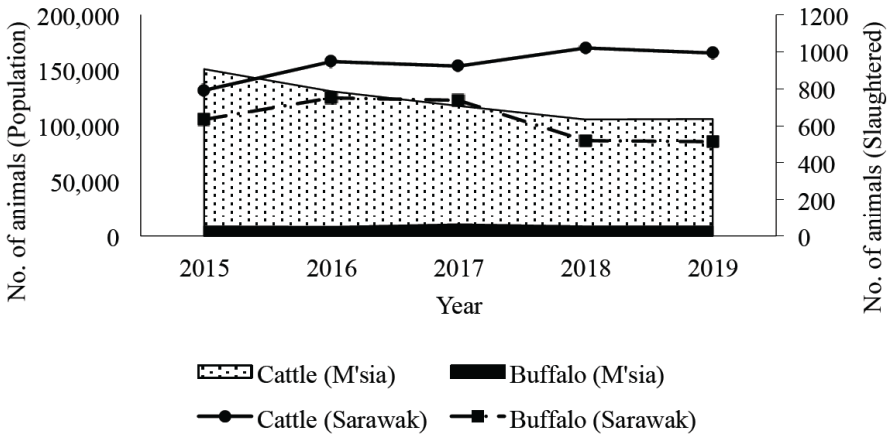



**Figure 3:** The estimated recorded slaughter of cattle and buffalo in Malaysia and Sarawak, 2015-2019 (Source: Department of Veterinary Services, DVS).

depending on economic status and consumer preference which explains the lower red meat consumption in the country [22]. The authors mentioned that as income increases amongst consumers, higher quality or more expensive red meat is preferred for consumption which also means a shift in demand from local to higher quality imported meats [22].

The trend in beef demand by local consumers, as shown in Figure **2**, maybe due to the rising price of local beef and the decreasing cost of imported beef. In Sarawak, the market price for local buffalo meat is at USD 8.46 (RM35.00) per kilogram, whereas imported meat is priced at USD 6.04 (RM25.00) per kilogram. The lower price of imported buffalo meat can influence consumers' decision in selecting buffalo meat over cattle. It is estimated that the demand increase for livestock products will continue in the near future, primarily due to population growth, income increase, urbanization, and changing consumption patterns [23]. The lower demand for local buffalo meat is supported by the inconsistent number of buffaloes slaughtered in Sarawak over the recent years (Figure **3**). The number of slaughtered buffalo previously showed an increasing trend which steadily declined to only 513 heads by 2019. On that note, buffalo used as a source of red meat first gained prominence due to the insufficient local production of beef cattle to meet the domestic demands. A key issue arising from this situation is the fact that not all consumers prefer buffalo meat over cattle meat.

The estimated self-sufficiency level (SSL) of livestock products in Malaysia from 2013 to 2019 is shown in Figure **4**. The self-sufficiency level (%) refers to the ability of local production to fulfil the demands of domestic consumers. For the beef industry, the SSL percentage has been slowly declining from 26% in 2013 to 21.59% by 2019. Through the Agriculture

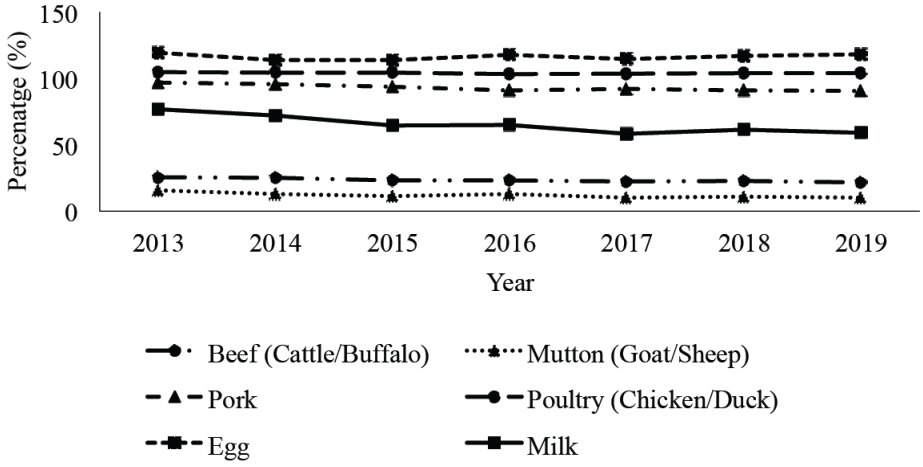



**Figure 4:** Estimated self-sufficiency of livestock products in Malaysia, 2013-2019 (Source: Department of Veterinary Services, DVS).

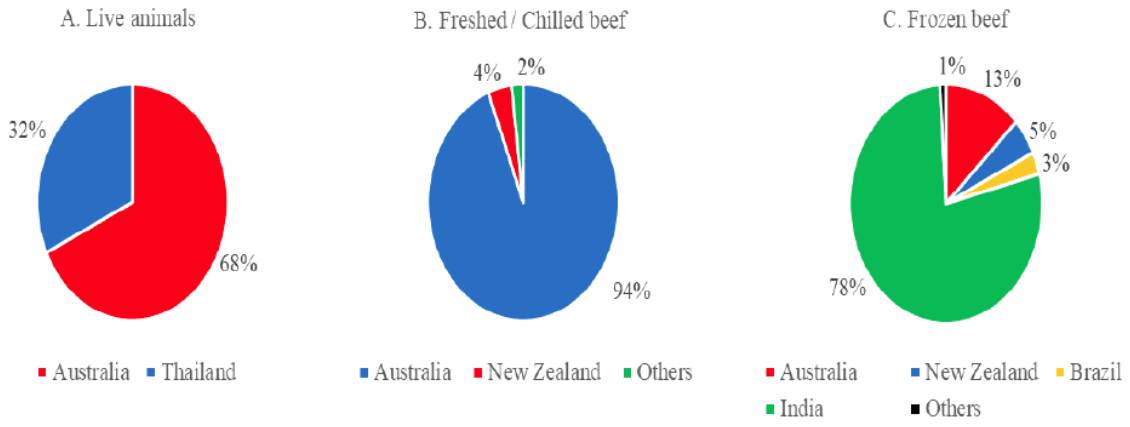



**Figure 5: A**) Live bovine imports by country of origin, **B**) Fresh/chilled beef imports by country of origin, **C**) Frozen beef imports by country of origin, 2018 (Source: International Trade Centre, ITC).

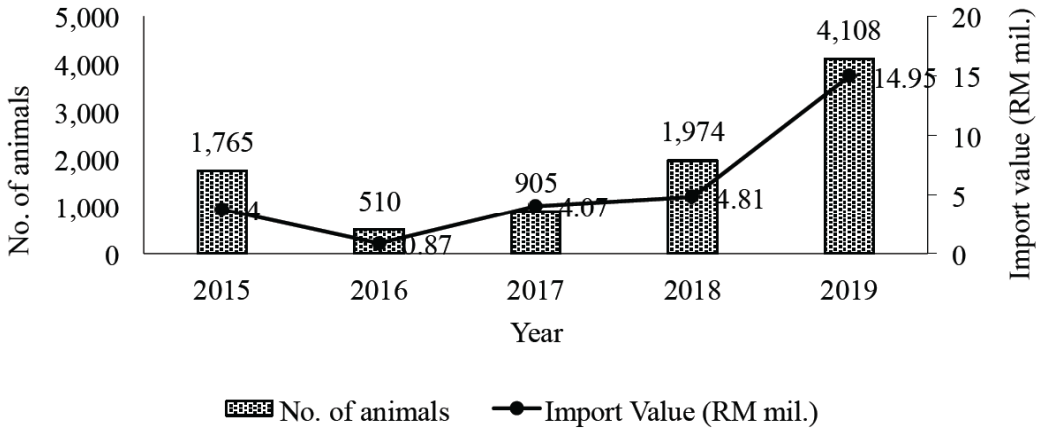



**Figure 6:** Import of live buffalo for slaughter in Malaysia, 2015-2019 (Source: Department of Veterinary Services, DVS).

Policy Plan (NAPs) launching, the Malaysian government targeted that by 2020, SSL for beef to be at 33%, which was to be achieved through increased production of domestic red meat, including buffalo meat [24]. In Sarawak, the state government has targeted to increase the SSL for buffalo meat from 1.3% in 2017 up to 6.5 % by the year 2030 (pers. comm.). Malaysia imports buffalo meat from various countries, with 70% coming from India and the remaining from Australia, Pakistan and Bangladesh. This is supported by data provided by the International Trade Centre (ITC), which states that Malaysia mainly imports live bovines from Australia and Thailand (Figure 5**A**), whereas fresh and frozen beef is imported from several countries, with the majority coming from Australia (Figure **5B, C**). Malaysia is massively dependent on importing live buffaloes for slaughter (Figure **6**) and imported beef from other countries (Figure **7**) to support local needs. For instance, in Sarawak, the number of imported live buffaloes has increased over the past 3 years from 150 heads in 2017 to 300 by 2019 (Table **1**). This shows the high level of dependency on imported buffaloes for beef supply in Sarawak.

## PROGRESSION OF BUFFALO REARING SYSTEMS IN SARAWAK

Farmers in Sarawak have been breeding and rearing buffalo for decades. In general, more than 90.0% of the ruminant population in Malaysia is still produced by small farm holders [21]. One of the reasons is due to the powerful draft capacity of this animal [6]. Most of them have been involved in this industry for over 20 years, with some being family businesses passed down from one generation to another [25]. The majority of local buffalo farmers in Sarawak practice an extensive buffalo management system (or traditional system). Small-scale farmers mainly practice an open system where their buffaloes are left to graze in unutilized open fields or pastures. Access to water bodies such as streams/rivers or watering holes for their buffaloes to wallow in is also common. The open pasture or grazing area is known

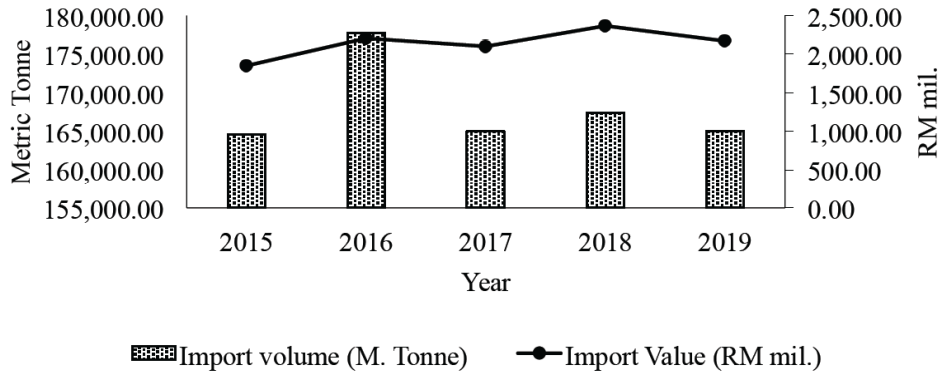



**Figure 7:** Import of beef in Malaysia, 2015-2019 (Source: Department of Veterinary Services, DVS).

**Table 1: The Import of Buffalo Beef (kg) from 2018-2019 and Importation of Live Buffalo to Sarawak from the Year 2017-2019 (Source: Department of Veterinary Services, Sarawak)**

| Year | Indian Beef/kg | Live buffalo import/head | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| 2017 | [a]n/a | 15 | 135 | 150 |
| 2018 | 3,417,038 | 20 | 209 | 229 |
| 2019 | 4,590,688 | 2 | 300 | 302 |
| Total | 8,007,726 | 37 | 644 | 681 |

[a]n/a not available.

as 'halaman' in Sarawak; the rearing area may or may not be fenced up. Open grazing systems are common among smallholders where the locals of Jawhar and Peint Tahsils also practice open grazing for their herds in the forest and agriculture fields after harvesting crops [26]. In the provinces of Rambutan and Indralaya in Indonesia, farmers let their buffaloes loose from cages to graze and wallow in the morning and cage them again in the afternoon [27].

In Sarawak, the 'Natad kerbau' (buffalo yard) system was introduced under the Buffalo Entrepreneurs Programme in 2016 (Figure **8**). The term 'Natad kerbau' comes from the local language of the LunBawang ethnic group, and the term refers to a fenced area used to house a herd of buffaloes (pers. comm.). This buffalo yard is a system that aims to enhance the traditional methods of breeding buffaloes to increase the buffalo population in Sarawak. 'Natad

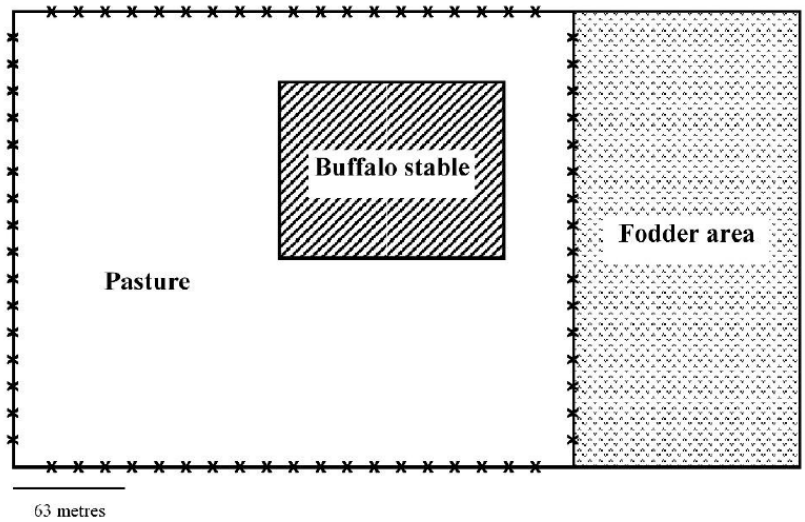



**Figure 8:** Layout of 'Natad Kerbau' introduced by the Department of Veterinary Services (DVS) Sarawak.

kerbau' involves a semi-intensive management system across eight hectares of land. This system entails a more precise husbandry system that aims to meet the buffaloes' nutritional needs by applying enhanced animal husbandry. The land is fenced with hardwood fencing and barbed wire; additionally, stables are constructed for the buffaloes. Napier grass sufficient for 50 buffaloes is grown in open areas under the cut-and-carry feeding system. The main goal of 'Natad kerbau' is to provide a systematic method for increasing the number of buffaloes in Sarawak. This undertaking is complicated and requires both strategic planning and intense rearing effort. A secondary goal of this system is to curb the occurrence of buffalo theft which is a problem endured by many buffalo breeders in Sarawak. Breeders are encouraged to register for the 'Natad Kerbau' system under the Department of Veterinary Services (DVS) Sarawak. The total number of buffalo breeders currently registered with the Sarawak DVS currently numbers 484 persons since the system was first introduced to farmers (pers. comm.).

## ISSUES AND CHALLENGES IN BUFFALO FARMING

The buffalo industry, especially in Sarawak, has stagnated over recent years, leading to a retarded growth rate in the number of buffalo farmers as well as the total population of buffaloes. Buffalo farming has largely been neglected in preference to other livestock such as cattle and goats [3]. A major challenge facing the local beef industry is the slow growth rate of local beef production in relation to the exponential rise in demand. Although efforts have been undertaken by the government to improve the industry through successive Malaysian plans, the slow growth rate of the beef production industry persists.

The niche market for buffalo meat in specific regions has not yet been fully exploited. In Sarawak, the Limbang and Lawas Divisions accounts for 86% of the buffalo population in the state, but the opportunity to develop buffalo as a major source of meat has not been exploited until recently. The state government has begun to focus more on developing breeding and production technologies for buffalo. Over the past 5 years, the number of live buffalo imported into Malaysia has increased (Figure **6**), and in the state of Sarawak, this increase amounted to 31.9% of imported live buffalo (Table **1**). The buffalo were imported from different parts of the world just to meet domestic demands. Local beef production has been side-lined in favour of the more lucrative beef import industry.

The lack of advanced breeding and rearing systems for buffalo farming is another key challenge to overcome for the buffalo industry. Technologies such as Artificial Insemination (AI) and Embryo Transfer Technology (ET) have yet to be applied in the breeding and production of the entire livestock industry in Malaysia. This, despite the shift towards modern methods in the management and production of livestock in recent years [28]. For instance, in the United States of America, it has been shown that 99% of the presently available Holstein AI sires and 95% of the currently existing Jersey AI sires, as well as their previous lineage, were developed via ET, which indicates the impact that ET has had on dairy cattle genetic development through the production of AI sires [29]. Thus, the neglect of buffalo in the livestock sector, the preference for importing cattle and buffalo beef from other countries, coupled with the lack of technology adoption in breeding and development of the buffalo industry are some of the major challenges to be met. Genome editing (GE) is another technology that needs to be explored in buffaloes. GE tools have been used in various livestock species to produce animals with economically important traits. Wool quality is enhanced in goats and sheep following alteration of the FGF5 gene [30, 31], and gene knockout of GDF8 led to double muscling and therefore increased meat production in cattle, goat, and sheep [32-35]. GE has the potential to improve buffalo farming and production in Sarawak, but mitigation measures may also be necessary to curb any detrimental effects to the industry.

## FUTURE DIRECTION OF BUFFALO INDUSTRY IN SARAWAK

In recent years, the buffalo industry garnered considerable interest from the government due to the potential of commercializing buffalo-based products such as meat, cheese and milk [36]. The government's primary focus is to minimize Sarawak's reliance on food imports by setting a target of 50% of SSL for Sarawak beef supply by 2030 and making Sarawak a net exporter of food within the next 12 years (pers. comm.). The 'Natad Kerbau' program and the system is one of the methods aimed at achieving this goal. Under the 11th Malaysia Plan (11MP), farmers will be assisted by training in modern farm management techniques and artificial insemination methods to increase calf production. The current focus of the buffalo industry is to increase the buffalo population numbers from 5,500 to 11,000 by 2025, with the primary focus area to achieve this target being the

Limbang Buffalo Valley. The main goal of this effort is for a greater focus on the reorganization and transformation of the local buffalo industry.

Buffalo farming in Sarawak has the potential to become a lucrative effort that can contribute meaningfully to the economy. Thus, with more initiatives and approaches to raise the production of local goods, this industry should flourish. Both governmental agencies and private enterprises are keen to develop the buffalo industry, which has been earmarked as an important resource for red meat with the potential to fulfil the high demand for animal-based protein. Recent initiatives to increase the population of male buffalo calves as an additional source of good quality meat are one of many potential avenues to promote the growth of this industry. Another interesting effort by the Ministry of Modernization and Agriculture Sarawak through the State Veterinary Department is developing a pilot dairy production centre within the Meragang Buffalo Station in Limbang, which is designed to house between 600-1000 dairy buffalo for both milk and Mozzarella cheese production. The dairy centre is still in the master planning stages, and the construction of facilities is estimated to begin by 2022 (pers. comm.). Such efforts bode well for the industry's future and could lead to a decrease of imported meats as well as dairy products into the country, and finally achieving the target for SSL of red meat production in Sarawak.

## CONCLUSION

The limited number of available studies on domestic water buffaloes in Malaysia means there is still a lack of comprehensive scientific research into breeding, meat quality, growth performance, carcass characteristics, reproductive physiology, and disease status. In other countries, institutions exist specifically to carry out research, training, and outreach programs on buffalo: in the Philippines, research and development of buffalo populations are undertaken at the Institute for Research on Buffaloes (CIRB), in India, the Dairy Research Institute (NDRI) plays this role, in Pakistan, it is the Buffalo Research Institute (BRI), and in China, there is the Guangxi Buffalo Research Institute (GBRI). Furthermore, several nationwide programs such as dispersal of semen for AI and bull loan initiatives have been implemented in the Philippines, enhancing national buffalo farming [37]. If Malaysia also adopted such a centralized research agency, this would lead to improvements in the Malaysian buffalo industry, including modern breeding technologies and improved milk production. Therefore, it is a step in the right direction for Sarawak to carry out their 'Natad Kerbau' program to increase the performance of local buffaloes. 'Natad Kerbau' targets improvements in weight gain, meat production and reproductive performance over current methods. Traditional farming systems utilized in Indonesia has caused low productivity due to poor breeding plans for buffalo farming [38]. Increased local buffalo meat production would decrease the state government's reliance on imported meats and boost chances of achieving the SSL target for red meat production in Sarawak. Although Vietnam produces and consumes more buffalo meat than beef, management and genetic improvement programs still remain a challenge they need to overcome [39].

In conclusion, buffalo have been and continue to be an integral part of the local socio-economic structure in Malaysia, especially amongst smallholder farmers in Sarawak. However, the global decrease in buffalo numbers is cause for concern; these animals have lost most of their former importance and may soon vanish from this region if mitigative measures are not undertaken. Thus, improvements in breeding plans and farm management are needed to tackle this issue. Most importantly, the development of the buffalo industry in Sarawak is not purely for economic importance but also of value for preserving local traditions. Thus, the role of the buffalo in sustainable agriculture continues.

## ACKNOWLEDGEMENT

The authors would like to thank the staff of the Department of Veterinary Services (DVS) Limbang and Lawas and all the buffalo farmers involved in this study who kindly devoted their time, resource, and efforts.

## CONFLICT OF INTEREST

The authors declare they have no conflict of interest.

## END NOTE

Comment by Mr. Robine Asut, Department of Veterinary Services Sarawak, Kuching.

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Received on 24-05-2021 Accepted on 08-06-2021 Published on 17-06-2021

https://doi.org/10.6000/1927-520X.2021.10.05