Understanding the Indigenous Socio-Economic and Ecological Systems of Indigenous Livestock Breeds for Designing Appropriate Extension Service and Delivery Systems

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ABSTRACT

Indigenous livestock breeds represent the collective heritage of the communities they are associated with, and cannot be conserved separately from their production systems. Such breeds will survive only when indigenous knowledge systems in which they have been embedded also survives. Modern livestock breeding and development programmes, however, heavily rely on only a handful of livestock breeds and genes, with narrow range of quantitative traits such as – quick growth and weight gain, etc. Further, such development programmes and associated extension and delivery systems seldom acknowledge the role of indigenous socio-cultural, traditional economic, and indigenous knowledge systems in improvement and conservation of indigenous livestock breeds and germ plasm. A study was conducted in eleven districts of the Indian state of Maharashtra to examine the relationship and embeddedness of a specific indigenous livestock breed within the socio-cultural landscape of its custodian indigenous community. Results of the study suggest that Indigenous livestock management systems are highly evolved and well positioned for improvement and sustainable management of both the indigenous livestock and associated genetic resources. However, indigenous knowledge on animal breeding is often "tacit" and not necessarily an expressed knowledge. Unlike modern science, the indigenous livestock management systems rely mostly on qualitative traits. Acknowledgement of their role and a little encouragement through designing inclusive institutions, extension services and delivery mechanisms could take improvement and conservation of indigenous livestock breeds/populations a long way.

Key Words: Gaolao cattle, Indigenous knowledge, Indigenous livestock, and Nanda Gawli community.

INTRODUCTION

Indigenous livestock breeds have evolved over centuries within specific indigenous socio-cultural, traditional economic, ecological, and indigenous knowledge systems (Marsoner, et al, 2018). They represent the collective heritage of the communities they are associated with, and cannot be conserved separately from their production systems. Such breeds will survive only when indigenous knowledge systems in which they have been embedded also survives. Indigenous communities – especially pastoralists – play an important role in the improvement and conservation of indigenous livestock breeds/populations and stewarding the priceless indigenous livestock germplasm and gene pools (LPPS and Köhler-Rollefson, 2005).

Modern livestock breeding and development programmes rely very heavily on only a handful of livestock breeds and genes, with narrow range of quantitative traits such as – quick growth and weight gain, production of gallons of milk, and lay crateful of eggs etc, achieved through infusion of very heavy dosages of synthetic medicines and feed. On the contrary, indigenous livestock management systems comprises of vast livestock diversity, with significant genetic range and variation. Indigenous breeds have been bred to thrive in harsh environments, resist diseases, cope with hardy living conditions such as long distance migration though difficult terrains, fend their off-springs, ward-off predators and serve multiple socio-cultural and economic purposes. Often indigenous livestock breeds are very much embedded and

co-evolved over centuries, within a specific indigenous, socio-cultural and traditional knowledge system (Ibid, 2005).

In this background, an exploratory study was conducted in eleven districts of the Indian state of Maharashtra to examine the relationship and embeddedness of a specific indigenous livestock breed within the socio-cultural landscape of its custodian indigenous community. Eight indigenous livestock breeds, with special focus on indigenous Gaolao cattle breed and the associated socio-cultural, traditional, economic, ecological and indigenous knowledge systems has been documented. The study also attempts to capture the perceptions, preferences, and criteria of the custodians for selection and improvement of breeds. The two main objectives of the study are: 1) to shed more light over the significance of indigenous socio-cultural, traditional, economic, ecological, and indigenous knowledge systems in breeding, improvement and conservation of the indigenous livestock breeds. and 2) to use such understanding in designing a more inclusive, holistic and appropriate public extension service and delivery systems for overall improvement of animal husbandry of the state. The example of Gaolao cattle breed (ICAR-NBAGR, 2019) is presented as a case for discussion about the relationship between indigenous socio-cultural practices and local economy; indigenous knowledge of selection and breeding, and evolution of community-based institutions with the support of public investment for improvement and conservation of the breed and local livelihoods.

METHODOLOGY

The Indian state of Maharashtra had been designated as the study area. It is the third largest and third most populous (11237.29 million) state of India, located at 19.7515° N, 75.7139° E, it is bordered by Chhattisgarh and Telangana in the East, Arabian Sea in the West, Gujarat and Madhya Pradesh in the North, Goa and Karnataka in the South and union territory of Dadra and Nagar Haveli to the North West. With an area of over 307,7713 km^2, it covers a significant portion of the Deccan plateau (Maharashtra Tourism, 2019). Godavari and Krishna are the two major rivers of the state. The state has a typical monsoon climate, with summer temperatures between 22 ^{0}C to 43 ^{0}C and monsoon temperatures between 12 ^{0}C to 34 ^{0}C. The state has a forest cover of 61,939 km^2, with five types of forests (Maharashtra Forest Department, 2018). Marati is the official language of the state and the state is an economic power house, contributing to 25 percent of industrial output and 70 percent of stocks of country (Pachouly, 2011; Reserve Bank of India, 2015).

Materials and methods

The present exploratory study was conducted during the year 2016 to 2019, at around 44 villages from 11 districts of Ahmednagar, Chandrapur, Gadchiroli, Gondia, Nagpur, Nanded, Nandurbar, Nashik, Palghar, Parbhani and Wardha of the Indian state of Maharashtra (table 1). A total 569 Households belonging to 7 indigenous communities of Banjara, Golkar, Gond, Kanadi Hindu Talwar, Mana, Nanda Gawli, and Pawara communities have been consulted for data collection (table 1). Households are selected using the random sampling method (Bryman, 2012; Bartlett, II, *et al*., 2001). Respondents for the purpose of data collection had been selected adopting the criterion sampling, a variant of the purposeful sampling technique (Creswell, 2013). Prior oral consent of the communities has been taken for collection of data for purpose of the present study.

Primary data pertaining to community perceptions, preferences, and criteria of breed selection and improvement, traditions, economics, and issues was collected from focus group discussions and personal interviews, using semi-structured questionnaire (Morgan, 1997; Vaughn et al., 1996). A detailed inquiry was conducted with the Nanda Gawli community of Wardha and Nagpur districts for examining the indigenous socio-culture and economics surrounding the Gaolao cattle breed. A total 249 Gaolao cattle breeder households belonging to Nanda Gawli community had been interviewed for purpose of data collection. Secondary data pertaining to landscapes, weather and ecosystems was collected from government records. The data was mixed, but predominantly qualitative in nature and analyzed using both qualitative and quantitative data analysis tools.

RESULTS

About eight indigenous livestock breeds have been identified in the study, which includes breeds of four cattle, two buffalo, a goat and a chicken (table 1). The 4 indigenous cattle breeds include Gaolao cattle breed (Agri-IS, 2019), reared by agro-pastoral Nanda Gawli community of Wardha and Nagpur districts. The Lal/Red Kandhari cattle breed (Agri-IS, 2019), reared by the Banjara community of Nanded and Parbhani districts. The Dangi cattle breed (Agri-IS, 2019), reared by the agro-pastoral, Kanadi Hindu Talwar community of Ahmednagar, Nashik, and Palghar districts. The Kathani cattle population reared by the Gond tribe of Gadchiroli, Chandrapur, Gondia, and Nagpur districts. The Nagpuri buffalo (Agri-IS, 2019), reared by the agro-pastoral Nanda Gawli community of Wardha and Nagpur districts. The Shahi/Golkar buffalo population reared by the Golkar community of Gadchiroli district. The Berari Goat breed (Agri-IS, 2019), reared by the Mana tribal community of Nagpur, and Chandrapur districts. And the Satpudi chicken population reared by the Pawara community of the Nandurbar district of Maharashtra (table 1 & 2).

Indigenous livestock breeders have preference for unique physical traits and characteristics in their livestock. For instance, breeders of Gaolao and Kathani cattle breeds prefer milky white coat, whereas the breeders of Lal/Red Kandhari cattle breed prefer red color coat with an oily glaze. Indigenous breeders pay special attention to the number, shape, and position of hair whorls on the body. In addition, indigenous breeders also take special interest in the colour, shape and size of the hooves, horns, eyes, and tail switch (table 2).

The Socio-Cultural, Economic and Institutional Ecosystem of Gaolao Cattle Breed

The indigenous cow-herding Nanda Gawli is a sub-group of the Gawli community. The other three sub-groups of Gawli community are Yadav Gawli, Ahir Gawli, and Ligayat Gawli, divided on the basis of their territory, (Singh, et al, 2004). Perhaps the name ‘Nanda’ is derived from Lord Krishna and they believe to be the descendants of Lord Krishna, who was raised by a cow-herding family. Legend has it that they arrived here along with Lord Krishna during his wedding with his wife, princess Rukhmini and settled in this area.

It was believed that their ancestors brought the Gaolao cattle along with them when they arrived here from Mathura. Since their settlement, the community continued to nurture the Gaolao cattle and improved it. The name of the breed Gaolao may have been given after the Gawli community as it was kept and nurtured by them. The community is still maintains few animals as sacred animals and they are known

locally as '*Jani'* (translates as origin/life). Animal products and calves produced by '*Jani'* are considered holy and sacred.

Gaolao cattle is extremely important for the community as it is a huge part of their culture and traditions. The animal is a part of every ceremony, ritual and festival of the Gawli community. Gaolao cattle is gifted to the new bride by her parents at her wedding and the pedigree of the cattle is drawn accordingly. Both men and women of the community shares the responsibility of taking care of the cattle. Men are involved in herding and breeding of the cattle, while women takes care of the new born calves and nurtures the old and sick animals. Women takes care of milking and usually keeps a record of the pedigree, sale and decides over which animals should be gifted to their daughters during their wedding.

Gaolao (known also as Arvior/Gaulgani) is a registered and popular indigenous cattle breed native to the Indian states of Madhya Pradesh and Maharashtra. The breed is reared by the indigenous Nanda Gawli Community in Wardha region of Vidarbha district of Maharashtra. They have been rearing this breed for generations for milk and draught purposes. Gaolao breed bullocks have a huge demand for their agility and ability to work in high temperature and tackle heavy loads. The low maintenance breed can survive on almost zero input, but gives optimum production. Local communities are besotted by this breed because of its color, shape, size and temperament. Although the breed is primarily famous for its draught power, it is very popular for its ghee (clarified butter). Gaolao ghee has already found a niche market among the city dwellers and commands a good price in the mainstream market.

The economics of Gaolao cattle has been calculated from the data of 249 breeders with an average herd size of 6.25 animals. The average income of the household in the year 2018-19 from Gaolao cattle is INR 230,382.57, (table 3). About 70 percent of the livestock based household income comes from the sale of animals for draught purposes (fig. 1).

Indigenous breeders of the Gaolao cattle follow their own indigenous knowledge and traditional breeding techniques for breeding improving the breed and maintaining its genetic purity. Similar to many other indigenous communities Nanda Gawli community traces pedigree of the breed patrilineally. Therefore, breeding bull occupies a very special place among the indigenous breeders of the breed. The indigenous breeders keenly observe for certain traits in a breeding bull, which are presented in the table (4).

Issues and the Evolution of Community-based Institutions

Maintenance of Gaolao cattle herds had been under threat due to every increasing restrictions on access to customary grazing lands inside the forests, due to declaration of protected areas and shrinking commons. The lack of adequate public investment for improvement of the breed and enhancement of livelihoods of the Gaolao cattle breeders, threats of germplasm erosion, population decline and crossing with exotic breeds became apparent. The agriculture system had been in a great transition, there had been a change in the cropping pattern and a huge shift from draught power to tractors, which completely altered the fodder availability for cattle. These undesirable paradigm shifts have escalated the inputs costs of the otherwise traditional low-input Gaolao breed maintenance. Consequently, many Gaolao breeders of Waradha abandoned cattle rearing.

The year 2011 had been a game changer, the animal husbandry department of Wardha district realized the need for revival of the Gaolao breed. During the year 2011, the department, in partnership with the Gaolao breeders and NGOs organized the first cattle fair of the Gaolao breed. In the following eight years of the Gaolao cattle fair there had been a remarkable spike in the interest of Gaolao breeders in rearing the breed. In the year 2016, a Gaolao cattle breeder has been felicitated with the Breed Savior Award 2016, by the government of India (SEVA, 2016). Since 2018, breeders voluntarily come forward and organized the Gaolao cattle fair on their own. In the process the breeders have also realized the power collective efforts and constituted the Gaolao breeders association in the year 2018. The Gaolao breeders association has 150 Members and provides support to the indigenous cattle breeders over improvement and conservation of the breed. The Gaolao breeders association is playing a major role in developing People's Biodiversity Registers for conservation of the Gaolao breed. Around 30 Biodiversity Management Committees have been formed in this region and most of them have Gaolao cattle breed conservation as their mandate. One of the major issues being considered by the Gaolao breeders association is the production of fodder on community forest lands issued under the Forest Rights Act, 2006.

DISCUSSION

Cattle rearing and animal husbandry had been the mainstay of the indigenous Nanda Gawli community. The Nanda Gawli community is considered as a sub-sect of the indigenous Yadava/Golla community. Nanda Gawli, similar to the Yadava/Yaduvanshi, believes to belong to the same lineage into which Lord Krishna was born. The name Golla, is derived from the Sanskrit word, 'Gopal', which means caretaker/protector of cows (Joshua Project, 2019; Yaadav, 2010). The Gora/Goramati Banjaras of Telangana keeps cattle because their spiritual guru, SantSevalal Maharaj (believed to be incarnation of lord Shiva) used to rear cattle (Nayak, 2009). Sheep and wool had been intricately woven into the customs, traditions, culture and social fabric of the indigenous Dangar/Kuruma/Kuruba pastoralist communities of the Deccan plateau region (Patil, 2009). Sant Balumama, the spiritual guru of Dangars was a shepherd, he kept Deccani sheep when he was alive and handed over his flock to the Admapur Panchayat during the time of taking "jeevasamadhi" (soulful meditation). The descendants of his flock is considered sacred and taken care of by the Balumama Trust of Admapur in Maharashtra, (Shri Balumama Trust, 2019). Likewise, Kuruama's of Telangana state keeps idols of sheep and dog in the temples of their idol Beerappa (believed to be incarnation of lord Shiva), (Patil, 2009).

Similar to Gaolao cattle for Nanda Gawli community, camels play an important role in the culture and identity of Rabari's of Gujarat and Raika's of Rajasthan. Camels are not only an integral part of their culture, rituals, customs, traditions and ceremonies but also influences their lifestyle to a great extent. They have a profound knowledge of breeding camels and devoted to their camels. Traditionally, Raika's neither sell camel milk nor other products like hair and hide. Slaughtering of camel for meat is totally forbidden in their culture and their relationship with camel is often spiritual than economics (Tripathi and Rajputh, 2006; The Raika Samaj Panchayat, 2009; Patel, 2018).

The indigenous Lingayat community of Tamil Nadu state claims to have been custodians of the indigenous Burugur cattle and *MalaiErumai*(hill buffalo). Their livestock breeds were said to have co-evolved with the Bargur forest ecosystem, their culture and traditions (Swamigal, 2009). Traditionally every Lingayat family keeps a cattle herd and dedicates at least one or two animals of the herd to Lord Matheswaraswami (an incarnation/form of Lord Shiva) and those animals are considered sacred and kept

until they die of natural causes. They are also allowed to graze freely in the premises of Lord Matheswaraswami temple. Cattle are an important part of their culture and every Lingayat temple bears a picture of a cow on the roof. The Gaolao cattle breeders of the Nanda Gawli community have initiated writing their community bio-cultural protocols for improvement and conservation of the breed.

Similarly, the Muslim, vegetarian and nomadic Van Gujjars of Himachal and Uttarakhand shares a very special bond with their buffalos. The lives of Van Gujjars is all about caring for their beloved buffalos and finding fodder for them. The traditional transhumant seasonal migration and rotational grazing of Van Gujjars is regarded as sustainable and environmentally sound system (Benanav, 2015; Gooch, 2004). Likewise, Buffaloes are an integral part of life and culture of the indigenous Toda communities, the oldest inhabitants of the upper Nilgiri Plateau of Tamil Nadu state. The life and culture of Toda's have evolved and revolves around their sacred buffalos. Traditionally, they maintain six hierarchical grades of sacred buffalo herds and also build special dairy temples for each grade (Chhabra, 2018).

Native chicken breeds occupy a very special place not only in ancient civilizations but also among the indigenous cultures (Siripurapu and Das, 2018). Native chicken breeds are used for a range of cultural and spiritual reasons and rituals of the indigenous communities across country. Chickens with black plumage is mostly preferred for indigenous rituals and traditional medicine, therefore, priced heavily (Siripurapu and Das, 2018). Indigenous communities refrain from using crossbreed chicken for religious and spiritual purposes. The demand for indigenous chicken spikes steeply during the festival season and breeders often fail to meet the demand. There are endless such examples depicting the relationship between indigenous communities and their livestock.

It is evident that indigenous livestock is crucial for keeping the socio-cultural fabric of indigenous communities intact and sustaining their livelihoods and economies, vis-à-vis socio-cultural fabric of indigenous communities is crucial for survival of indigenous livestock. This connection is however under threat, livestock managers are increasingly finding it difficult to sustain the system due to myriad reasons - restrictions on grazing, declaration of protected areas, shrinking commons, changes in agriculture, lack of public investment in improvement of breed and local livelihoods, changing aspirations of the community, among others,(Asher, 2018; Benanav, 2015; Swamigal, 2009). Major challenges faced by the indigenous livestock managers is the lack of:1) public investment in characterization and conservation of the indigenous populations, 2) ensuring access to customary grazing lands and other natural resources,3) lack of recognition for indigenous knowledge and making them equal partners, 4) public investment in promotion and strengthening of community-based institutions, 6) establishment of proper market linkages and 7) Holistic and sustainable development of production systems through community-based extension services.

CONCLUSION

Indigenous livestock management systems are highly evolved and well positioned for improvement and sustainable management of both the indigenous livestock and associated genetic resources. However, indigenous knowledge on animal breeding is often "tacit" and not necessarily an expressed knowledge. Indigenous livestock management systems rely mostly on qualitative traits (ability to walk long distances over difficult terrains, resistance to diseases, fend off-springs and ward-off predators) than quantitative (LPPS and Köhler-Rollefson, 2005). Much of this knowledge is orally transferred through generations,

often through traditions, culture and practice. Henceforth, survival of such indigenous socio-cultural systems and people with knowledge of the qualitative traits is quintessential for improvement and conservation of indigenous livestock breeds and germplasm. The majority of state supported livestock development programmes fail because they rely heavily on quantitative aspects and traits, without consulting, involving and engaging the actual custodians of the livestock – the indigenous communities.

The policy landscapes surrounding the breeds and biodiversity had been changing across the globe. For instance, the Article 8 (i) of the Convention on Biological Diversity (CBD) recognizes indigenous knowledge and the Biological Diversity Act of 2002, of India provides the local communities, in this case the indigenous livestock breeders, the opportunity to conserve the biological diversity, sustainable use of its components and gives direct access to fair and equitable sharing of benefits arising from the use of such biological diversity and associated traditional knowledge (TK).The Section (36)of the act requires the Central Government to promote conservation and sustainable use of biological diversity through *in situ* conservation and minimize the adverse effects on biological diversity. Similarly, the Section (3d) of the Forest Rights Act, 2006, bestows on the community the right to use or excise entitlements, which includes grazing (both settled and transhumant) and traditional access to seasonal resources of nomadic or pastoralist communities. Therefore, it is necessary to design more inclusive extension services and delivery systems to accommodate and empower indigenous communities. The instance of Gaolao and other similar learning and experiences may provide few insights and pointers for designing holistic and inclusive institutions, extension services and delivery mechanisms.

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TABLES AND FIGURES

Table1:Details of the Indigenous communities, Livestock Breeds/Populations, their Native Breeding Tracts and Ecosystems					
S.No	**Indigenous Community**	**Community Lifestyle**	**Indigenous Livestock Breed / Population**	**Native Breeding Tract**	**Ecosystem of the Breed / Population**
1	Nanda Gawli	Agro-Pastoral	Gaolao Cattle and Nagpuri Buffalo	Wardha, and Nagpur	Shrub forests, Savanna Grasslands
2	Banjaras	Settled	Lal/Red Kandhari Cattle	Nanded, and Parbhani	Degraded wastelands
3	Kanadi Hindu Talwar	Agro-Pastoral	Dangi Cattle	Ahmednagar, Nashik, andPalghar	High mountains and valleys with grasslands and high rainfall
4	Gond Tribe	Settled	Kathani Cattle	Gadchiroli, Chandrapur, Gondia, and Nagpur	Deep inside forests
5	Golkar	Settled	Shahi/Golkar Buffalo	Gadchiroli	Deep inside forests
6	Mana Tribe	Settled	Berari Goat	Nagpur, and Chandrapur	Deep inside forests and fringes
7	Pawara	Settled	Satpudi Chicken	Nandurbar	Valleys and deep inside forests

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Table2:Details of Physical Characters Desired by the Indigenous Breeders/Populations in their Livestock			
S.No	**Breed / Population Type**	**Native Breeding Tract**	**Preferred Physical Characteristics of the Breeder**
1	Gaolao Cattle	Wardha, Amravati and Nagpur districts	Thin skin, with a milky white coat, three hair swirls, black hooves, muzzle and tail switch, small backward horns, medium size dewlap, bowl shaped udder with medium sized tits, curved milk veins, equally proportionate long and straight legs.
2	Lal/Red Kandhari Cattle	Nanded, Parbhani and Hingolidistricts	Red color coat with an oily glaze known as Telya is generally preferred. Large body with long legs and rounded black hooves, long tail reaching beyond hock. Short and broad horns. Thin skin attached compactly to the body. Two, clockwise, round shaped hair swirls located at the center of the back bone.
3	Dangi Cattle	Ahmednagar, and Nashikdistricts	Black and white colored spots uniformly distributed all over the coat. Oily skin, with two hair swirls.Large hump in bulls. Long

			tail and black hooves. Straight and backward curved horns.
4	Kathani Cattle	East Vidarbha district	Small size body with white coat. Small hooves and dewlap. Horizontal and pointed ears and small straight horns.
5	Shahi Buffalo	East Vidarbha district	Black and ash colored body devoid of any white spots. Medium size horns, short legs with grey colored hooves. And bowl shaped udder.
6	Berari Goat	Vidarbhadistrictarea	Dark red coat with black borders. Hind limbs with strong muscles and compact pouch i.e belly.
7	Satpudi Chicken	Satpuda hills and valleys of Nandurbar district	Different plumage with long wings and large and round Shank beak and yellow nails. And pea shaped combs on roosters.

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Table 3: Economics of the Gaolao Cattle Breed

S.No	Investment and income	Components	Unit	Price Per Unit (in INR)	Avg. no of units sold	Total Amount (in INR)
1	Avg. expenditure in the year 2018-19 for a herd (avg. size of 6.25 animals)	labour	Per herd	5768.75	----	5768.75
		Vaccination	Per herd	45.13	----	45.13
		Health Care	Per herd	205.89	----	205.89
		Other (Miscellaneous)	Per herd	111	----	111
2	Avg. income of the breeders in the year 2018-19	Income from sale of 1 yr old male calf	Per animal	3527.58	2.5	8818.95
		Income from sale of 2-3 yr old male calf	Per animal	7000	2.5	17500
		Income from sale of a bullock	Per animal	30000	2.5	75000
		Income from sale of a breeding bull	Per animal	75000	1.5	112500
		Income from sale of milk and milk-based products	Per annum	40	1162.5	46500
		Income from sale of manure	Per ton	9062.5	2	18125
		Income from lease of bullocks	Per day	1710.5	15	25657.5
3					**Gross Income**	**236601.45**
4					**Net Income**	**230382.57**

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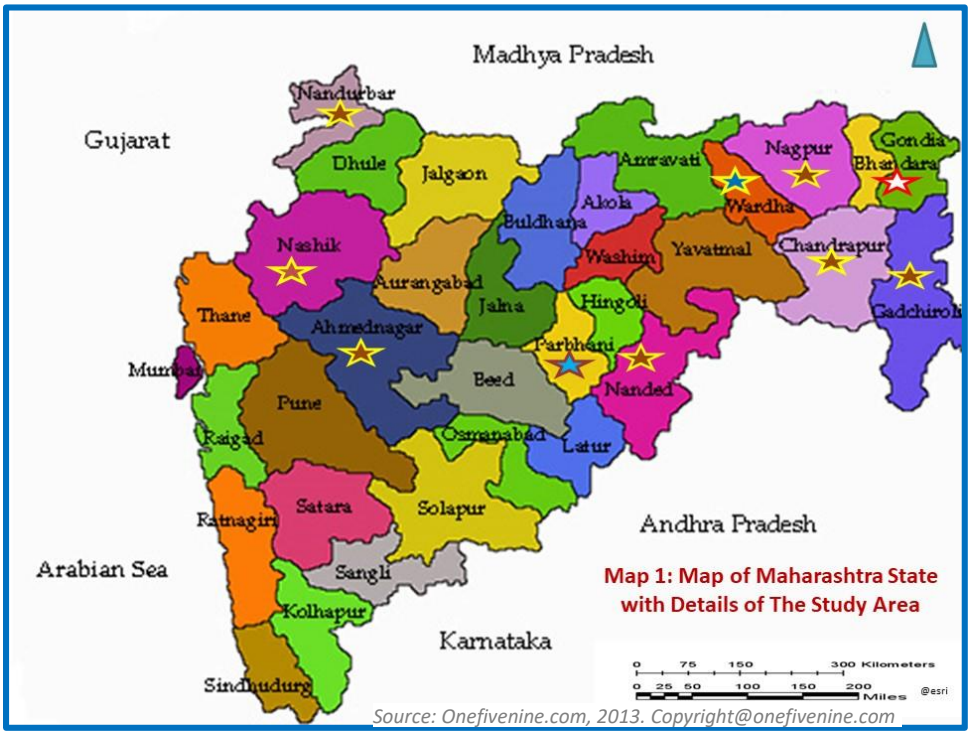
Table 4: Indigenous Criteria For Selection of Breeding Bull of Gaolao Cattle

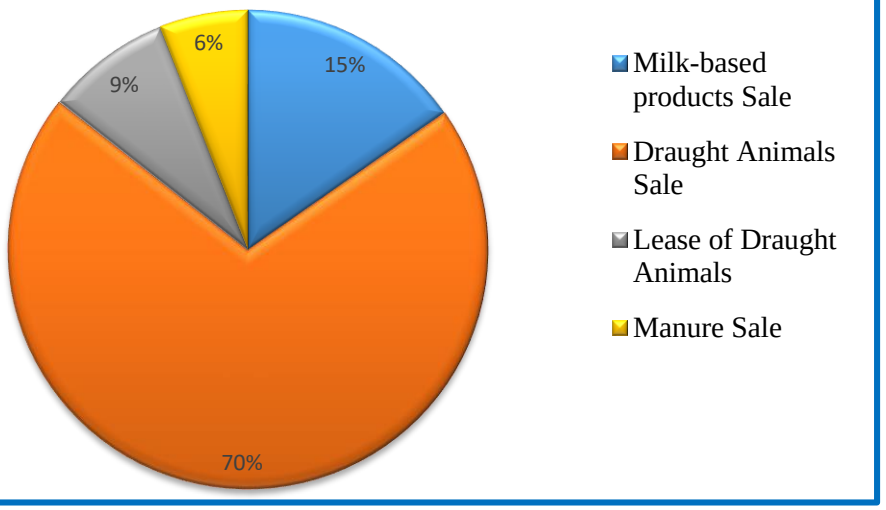
1	Age	over two Years
2	Head	Broad

3	Forehead	Roman in shape resembling the beak of a parrot
4	Hooves	Black
5	Tail	Long and thin, should be milky white
6	Gait	Should be firm and no dragging feet
7	Legs	Straight, long and strong hind joints
8	Horns	Curved backward
9	Naval flap	Prominent with folds
10	Eyes/Iris	Almond shape and black
11	Dewlap	Grey with folds
12	Ears	Perpendicular and white in color
13	Hair swirls	Should be only one
14	Coat	Milky white with grey on the forehead, dewlap and hump
15	Scrotum	Should be black at the tip and size of the testis should be equal and proportionate



Map 1: Map of Maharashtra State with Details of The Study Area

Figure 1: Breakup of the Gaolao Cattle Economy



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