CHAPTER VIII
SYNTHESIS
SUMMARY OF FINDINGS AND PATH AHEAD

The present research work for the Doctor of Philosophy Programme was initiated keeping in my mind two important aspects of this study i.e. i) paucity of research and literature related to cultural ecology of bovine stock and its economy particularly by the discipline of geography and ii) the general understanding of poor performance of the state of Assam in this sector of the economy. The first general objective was to know in detail the regional pattern of the cultural ecology of bovine stock and its economy. The second general objective was to contribute significantly to the geographical literature related to the livestock geography which can be traced through the existing economic and agricultural geography mostly treated as an allied sector to crop production through region approach.

The actual haunch of the study was to highlight the complementary nature of crop cultivation to livestock rearing. That is to explain further inter-dependence of these two sectors through the compulsive requirement of draught power requirement in many agro-climatic regions was not properly highlighted effectively by earlier researchers. Therefore, the limited geographical literatures as well as other social science literature dominated mostly by economic literature had been considering livestock economy as an allied sector to crop cultivation within overall agricultural sector. The state of Assam was deliberately considered through the prior knowledge of agricultural geography of Assam with certain level of adequacy to test the haunch of the study through practice.

To start with the summary, the beginning of the study is put in Chapter 1 which deals with the statement of the problem, objectives, hypotheses and methodology of the study. A brief review of some related works has also been incorporated in this chapter which is necessary to carry out the study in proper direction. Various methods including cartographic and quantitative methods used for analysis and presentation of data in the study are also discussed in this chapter. The data required for the study have been collected from both secondary and primary source. Relevant secondary data have been collected from different offices of Assam.
like Directorate of Animal Husbandry and Veterinary Science. Directorate of Agriculture, Directorate of Economics and Statistics and Directorate of Census Operations. Primary data have been collected at household level from twenty four villages from six sampled districts of six agro climatic regions with the help of a well-designed questionnaire by using stratified random and purposive sampling to get a proper picture of the existing Livestock population of the state.

As already covered the entire main work on the topic has already been presented systematically in six chapters, from chapter II to chapter VII.

The findings of the Second chapter which is based on literatures of secondary sources are given below:

i. The whole state of Assam is divided into four physiographic divisions namely Brahmaputra Valley, Barak Valley, Karbi plateau and Barail and Southern Hills by pioneer geographers.

ii. The physical elements such as physiography and relief, climate, soil, vegetation vary significantly over the state of Assam creating six agro-climatic zones which alternately governs the spatial distribution of bovine stock.

iii. It is also found that the dominated hot and humid climate of this region affects the general health of bovine stock. Animal diseases are common in this region.

iv. Cattle and buffalo are the most important animal next to land in use for farmer of the state. The cattles are generally poor in quality and belong to non-descriptive breed. Pedigree stocks like the Kankrej of Gujarat, a highly valued dual purpose breed or the Amritmahal of Karnataka, a very good draught breed are not identifiable in the state. The bovine stock identified here as non-descriptive type are poor in quality and low in body weight with low milk yield and working capacity.

To cover the entire population of bovine stock of the state and to understand the basic structure and pattern of the same, an attempt has been made in chapter III to analyse two time period data from the livestock census i.e. 2002 and 2007. It is found that the spatial distribution and pattern of utilization of both the specie of cattle and buffaloes are not uniform over the state. It varies from district to district. Growth of cattle population is more compared to the growth of buffalo population. Using inter-
species (cattle vs. Buffalo) and intra-species (indigenous vs. crossbreed) composition of bovine stock has been studied at district level for two time period i.e. 2003 and 2007. Structure of bovine stock has been discussed in the light of age and sex composition. Age composition has been studied by using age classification given in the livestock census report of Assam. Sex ratio for both cattle and buffalo has been calculated using ratio of male per hundred female for all the districts and analysed for two time period. Growth pattern of indigenous and crossbreed cattle is also discussed in this chapter.

It is found that there has been steady increase of cattle from 2002 (92.55 percent) to 2007(95.17 percent) for the state. But buffalo composition in the state has been reduced from 7.45 percent in 2002 to 4.83 percent in 2007 during the five years intervening period. The implication of this increase in favour of cattle could be attributed to three different facts i.e. i) preference for cattle, ii) increase in number of households and iii) difficulty in maintaining buffaloes by random households. The three percent decrease in the composition of buffalo population is because of the factors of increase in cattle population and decrease in buffalo population in absolute number.

At the district level the composition between cattle and buffalo confirms the general trend of the state. However, the lowest concentration of cattle composition of (60.32%) of Dima Hasao in 2002 which has further gone down to (54.79%) in 2007 clearly indicates at the increase in buffalo population in that district which belongs to the relatively special agro-climatic zone that is Hill zone. In this context the district of Karbi-Anglong also belonging to the Hill zone shows a different trend whereby buffalo composition of (16.34%) in 2002 has gone down to a very low of (3.58%) which is even lower than the state average of (4.83%). The composition study of the species (cattle vs. buffaloes) reinforces the idea of importance of agro-climatic zone as well as the changing nature of livestock preference.

As far as the intra – species composition of the available cattle stock comprising the indigenous non descriptive type to the crossbred ones is concerned to understand the existing pattern of the economy of the species with reference to the dairy development the crossbred cattle had a composition of nearly 7 percent by the livestock census year 2007 which indicates rather a slow pace of dairy development
programme through the state. At the district level, significant progress in development of crossbreeding is observed in some of the pockets like the districts of Kamrup, Hailakandi, Nalbari and Dima Hasao.

The analysis of bovine structure covering age and sex for the whole state of Assam at district level reflects the following pattern:

i. The percentage share of young cattle has decreased marginally in the state between 2003 to 2007.

ii. The Compositions of young and adult buffalo for Assam in 2002 were 37 percent and 63 percent respectively which has changed in favour of the young ones recording 43 percent.

iii. The cattle sex ratio of 90 numbers of males in the year of 2002 has actually increased to 92 by 2007, a clear reverse trend to the national trend.

iv. Unlike other states the bullocks are not being displaced in the state of Assam.

v. At the district level, Lakhimpur in the north bank agro-climatic zone maintained as many as 118 by 2007 male cattle for every 100 female cattle, a clear indication of the regions requirement and compulsion of ploughing requirement, an indication of poor level of tractorisation.

vi. The buffalo sex ratio of 83 for the state of Assam in 2002 has decreased to 80 within the census period a general trend in case of draught buffaloes. The marginal reduction of 3 numbers in sex ratio hints at mostly stagnation in this sector barring some pockets introducing dairy buffaloes in the state.

vii. The bovine sex ratio in Assam varies significantly from one agro-climatic zone to another.

Fourth chapter examines the nutrition status for bovine stock through availability of feed and pasture land of Assam. Availability of fodder for bovine stock at district level has been found out with the help of number of bovine per pasture land. On the other hand types of feed and their sources are looked into for finding out the level of nutrition in terms of Total Digestible Nutrient (TDN) and Digestible Crude Protein (DCP) for bovine unit of Assam. Distribution pattern of
DCP and TDN per bovine unit per annum have been found out to know the available nutrition for bovine unit. Growth rate of pastures and nutrients have been calculated from secondary source of land use and crop production data.

The analysis on average bovine heads per pasture land for the state by 2007 shows a figure 4.45 heads of bovine per hectare of pasture. There has been an increasing pressure of bovine stock on pasture land for the state of Assam. The increase has been very sharp which amounts to nearly 20 percent within a short period of five years. It is clear that the state witnessed an increasing pressure of bovine stock on the pasture land.

The regional variation related to the above analysis that is bovine heads per hectare of pasture land also is found to be highly skewed. As many as three districts are found to have more than 10 heads of bovine per hectare of land.

As far as feed availability of the state is concerned, Digestible Crude Protein (DCP) in kg per bovine unit per annum has been calculated for the two time periods (2002 and 2007) for the state of Assam. In 2007 state has recorded on an average of 5 kg of DCP for one bovine unit. It is increased by 1 kg for one bovine unit during the span of 5 years. It is because of the increase in production of food crops with high DCP content and change of feeding requirements for bovines, an encouraging feature for the dairy economy of Assam. But the availability at district level of this quality feed is highly skewed showing more than 50 percent of the sub-regions having deficit compared to the state average.

As far as quantum availability of nutrition is concerned at 2007, an average amount of 255 kg of TDN per bovine unit was available in the state. This state average value does not give a clear picture of the spatial distribution of availability of TDN for bovine unit. It varies from 108 kg/BU/Annum in Chirang to 462 kg/BU/Annum in Nalbari for the same period. It is seen that, during 2002-07 there was a reduction of 123 kg per bovine unit per annum. It indicates that within a short span of 5 years there has been sharp reduction of nutrition level for bovine stock in terms of TDN per bovine unit per annum. This variation affects the quality of bovine stock in the absence of commercialisation of fodder and feed.

In conclusion, the study indicates that the state of Assam faces the shortage of fodder for its bovine stock due to a combination of factors. This is mainly because of
the changing pattern of land utilisation which reduces the natural pastures for free
grazing. The second important point is the increase in the number of bovine stock as
per increase in demand for milk. The third is insignificant increase in the level of
mechanisation hence, poor restructuring of bovine stock in favour of dairy stock. The
fourth reason could be fluctuation in agricultural productivity due seasonal fluctuation
of rain and flooding. Hence, State government can take initiatives by formulating new
policy to meet these problems so that demand of feed for the bovine stock can be met
effectively and productivity can be increased desirably particularly to meet the
increasing demand for milk in the emerging urban centres through development of
commercial dairy units and better forward linkages in rural urban milk supply.

To confirm nutrition status of the state found in the secondary source, primary
data on nutrition has been generated at household level for all the 445 households
surveyed. As compared to concentrates the state of Assam produces more roughage
because of the land use pattern which is specially dominated for rice cultivation. That
is why roughages are available in more quantity as feed than concentrates in region.

Socio-economic conditions of surveyed households discussed in chapter - V
includes the distribution of population, sex composition, age structure, caste
composition, level of education, family size, occupational pattern, landholding size
and income pattern. The analysis of the primary data shows the following results:

i. The present study reveals the caste composition of 50 percent general caste,
18.88 percent scheduled caste, 9.21 percent scheduled tribes and 21.35
percent other backward caste.

ii. Total population covered through 445 samples is 2416.

iii. The average family size of 445 households of the study area is recorded as
5.43 persons.

iv. The largest average family size varies from 6.56 persons/family in Bijni to
4.82 in Barpeta.

v. The average sex ratio is 847 females for every thousands males during
2013-14 as per the primary study.
vi. Among the sub-divisions, the highest sex ratio has been registered (982) in Hamren and the lowest sex ratio (710) in Barpeta for the same period.

vii. The dependency ratio of the surveyed households of the study area during 2013-14 is recorded as 46 percent which indicates that a portion of people at working aged group is high in the study area. But there is a variation in dependency ratio within the sub-divisions also.

viii. The overall literacy rate of the households during survey period for the persons above 6 years of age is found to be 79.67 percent. It rightly indicates the literacy rate of the study area is higher than the literacy rate of Assam (73.18 %) justified by the four years time gap after the last census (2011) and remaining 20.33 percent are found to be illiterate.

ix. The highest literacy rate has been recorded in Nazira which accounts for 85.98 percent to the lowest literacy rate in Hamren sub-division (73.96%).

x. The population of the study area are mainly engaged in agriculture and its allied sector such as animal husbandry and fishing. Out of the total workers 73.38 percent of the workers were engaged in this primary sector as their main economic activity.

xi. Only 8.81 percent population are engaged in secondary sector (household and other industries like weaving, carpentry and mat making industry etc). Limited industrial development is reflected in this kind of occupational pattern.

xii. The percentage of workers engaged in the tertiary sector is 17.81 percent. This figure is higher than the secondary sector. This indicates that the workers of the study area are forced to go for tertiary sector in the face of dwindling profitability in the cropping sector, a general feature for most part of the country.

xiii. As many as 35 percent of the total households surveyed are categorised as marginal farmers (<1 hectare), a volatile group with high propensity for changing occupation. The number of small farmers and medium farmers in percentage terms are 31.46 percent and 13.48 percent respectively. The number of households with operational holding size of the category of large
farmers is 48 (10.79%) also significant as far as the bovine holding size is concerned.

The primary study covering bovine structure at household level discussed in Chapter VI reveals the following pattern:

A. Cattle Stock

a. Structure and Pattern

i. The average operational holding size of the study area is found to 1.55 hectare which belongs to the small farmer category. In other language majority of the households belong to the small farmers’ category.

ii. The largest size of average operational holding is recorded at Hamren (2.2ha.) of Karbi-Anglong district and the smallest average operational holding has been found in Hojai (0.99ha).

iii. The size of average bovine stock for the study area is 4.9 Heads per family.

iv. The regional variations range from 9.2 bovine heads in Hojai to 1.2 bovine per family in Diphu in the hill zone.

v. The average market value of average bovine stock size for the whole region is calculated to be Rs. 56143.00 which means the average cattle head in Assam costs Rs. 11528.34 irrespective of its use.

vi. At sub-regional level the variation in quality is clearly reflected through the average cattle head value of Rs.14649.56 in Hojai to Rs.7277.50 in Diphu.

vii. The proportion of young (<3 years) to adult cattle stocks are 44.58 per cent and 55.42 per cent respectively for the state as whole.

viii. At sub-division level, adult cattle stock varies from 51.63 per cent in Hailakandi to 67.83 per cent in Bongaigaon.

ix. The cattle sex ratio for the study area is 72 males per 100 female cattle during 2013-14. During 2007 the cattle sex ratio for the state was 92 males per 100 females. This confirms the trend of reduced number of male cattle over time.
x. With the sex ratio of 88 males per 100 females Bijni has maximum number of bullocks among the regions indicating the significance of the requirement of draughting in that region.

xi. The lowest sex ratio for cattle has been recorded at Hojai (52 males per 100 females).

b. Draughting Utilization

i) Above all only 165 pairs of bullocks have been registered for 445 households of the study area. This figure can provide important information about the influence of tractors in ploughing the land. This is because of the displacement of bullocks is happening across all the regions and across all size classes of farming households through improved availability of tractorisation. Point to be noted is that hiring of tractors remains convenient compared to hiring and sharing of bullocks.

c. Dairy Utility

i) The in milk population of cows in percentage for the survey period was estimated at 70.1 per cent than dry cows.

ii) The in milk cows include both crossbreed and non-descriptive type, which are used for various purposes like milk, breeding and dropping cow dung used for manure and fuel.

iii) Under different agro-climatic conditions, all sub-divisions have showed varying interest in keeping cows and bullock according to need and demand.

B. Buffalo Stock

b. Structure and Pattern

i) The proportion of young and adult buffaloes have been recorded as 32.61 and 67.39 percent

ii) The adult calves constitute vary low numbers (6.00 %) indicating very poor survival of young calves into adulthood age as they remain unproductive for next two years.
iii) The young calves of less than one year of age (26.6%) have a greater utility in the form of dam* for their mother buffaloes for better milk yield.

iv) The age composition of young buffalo stock varies from 37.5 percent in Nazira to 20.00 percent in Hamren.

v) Only adult buffaloes are reported from the districts of Sibsagar, Bajali and Bijn. These are male buffaloes, reared for agricultural operations and used for ploughing in low lying wet lands in these regions.

vi) Not a single household has been reported from the Hojai and Diphu who rear buffalo confirming the diminishing and non preference for buffaloes in that agro-climatic region and also in the state of Assam.

vii) Overall sex ratios of 96 male buffaloes have been reported for every 100 females for the whole sample size.

viii) The intervening period of almost two livestock census periods has experienced decrease in number of buffaloes in the region and dairy buffaloes have been the causalities.

ix) The minimum requirement of working buffaloes in specific micro agro-climatic areas have remain constant for revealing such kind of buffalo a sex ratio in 2014 in Assam.

x) The sub-divisions of Bongaigaon and Hamren confirm the above point with similar high sex ratios of 150 male buffaloes for every 100 females.

b. Dairy Utility

i) As a whole 66.2 percent of the adult female buffaloes were found to be in milk.

ii) The highest percentage of buffaloes in milk with 71.15 percent is recorded in Barpeta and the lowest percent of female buffalo in milk is recorded in Bongaigaon (40 pc) during field survey.

Production Pattern of Bovine Stock

i) The total per day production of the study area for the year 2013-14 was estimated as Rs. 72420. Out of the three categories of economic productions
dairying occupies the highest share with 77.44 percent it is followed by draughting (21.01%) and cow dung (1.55%).

ii) The rearing of bovine stock has mutually exclusive benefits out of which the contribution of milk in terms of value stands out.

iii) Among three categories of output from the bovine production, the highest share of dairy production has been found in Hojai (93.99%) followed by Sibsagar (87.01%), Bajali (85.46%), Nazira (80.6%) and Koliabar (74.51%).

iv) The lowest share of dairy has been recorded at Hamren which accounts only 32.27 percent because culturally ST people of this area do not adapt to dairying activities.

v) Cow dung is mainly used as manure in agricultural fields. The share of cow dung in the total production is observed to have constituted only 1.55 per cent. The highest share of cow dung has been recorded at Diphu which accounts for 5.56 per cent followed by Bijni (2.35%) and Nazira (2.14%). Less than 2 per cent production comes from cow dung in the remaining eight sub-divisions.

Consumption Pattern of Bovine Stock

i) The overall consumption pattern of milk produced in the area shows that 64.5 per cent is sold by the producer and the rest 35.5 per cent is consumed by the household itself.

ii) The highest sale volume of 76.6 per cent of the total milk produced is in the sub-division of Hojai as the most advanced dairy region within the state.

iii) In most of the sub-divisions small herds of non-descript indigenous cows have been reared by the people whose milk producing capacity is very low. These cattle remain non-profitable in the face of increased deficit of forage.

In terms of five aspects of bovine rearing the determinants of the bovine economy have been studied in chapter VII and findings are given below:
A-Quality Distribution of Bovine

i) It is seen that there exists high positive relationship between the related variables i.e. TDN and BSV for the 343 which is significant at 0.01 significance levels.

ii) The hypothesis that "there is a marked positive relationship between the Bovine Stock Value (quality) with the availability of Total Digestible Nutrient (TDN) in the regions of Assam" is accepted and confirms the general understanding about quality determination of bovine through the independent variable of nutritional availability.

B- Compulsion of Draught Requirement

i) There exists high positive relationship between operational holding and draught cattle for 165 numbers of observations.

ii) Hence, the second hypothesis, "Draughting requirement will remain significant at different agro climatic regions" is accepted with 99 percent level of confidence.

iii) The relationship between the variables of operational holding on total stock size yields the co-relation coefficient value of ‘r=0.23’ for the study area. It is found from the analysis that there exists positive relationship between operational holding and total bovine and the value is significant at 0.01 levels because of the large sample size.

Hence, it is concluded here that the operational holding governs the total stock size in the state as was expected with the formation of the earlier hypothesis because Assam remains relatively backward in terms of improvement of dairy stock depending on locally produced feeds and indigenous cattle.

C) Level of Dairying

i) The correlation analysis between FC (Feeding Cost) and milk yield of households for the total covered households shows through the correlation co-efficient value of (r=0.85) a very strong positive relationship which is significant at 0.01 level.
ii) Hence, the third hypothesis of the study, “Yield of milk is directly related to Total Digestible Nutrient (TDN) fed to the dairy bovines at the farmstead level” is accepted with 99 percent level of confidence.

iii) It is emphasised that dairy development through proper nutritional planning is going to be accepted as a universal truth and the case of Assam is no exception.

D) Profitability of stock size

i) The Total Benefit for the state through 445 households is computed as Rs.72.72 per day.

ii) Income accruing from dairying through value of milk and milk products and draughting values of bovines mainly determines the profit parameter.

iii) It is clear from the cost-benefit analysis that bovine rearing in total dominated by draught use is not very beneficial which is reflected in hill agro-climatic zone represented by Diphu and Hamren.

Dii) The sub-division of Diphu reflects a loss of Rs.5.39 per day per household to maintain its bovine stock mostly dominated by draught utility cattle. This phenomenon of loss incurring activity has to be appreciated on the basis of the experiences of draughting cattle maintenance in the situation of non-mechanised and non-commercialised seasonal crop cultivation where draughting value is limited to less than six months a year.

E) Role of Dairying in Employment Generation

a-i) The Total Labour Cost and Milk Yield for 352 households are positively related (r=0.50) and it is significant at 0.01 level.

ii) Hence the fifth hypothesis in part is accepted with 99 percent level of confidence. It can be summed up here that dairying will induce increase in income level to the household of the study area.

b- i) There exists positive correlation between Female Labour Cost and Milk Yield for 290 households where involvement of female labour is documented during the household survey. The correlation co-efficient value for milk yield to female
labour cost for the state for the 290 households is computed at r=0.30 that is positively related at 0.01 level of significance.

ii) Hence, the second part of the fifth hypothesis related to female labour opportunities in dairying is accepted at 99 per cent level of confidence.

It is also clear from the analysis that dairying as an activity holds promise for employment generation for rural labour without bias and beneficial for women employment.

India is the largest milk producing country in the world. But as a part of India, Assam is far behind to touch it though she has large stock size of bovine population. It is because of the local non-descript and small sized cattle whose milk yielding capacity is very low (1 to 2 litter per day) and have long calving interval.

Path Ahead: The following general and specific approach should be per sued for a performing and vibrant bovine sector in the state of Assam.

General Approach

1. Proper Plan and Strategies are required to reduce the acute shortage of feed and fodder. Cultivation of green fodder in wasteland can reduce this problem.

2. Proper health care and facility for Artificial Insemination (AI) to improve the indigenous non-descript cattle by Veterinary services should be available at farmers door.

3. The Veterinary department must take initiatives to create awareness among the farmers towards

   i) Artificial Insemination (AI) of cattle

   ii) Various schemes launched by the government to bring the economic changes among the poor. Non-Government Organisation (NGO) are to play an important role to motivate the farmers.

4. Mechanisation should be promoted to further displace draught requirement for creation of scope for dairy activities.

5. Well organised market should be established so that farmers sale the milk and milk products.
6. Dairy co operatives and chilling plants will go a long way to help small and medium stock holders in making dairying more profitable.

7. Using cow-dung as raw materials, the household Gobar-Gas (Bio-Gas) Plant can be developed in the region to substitute for household energy consumption.

Specific Suggestions:

1. Gobar-gas (Bio-Gas) plants in Areas like Hojai, Barpeta and Sibsagar should be encouraged as bigger and healthier stock sizes are self sustainable at individual household level.

2. Dairy Co operatives in the areas like Koliabar, Bijni and Bongaigaon should be promoted in the line of Hojai and Bajali which are being run affectively and profitably.

3. Chilling plants should be established in service centres like Hojai and Bongagaon to preserve surplus milk and its products in those areas for further value addition to these products which will ultimately benefit the farmers.

4. Promotion of Mechanisation through appropriate tractors and harvest combiners in the areas like Barpeta and Koliabar should be made available to the households through agencies to create scope for dairying activities.

5. Dairy buffaloes in the areas like Harmen and Sibsagar should be introduced in the line of Barpeta experiences to utilise the stock for dual purpose benefits that is draughting of the male stock as it is already preferred and profitable in those areas holding the dairy variables constant.

**************************************************************************

183