Archives of Agriculture and Environmental Science 9(3): 561-567 (2024)
https://doi.org/10.26832/24566632.2024.0903022

e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes

ORIGINAL RESEARCH ARTICLE

Socioeconomic impact of livestock production in Gokuleshowor, Baitadi, Nepal

Dipak Raj Bist*, Ganesh Raj Joshi, Pawan Chapagaee, Ashmita Mandal, Puspa RC, Renu Awasthi, Ramila Rawal, Gita Bist and Rukmani Bohara

Gokuleshwor Agriculture and Animal Science Collage, Baitadi - 10200, NEPAL
*Corresponding author's E-mail: dipakbist81@gmail.com

ARTICLE HISTORY

Received: 17 July 2024
Revised received: 22 August 2024
Accepted: 05 September 2024

Keywords

Benefit Cost ratio
Dairy sectors
Feed management
Livestock farming
Socioeconomic impact

ABSTRACT

The study was carried out at the Baitadi district's Dilashaini rural municipality. The study area was primarily based on agriculture. Farmers in the studied area adopted a complex type of farming system that includes livestock, crops, fruits, forestry, and vegetable farming. This study was mainly conducted to identify key problems faced by farmers and the socioeconomic importance of livestock farming. Semi-structured questionnaires were used to randomly choose respondents for a key informant interview. 61 households were randomly selected without the replacement method. The results showed that most of the households were headed by men (52 households). The primary occupation was agriculture (72%), followed by business (22%). A benefit-to-cost ratio of 1.65 was discovered. Milk was priced at 48.08 rupees per liter. We found feeding management to be the main problem. Farmers invest a huge amount of their income in managing feed for livestock. Natural breeding was largely prevalent in the study area (96%); artificial insemination was still rare. In the studied area, the dairy sector was profitable, so it emphasized improved breeding programs, improved feeding management, and the establishment of well-managed dairy cooperatives, which helped in the development of the rural economy and the lifestyle of farmers.

Citation of this article: Bist, D. R., Joshi, G. R., Chapagaee, P., Mandal, A., R. C., P., Awasthi, R., Rawal, R., Bist, G., & Bohara, R. (2024). Socioeconomic impact of livestock production in Gokuleshowor, Baitadi, Nepal. *Archives of Agriculture and Environmental Science*, 9(3), 561-567, https://dx.doi.org/10.26832/24566632.2024.0903022

INTRODUCTION

The economy and way of life of Nepal are fundamentally based on their livestock. It is one of the agricultural subsectors with the quickest rate of growth and a major provider of both jobs and food. The agriculture sector contributes 24.1% of the gross domestic product (GDP) of Nepal, which is estimated to grow up to 2.73%. Agriculture and livestock production also have a major influence on increasing the per capita income of a country. Nepal is considered a developing country with a per capita income of $1027. Minimum requirement of livestock product is more than availability, as the requirement of milk is 91 liters per person per man, and meat requirement is high, where the minimum requirement is 14 kg and availability are 21 kg (Economic Survey, 2023). Livestock production contributes 24.01% to agriculture's gross domestic product. Raw cattle milk contributes 3.9501%, raw buffalo milk contributes 7.28%, goat farming contributes 3.95%, and meat of buffalo contributes 4.23% on AGDP (MoALD, 2023). A mammary gland's primary purpose in producing milk is to provide all of a newborn's nutritional needs. Water, vitamins, inorganic elements, essential amino acids, amino groups for the production of non-essential amino acids from proteins, and energy from fats and lactose are all needed by the organism (Goh *et al*., 2014). On average, milk comprises the following nutrients: 87.2% water, 3.7% fat, 3.5% protein, 4.90% lactose, 0.7% ash, 9.1% fat-free solid residue, and 12.8% total solid (Lambrini *et al*., 2020).

Nepal's livestock and poultry populations have been steadily rising over the past ten years, and this trend is expected to continue as interest in this sector grows. The cattle industry is a major provider of both jobs and food (Poudel *et al*., 2020). In developing nations like Nepal and other Asian countries,

livestock is an essential component of small-scale crop livestock mixed agricultural systems and a major source of nutritional elements (Khanal *et al*., 2022). Rising urbanization and income levels in developing nations are expected to drive up demand for animal products. Livestock production has significant variation on source of income generation; mostly raw milk, butter, meat, and manure can be utilized (Br *et al*., 2018). The cattle industry appears to be crucial to reducing poverty and enhancing the population's nutritional status in Nepal. Once a way of life, raising livestock is now becoming a lucrative economic endeavor (Pradhanang *et al*., 2015). Since they give the weaker sections of society jobs and help them increase their income, planners and policy makers see livestock production and dairy growth as powerful tools for bringing about social and economic reform in rural areas. Thus, cattle play a significant role in the growth of rural economies and in raising the standard of life for the majority of people living in rural areas (Davies *et al*., 2010).

Livestock farming is profitable for small stakeholders in the Terai region of far-western Nepal. Livestock farming gives a significant contribution to the rural economy. The far-western region has a substance type of livestock farming; rural areas contain at least one productive animal for milk production (Bhandari, 2020). Milk production contributes to diet management; rural area populations are more self-dependent upon milk production and organic manure for crop cultivation than urban populations. Rural place populations are mostly dependent upon agriculture and livestock production as major sources of income (Khanal *et al*., 2022). The far western region of Nepal is considered the least developed as compared to the eastern part of Nepal on agriculture modification and improved farming technology. A primary barrier to livestock production in Nepal is the little amount of land owned by farmers. An extensive system for livestock farming should be adopted by farmers to manage the feed management constraint. Agroforestry parturition has great potential in the far-western region as there are many grazing green lands present (Kingdom, 2017). Livestock farming also helps significantly with poverty alleviation, as 79% of rural households are involved in a mixed farming system as they generate income from both crop cultivation and livestock farming (Jha & Polytechnic, 2019). Due to the high population of Hindus and their belief in worshiping cow as God, cow is also the national animal of Nepal. There is a lower population of productive cattle as compared to the productive buffalo population, which significantly affects the productivity of livestock. The population of cattle is higher than buffalo in Nepal (Ghimire & Pandeya, 2021). There are more indigenous breeds in Nepal as compared to high-yielding improved breeds, which also affect significantly the productivity of livestock (Khanal *et al*., 2022). In the USA, production of livestock was improved by technological advancement, genetic enhancement, and an improved system of livestock farming. In the United Kingdom, extensive system livestock farming contributes significantly to production livestock. Livestock trade is an important component of agriculture globally (Papakonstantinou *et al*., 2024). The Dairy Cattle Improvement Program (DCIP) resulted in a 300-day milk output of 2735±38.7 kg from jersey cattle crossbreeds. About 36% of buffaloes are cross-bred. Crossbreeding has the ability to develop high-producing bovines in Nepali indigenous breeds (Kamlesh & Trivedi, 2019).

Examining the socioeconomic effects of livestock husbandry on rural economies is the goal of this study. To understand the various management techniques used by farmers in the examined area, one must understand the significance of livestock farming to the rural economy. to research how much money farmers make from their livestock and how to produce animals economically in Nepal's rural areas. to research the main issues surrounding livestock farming and farmers' satisfaction levels.

MATERIALS AND METHODS

Study area

The hilly district of Dilashaini Rural Municipality, Baitadi, is located in Province No. 7 (Sudurpaschim Province) of Nepal, extending to the border of India at Jhulaghat. Since everyone in this area is a farmer, we chose wards 5 and 6 of the Dilashaini rural municipality at random for our study. Since it is easy to identify cattle and buffalo in the research region, raising livestock is a prevalent and dominant practice.

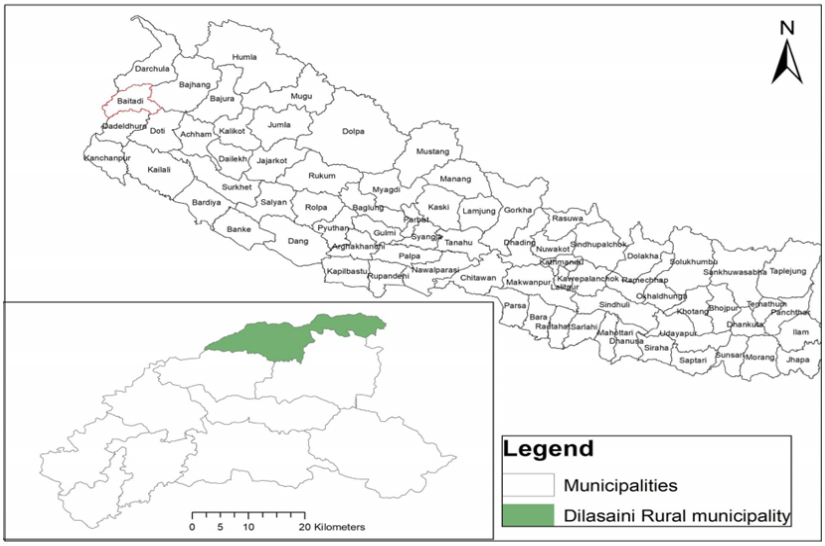

Figure 1. *Map of Nepal including studied area.*

Research design and data collection

Using the without replacement approach, a survey with random sampling was carried out, with research locations and respondents chosen at random. To gather data, 61 homes in total were chosen. In order to assess the validity of the questions, a key informant interview was also performed with respondents who were chosen at random and who completed semi-structured questionnaires. Based on issues raised by participants in the research region during pilot testing, more constraints were imposed. Ten participants in the pilot study were excluded from the final poll. The study was carried out in 2022 between December 1 and December 5. Face-to-face interviews were used to collect data as they are the most appropriate and transparent technique.

Statistical analysis

Data input was done using Microsoft Excel 2013, and descriptive statistics analysis was done using IBM Statistical Package for Social Science (SPSS v.21.0). The mean, frequency, and standard deviation calculations are examples of descriptive statistics.

RESULTS AND DISCUSSION

Socio-demographic characteristics

Average age and gender of household heads: After conducting interviews with 61 homes, the average age of the household head was 48 years. This figure is comparable to that of Malla *et al.* (2021), who found an average age of 49.25 years for the same gender of household head. The results obtained from descriptive statistics revealed that 52 household heads were male and 9 were female since male members were in India for employment to support family expenses. The patriarchy in Nepalese society is widespread; a similar result was found in (Thapa *et al.*, 2020). 81.8% were male-headed households, whereas 26.3% were female-headed, as recorded by FAO (2012).

Marital status of household heads: The figure indicates that 75% of the household heads were married, whereas 25% were unmarried. According to FAO (2012), 33.6% of the population in the study area were unmarried, and among them, 37.7% were male and 29.8% were female. Whereas 61.5% were married, and among them.

Family type of sampled households: Two types of family types were reported in the study area, viz., joint and nuclear families. 80% of the households have a nuclear family, and in 20% joint families have been reported. Nuclear families predominate in Dilashaini and Baitadi as a result of economic migration to urban areas in search of better employment opportunities, changing social norms favoring independence, limited housing space, and the younger generation's focus on education and career, all of which encourage smaller, self-sufficient household units. But according to Devkota & Bhatta (2018), joint family type was found to be predominant in the Baitadi district.

Average family size of respondents: The respondents' average size of family in the surveyed area was 5.97. The average national household size was 4.37 CBS (2021). Malla *et al.* (2021) found an average family size of 7.89, the highest reported compared to another research. Education status of respondents. The education status of the respondents was classified in five categories based on schooling year (Table 2). According to the study, just 10% of participants were illiterate. Of those who could read and write, 16% had completed elementary school, 51% had completed secondary school, 6% had completed a bachelor's degree, and 13% had gone to college. During a function held in the area on Friday, Baitadi was formally declared the literate district. The district is divided into ten local entities. By mid-June 2018, all of the local units had been certified as literacy rates. According to the Education Development and Coordination Unit, the district's literacy rate is 96.53 percent.

Table 1. Feature of the study area.

Features	Description	References
Ecological zone	Mid-hill	(Climate Data, 2024a)
Altitude	1927m	(Climate Data, 2024b)
Population	22,966	(CBS, 2021)
Literacy rate	76.7%	(CBS, 2021)

Table 2. Family type of sampled households in study area.

Family type	Percentage
Joint family	14 (20)
Nuclear family	47 (80)
Grand Total	(100)

Table 3. Education status of respondents in study area.

Level of education	Count of level of education
Illiterate	6 (10%)
Primary	10 (16%)
Secondary	31 (51%)
Bachelor	4 (6%)
University	9 (13%)
Grand total	61 (100)

Table 4. distribution of landholding of respondent's household in study area.

Type of landholdings	Area (Ha)
Irrigated	0.17
Non irrigated	0.14
Non cultivated	0.07

Table 5. Total cost, total income, net income, per liter cost and benefit cost rate.

Parameter	Amount (Rs.)
Total cost	66056.84
Total income	109554.3
Net income	43497.46
Cost per liter	48.08
B/C ratio	1.65

Education status of respondents: The education status of the respondents was classified in five categories based on schooling year (Table 3). Only 10% of respondents to the study were illiterate, and of those who were, 16% had completed elementary school, 51% had completed secondary school, 6% had completed a bachelor's degree, and 13% had gone to college. According to the National Census 2021, Napal's literacy rate was 76.3%, whereas our study area's literacy rate was 76.6% (CBS, 2021). During a function held in the area on Friday, Baitadi was formally declared the literate district. The district is divided into ten local entities. By mid-June 2018, all of the local units had been certified as literacy rates. According to the Education Development and Coordination Unit, the district's literacy rate is 96.53 percent (Chand & Bhatt, 2024) Many people even lack the ability to make decisions regarding their daily lives, finances, and other areas of research.

Primary occupation of respondents: Agriculture is the major occupation of the study area, followed by business and service in the government and private sector, as shown in table 4. Nearly 30 million people live in Nepal, an agricultural nation with a variety of natural zones. 57.3% of them, or 50.6% of the males and 64.8% of the women, are employed in agriculture. Agriculture, the backbone of Nepal's economy, provides livelihoods, creates jobs, and contributes 24.1% of GDP (Krishi Diary, 2024). Agriculture is the main source of income for households in rural Nepal. However, it is still subsistence farming, carried out on small, low-productivity plots of land. As a result of the seasonality of agriculture, rural households also engage in temporary work for little financial gain (Prakash & Lall, 2012).

Distribution of landholding of respondent's household: The landholding has been classified as irrigated, non-irrigated, and non-cultivated based on the irrigation and cultivation status (Table 4); the first two are cultivated, and the latter one is fallow land or marginal land used for grazing purposes. Average landholding of the respondent's household = 0.38 hectare. As per CBS (2021), the mean land area owned by farmers was 0.54 hectares (ha).

Distribution of livestock holding of respondent's household: To determine the various livestock possessed by respondents per household, the average livestock population was calculated in Livestock Standard Unit (LSU) = 1 (cow/bull) + 1.5 (buffalo) + 0.4 (goat/ship) + 0.6 (swine/pig) + 0.2 (poultry) (Joshi *et al.*, 2023).

Livestock Standard Unit (LSU) = (2.05* 1.5 + 2.17* 1 + 0.41* 0.6 +4.98*0.4+1.8*0.2) = 8.84.

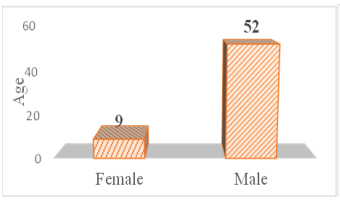

Figure 2: Gender of household heads.

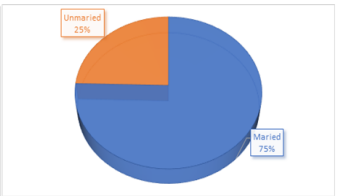

Figure 3: Marital status of household heads.

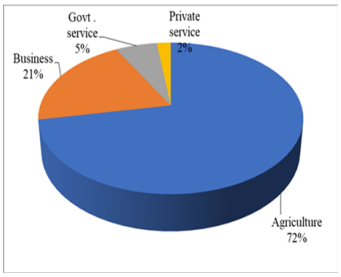

Figure 4: Primary occupation of respondents household in study area.

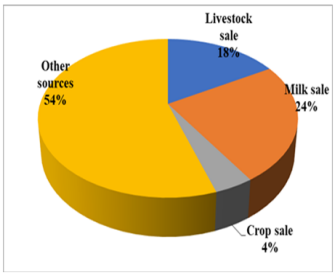

Figure 5: Income characteristic of respondent's in study area.

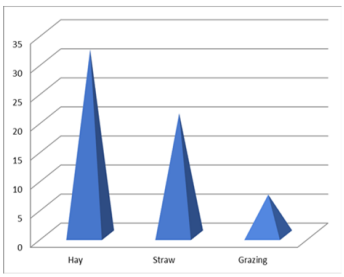

Figure 6: Feeding management in study area.

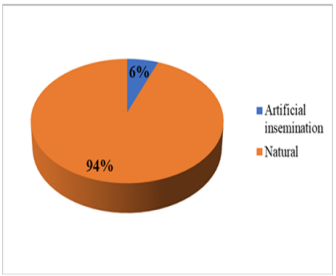

Figure 7: Availability of breading system.

Income characteristics of respondent's household: The study area's economy is based mostly on agriculture, which generates 46% of total revenue from sales of crops (24%) and animals (18%). However, a variety of sources of income support the community's economic stability. Dairy farming is important since milk sales account for 24% of household income, which is a critical role. In addition to agriculture, remittances from family members living overseas provide much-needed financial support, while local services and job opportunities increase the variety of sources of income. This multifaceted strategy improves overall economic stability in addition to stabilizing household incomes against agricultural uncertainty. Salary income from a salaried position is the highest, followed by remittances; labor income is the lowest (Maharjan & Joshi, 2007). According to Shah *et al.* (2023), agriculture represented 96.71% of the farmer population, while office employment comprised 3.09% in the mid-hall of Nepal. Based on (Details, 2024; Gupta & Singh, 2019), the majority of study respondents were employed in agriculture as compared to other occupations.

Feeding management

From the study area, it has been found that hay was most widely used in feeding, followed by straw, and only 7 respondents were found to use grazing as fodder. The use of tree fodder, green grasses, and straw constitutes a major composition in the dietary pattern of livestock. Due to import constraints of improved feedstock, there's still a feed deficit and nutritional deficiency in most livestock in Nepal. Fodder trees and bushes are vital to provide enough feed for cattle in Nepal's mountainous regions during the dry season, when the amount and quality of available forages are limited. Tree fodders serve as supplements to agricultural wastes or low-quality byproducts and are crucial sources of high-quality feed for grazing ruminants throughout the winter (Shah *et al.*, 2023).

Availability of breading system

In the study area, rearing of livestock for household demand has been reported from almost all the respondents, which showed the subsistence nature of farming, and in the case of breeding system selection, the traditional system of farming can still be seen. Only 6% of the respondents were found to adopt artificial insemination (AI), and the rest, 94%, are still following the traditional method of natural mating (Figure 7). Nowadays, breeding practices increasingly use artificial insemination. However, it is relatively low in Nepal, with just 6.30% AI penetration in Buffalo till 2020/21 (Devkota *et al.*, 2022). Most of the rural parts are out of the national livestock breeding center (NLBC) and don't receive service from NLBC, although it was started six decades ago. Artificial insemination systems are not cost-effective; natural breeding systems are cheap and easy to access. AI system of breeding helps in genetic improvement program (BGIP) through crossbreeding (Siddiky, 2018).

Total cost, total income, net income, per liter cost and benefit cost rate

For the production function assessment record of the cost of expenditure, total income, net income, and the selling price of farm products are to be recorded fairly. Though accurate bookkeeping was lacking in the study area, farmers' estimations were recorded to access the status of farm economic condition and operational status of the farm. The total cost of production was Rs. 66056.84 and the total income was Rs. 109554.3. The average net income of the farm was found to be Rs. 43497.46, and the mean farm gate price of milk was Rs. 48.08 per liter (Table 4). Benefit-cost ratio (B/C ratio) analysis suggests that the farm is in the situation of profit, and for every Rs. 1 investment return is Rs. 1.65. When the B/C ratio is less than one farm is in loss, it equals neither profit nor loss, and above 1 farm is running under profit. Timsina (2010) reported that the B/C ratio of large farms was 1.42, medium farms were 1.33, and small farms 18 were 1.23. The B/C ratio of farms was comparatively higher in the study area as compared to Timsina's findings.

Level of satisfaction

The majority of the respondents were found satisfied with their occupation, 26% were somehow satisfied, and the remaining 22% were found not satisfied. Livestock sector of Nepal is integral type; livestock sector is facing low productivity and ability to be modified to modern commercial farming system through improvement of genetic potential of productive animals and scientific method of housing system (Khanal *et al.*, 2022). Livestock farming is a subsistence type; people are self-dependent on dairy products in rural areas of Nepal, which also improves the socio-economic condition of livestock farming (Sapkota, 2022).

Problem Faced by the Respondents

A five-point Likert scale was used, a technique for measuring attitudes using several different response formats (Batterton & Hale, 2017) to get respondents' opinions on prevailing problems. An index of agreement based on severity was used to rank the constraint. First rank was the higher price of input (3.02) was the most severe problem in the study area, which increased the production cost. Accordingly, the second rank is the unavailability of inputs in time (2.42), the third rank is the unavailability of improved breeds (1.67), the fourth rank is the problem of diseases (1.07), and the fifth rank is the lack of credit (0.40). An index of agreement is used to order them. The problem needs to be prioritized over other concerns since the greater the index of agreement value, the more serious the issue is.

Conclusion

In the extreme west of Nepal, in the Dilashaini rural municipality of Baitadi district, research was carried out. In the research region, almost every family practices a complicated farming system that combines raising cattle, cereals, fruits, forestry, and

vegetable cultivation. In the research region, patriarchy was noted, with 70% of families being headed by men. The study area's primary industry is agriculture. The dairy sector in the study area was of subsistence type and running under a profit condition with a B/C ratio of 1.65 and a cost of production per liter of milk of Rs. 48.08. Still, people follow natural breeding for producing the offspring of cattle and buffalo, which do not have a good production efficiency (mostly due to inbreeding depression). The milk distribution system was not properly channeled, and the essence of the dairy cooperative in the study area is of utmost importance. Due to geographical constraints, the cost of feeding input was reported to be high; thus, if proper training is given to farmers regarding the feed management and importance of the dairy sector in the study area, it helps to increase the economic status and lifestyle of farmers.

DECLARATIONS

Author contribution statement

Conceptualization: D.R.B., Methodology: G.R.J.; Software and validation: P.C.; Formal analysis and investigation: P.C.; Resources: A.M., R.A., R.R., G.B., R.B., G.R.J., and D.R.B.; Writing—original draft preparation: P.C., D.R.B., A.M., P.R., R.A., R.R., G.B., R.B., and G.R.J.; Writing—review and editing: D.R.B.; Visualization: D.R.B.; Supervision: D.R.B. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest: The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethics approval: This study did not involve any animal or human participant and thus ethical approval was not applicable.

Consent for publication: All authors are agreeing to publish this paper in AAES.

Data availability: Data will be made available on request.

Supplementary data: Not available.

Funding statement: Funding organizations in the governmental, private, or nonprofit sectors did not provide any special grants for this study.

Additional information: No additional information is available for this paper.

REFERENCES

Batterton, K. A., & Hale, K. N. (2017). The Likert scale: What it is and how to use it. *Phalanx*, *50*(2), 32–39.

Bhandari, T. (2020). Analysing dairy business value chains in far-western terai districts of Nepal. *Journal of the Institute of Agriculture and Animal Science*, *33*, 20714. https://doi.org/10.3126/jiaas.v33i0.20714

Br, B., Kaphle, K., & Kk, Y. (2018). Situation of livestock, production and its products in Nepal. *Animal Veterinary Science and Management*, *1*(1), 1–8. https://doi.org/10.26502/avsm.001

CBS. (2021). National agriculture census 2021. National Planning Commission. https://www.agricensusnepal.gov.np/post/10_64fc38a5a62c8

Chand, P. B., & Bhatt, B. (2024). Exploring literacy rate and financial literacy levels in Pancheshwor Rural Municipality, Nepal: A secondary data analysis. *International Research Journal of Modernization in Engineering Technology and Science*. https://doi.org/10.56726/IRJMETS53078

Climate Data. (2024a). Baitadi climate: Weather Baitadi & temperature by month. https://en.climate-data.org/asia/nepal/far-western-development-region/baitadi-1025248/

Climate Data. (2024b). Baitadi climate: Weather Baitadi & temperature by month. https://en.climate-data.org/asia/nepal/far-western-development-region/baitadi-1025248/

Davies, J., Niamir-Fuller, M., Kerven, C., & Bauer, K. M. (2010). Extensive livestock production in transition: The future of sustainable pastoralism. *In Livestock in a Changing Landscape*, *2*, 19-46.

Details, A. (2024). Ecofeminism and climate change: Opportunities and challenges of climate-smart agriculture. *Ecofeminism and Climate Change*, *5*(1), 37–50. https://doi.org/10.26480/efcc.01.2024.37.50

Devkota, M., & Bhatta, M. (2018). Newborn care practices of mothers in a rural community in Baitadi, Nepal. *Health Prospect*, *10*, 5–9. https://doi.org/10.3126/hprospect.v10i0.5637

Economic Survey. (2023). Economic Survey 2022/23 - Government of Nepal (Ministry of Finance). Ministry of Finance. www.mof.gov.np

FAO. (2012). A living from livestock. http://www.fao.org/docrep/015/i2744e/i2744e00.pdf

Ghimire, S. H., & Pandeya, Y. R. (2021). Cattle research in Nepal: Current status, challenges, and way forward. *Journal of Nepal Agricultural Research Council*, *6* (1), 39-50.

Goh, K. K. T., Sarkar, A., & Singh, H. (2014). Milk protein–polysaccharide interactions. In *Milk Proteins: From Expression to Food* (2nd ed., pp. 387–419). Elsevier. https://doi.org/10.1016/B978-0-12-405171-3.00013-1

Gupta, R. P. B. D. N., & Singh, A. (2019). A study on the pattern of infant health care in Baitadi District of Nepal. *Journal of Health Sciences*, *4*(3), 36-48.

Jha, D. K., & Polytechnic, O. (2019). The role of livestock in rural households in Nepal. *Journal of Rural Development*, *42*, 67-91. https://doi.org/10.18488/journal.135.2019.42.67.91

Joshi, L., Karna, B. K., Dhital, B., Panta, H. K., & Kohar, G. R. (2023). Economics of milk production in Kailali and Kanchanpur districts of Province -7, Nepal. *Journal of Dairy Science*, *11*(9), 112-125.

Joshi, N. P., Maharjan, K. L., & Piya, L. (2012). Poverty dynamics in Far-Western rural hills of Nepal: Evidences from panel data. *International Journal of Child Mental Health*, *2*(1), 55-66. https://doi.org/10.4137/IJCM.S5476

Kamlesh Trivedi, K. P. (2019). Breeding strategy and action plan for genetic improvement of livestock in Nepal. *Journal of Livestock Genetics*, *5*, 12-23.

Khanal, P., Dhakal, R., Khanal, T., Pandey, D., & Devkota, N. R. (2022). Sustainable livestock production in Nepal: A focus on animal nutrition strategies. *Nepal Agricultural Journal*, *4*(1), 1–20.

Kingdom, U. (2017). Technical assistance consultant's report Nepal: Far Western Region Urban Development Project (Volume 2). *Ministry of Urban Development Second Integrated Urban Development Project Economic and Urban Development Vision for Far Western Terai Region*, *2*, 19-34.

Krishi Diary. (2024). Agriculture Information and Training Center. AITC. https://aitc.gov.np/en/notices/details/df9bsshh94cpm31yctdp9hxypu5ea3kv6bzgb280

Lambrini, K., Aikaterini, F., Konstantinos, K., Christos, I., Papathanasiou, V., & Areti, T. (2021). Milk nutritional composition and its role in human health. *Journal of Pharmacy and Pharmacology*, *9*, 10–15. https://doi.org/10.17265/2328-2150/2021.01.002

Maharjan, K. L., & Joshi, N. P. (2007). A poverty analysis in Baitadi District, rural far western hills of Nepal: An inequality decomposition analysis. *Nepalese Journal of Development and Rural Studies*, *4*(2), 16–35. https://mpra.ub.uni-muenchen.de/35384/

Malla, S., Rosyara, U., Neupane, B., & Sapkota, B. (2021). Food and Agri Economics Review (FAER), 1(2), 88–92. https://doi.org/10.26480/faer.02.2021.88.92

MoALD. (2023). Statistical information on Nepalese agriculture 2078/79 (2021/22). *Ministry of Agriculture and Livestock Development*, *Nepal*, 1–269.

Papakonstantinou, G. I., Voulgarakis, N., Terzidou, G., Fotos, L., Giamouri, E., & Papatsiros, V. G. (2024). Precision livestock farming technology: Applications and challenges of animal welfare and climate change. *Veterinary Sciences*, *11* (1), 1–17.

Poudel, U., Dahal, U., Upadhyaya, N., Chaudhari, S., & Dhakal, S. (2020). Livestock and poultry production in Nepal and current status of vaccine development. *Animal Science Research*, *5*(2), 1–9.

Pradhanang, U. B., Pradhanang, S. M., Sthapit, A., & Krakauer, N. Y. (2015). National livestock policy of Nepal: Needs and opportunities. *Agriculture*, *5*(1), 103–131. https://doi.org/10.3390/agriculture5010103

Prakash, N., & Lall, K. (2012). Determinants of income and consumption poverty in far-western rural hills of Nepal. *Poverty and Economic Policy Journal*, *4*(2), 25-35.

Sapkota, R. (2022). Economics of smallholder animal husbandry in Lalitpur District of Nepal. *Agriculture Review*, *31*, 1–2.

Siddiky, N. A. (2018). Animal breeding policies and strategies in South Asia. *Journal of Animal Breeding*, *5*(3), 15-25.

Singh, H. (2014). Milk protein–polysaccharide interactions. In *Milk Proteins* (2nd ed., pp. 387–419). Elsevier. https://doi.org/10.1016/B978-0-12-405171-3.00013-1

Shah, M. K., Pandey, L. N., Bastola, R., Shah, B., & Shah, S. (2023). Goat feed resources and feeding management in mid-hill of Nepal. *International Journal of Applied Sciences and Biotechnology*, *11*(1), 15–24. https://doi.org/10.3126/ijasbt.v11i1.53701

Thapa, S., Bhandari, R., & Nainabasti, A. (2020). Survey on people's attitudes and constraints of rooftop gardening in Dhulikhel. *Ecofeminism and Climate Change*, *1*(2), 89–96. https://doi.org/10.1108/efcc-04-2020-0008

Timsina, K. (2010). Economics of dairy farming: A case study of Phulbari village in Chitwan District of Nepal. *Nepal Agriculture Research Journal*, *10*(7), 55–63.