

# **AGRO-ECONOMIC ENVIRONMENT AND FOOD SECURITY IN SIKKIM**

THESIS SUBMITTED FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY (ARTS) IN GEOGRAPHY  
UNDER CENTRE FOR HIMALAYAN STUDIES  
UNIVERSITY OF NORTH BENGAL

SUBMITTED BY

**TANKA PRASAD DHUNGEL**

UNDER THE SUPERVISION OF  
**PROF. MAITREYEE CHOUDHURY**

CENTRE FOR HIMALAYAN STUDIES  
UNIVERSITY OF NORTH BENGAL  
P.O. NORTH BENGAL UNIVERSITY  
RAJA RAMMOHANPUR, DIST.DARJEELING  
WEST BENGAL, PIN 734013

2018

### **Declaration**

I hereby declare that the thesis entitled “Agro-Economic Environment and Food Security in Sikkim” has been prepared by me under the guidance and supervision of Dr. Maitreyee Choudhury, Professor, Centre for Himalayan Studies, University of North Bengal. No part of the thesis has formed the basis for the award of any degree previously as per my knowledge and belief.



30.06.2018

**Mr. Tanka Prasad Dhungel**  
Centre for Himalayan Studies  
University of North Bengal  
Dist. Darjeeling:

Date: 30/06/2018

# UNIVERSITY OF NORTH BENGAL

Accredited by NAAC with Grade A

DIRECTOR  
CENTRE FOR HIMALAYAN STUDIES



ENLIGHTENMENT TO PERFECTION

P.O. NORTH BENGAL UNIVERSITY,  
RAJA RAMMOHUNPUR, DT. DARJEELING,  
WEST BENGAL, INDIA, PIN - 734 013,  
PHONE: (0353) 2776 360,  
FAX: (0353) 2699001, 2581212  
email: dirchs@rediffmail.com,  
maitreyee.choudhury@gmail.com

Ref. No.....

Dated 02 July, 2018

## CERTIFICATE

I certify that the dissertation entitled "*Agro-Economic Environment and Food Security in Sikkim*" submitted by Shri Tanka Prasad Dhungel in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy of the University of North Bengal has not been published previously, nor submitted for any degree of this University or any other University. He has fulfilled all the requirements of Ph.D regulation of this university for the submission of this dissertation. The paper is a product of the candidate's own investigation. He has completed the work under my guidance and supervision.

  
02-07-2018

(Maitreyee Choudhury)  
Supervisor  
Centre for Himalayan Studies  
North Bengal University

Director  
Centre for Himalayan Studies  
University of North Bengal

## Urkund Analysis Result

Analysed Document: Ph.D. Thesis of Tanka Prasad Dhungel\_CHS.pdf (D40481957)  
Submitted: 7/2/2018 12:48:00 PM  
Submitted By: nbuplg@gmail.com  
Significance: 4 %

### Sources included in the report:

<http://shodhganga.inflibnet.ac.in/handle/10603/183410>  
<http://www.doria.fi/handle/10024/72580>  
<http://shodhganga.inflibnet.ac.in/handle/10603/203492>  
<http://www.sikkimforest.gov.in/Reports%20and%20Publications/Annual%20Administrative%20Report%202003-04.pdf>  
[https://en.m.wikipedia.org/wiki/Sikkim\\_\(India\)](https://en.m.wikipedia.org/wiki/Sikkim_(India))  
<https://sassygurlblog.wordpress.com/2017/08/27/food-as-more-of-an-experience-and-identification-than-an-commodity/>  
<http://www.crida.in/CP-2012/statewiseplans/Sikkim/SKM2-North%20Sikkim-30.10.12.pdf>  
[http://www.kvkeastsikkim.nic.in/About\\_KVK/profile\\_sikkim.htm](http://www.kvkeastsikkim.nic.in/About_KVK/profile_sikkim.htm)  
<http://www.sikkimagrisnet.org/General/UploadedFiles/Downloads/5.pdf>  
[http://www.ijetsr.com/images/short\\_pdf/1504629439\\_523-529-ieteh934\\_ijetsr.pdf](http://www.ijetsr.com/images/short_pdf/1504629439_523-529-ieteh934_ijetsr.pdf)  
<http://14.139.206.50:8080/jspui/bitstream/1/4205/1/Role%20of%20female%20labour%20in%20farming%20sector%20a%20study%20of%20state%20of%20Sikkim.pdf>  
<http://www.sikkimforest.gov.in/Reports%20and%20Publications/Annual%20Administrative%20Report%202005-06.pdf>  
<https://dokumen.tips/documents/carrying-capacity-study-of-teesta-basin-in-sikkim-water-.html>  
<https://www.webindia123.com/sikkim/economy/agriculture.htm>  
<https://www.ibef.org/download/Sikkim-July-20171.pdf>  
[http://www.igidr.ac.in/conf/ysp/Sikkim\\_2001\\_en.pdf](http://www.igidr.ac.in/conf/ysp/Sikkim_2001_en.pdf)  
<http://www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html>

### Instances where selected sources appear:

100

*Maitreyee Choudhury*  
03.07.2018  
( Maitreyee Choudhury )  
Supervisor  
Professor  
Centre for Himalayan Studies  
University of North Bengal

*Tanka Prasad Dhungel*  
03.07.2018  
(Tanka Prasad Dhungel)

## ***Acknowledgements***

*I owe immense gratitude to my teacher as well as my supervisor Professor as well as Director Dr. Maitreyee Choudhury, Centre for Himalayan Studies, University of North Bengal. Without her unstinted support, effortless inspiration, constant guidance and dedication from the initial stage of the work till the compilation, this thesis would have not been completed by me in stipulated time.*

*I am greatly indebted to my esteemed teachers at the Centre for Himalayan Studies, University of North Bengal for their support and encouragement.*

*My special thanks to the Assistant Professors of Namchi Government College, Sikkim for their constant support and help, namely Dr. Robin Sharma for literary support, Dr. C.P. Khatiwada for technical support and Mr. Deepak Tiwari for his encouragement.*

*I sincerely thank Dr. Parsuram Poudyal, Principal, Namchi Government College and Assistant Professors Mr. Saran Chettri, Mr. Chetraj Sharma, Mr. Uttam Kumar Udpadhaya, Dr. Anil B. Sharma, Mr. Narendra Kharel, Mr. Dilliram Sharma, Mr. Navin Pandey, Dr. Tshewang Bhutia, Mr. Mingma O. Lepcha, Dr. Surjapada Paul and Dr. Ashok G.V. for providing constant help and support according to my need.*

*I would like to thank Mrs. Parvati Sharma (Statistical Inspector), Mrs. Sangita Kharel (Deputy Director), Mr. Kamal Gurung (VLW) and Mr. Narayan Dhakal (Account Officer) for furnishing statistical update.*

*I would like to thank Department of Agriculture and Horticulture as well as Bureau of Economics and Statistics (DESME), Government of Sikkim, for their continuous support and useful information.*

*I am grateful to my fraternity, Department of Geography, Namchi Government College, for helping me out during different phases of this work.*

*My sincere thanks go to the staff of Documentation Cell, Centre for Himalayan Studies and Central Library, University of North Bengal and special thanks go to Mr. Dilliram Chettri, for providing me ideas about GIS maps.*

*I am also thankful to the Panchayat members of the respective villages for their kind co-operation during field survey. Moreover, I express thanks to the respondents of the villages for their support and positive response.*

*Lastly, my sincere thanks go to my Father, Mother, Wife, Son and Sister as well as Brother-in-law and family members. They not only encouraged me but also morally supported to complete my thesis.*

  
20.06.2018

*Tanka Prasad Dhungel*

# Contents

Declaration	
Certificate	
Anti-Plagiarism Report	
Acknowledgements-	
List of Tables	x
List of Figures	xix
List of Abbreviations	xxii
<b>Chapter 1. Introduction to Agro-Economics and Food Security</b>	<b>1-40</b>
Introduction	1
The Conceptual Framework of Agro-Economics and Food Security	1
Agricultural Economics- Applied Science or Pure Science	4
Agricultural Economics- Science or an Art	5
Food	5
Food security	8
Review of Literature	17
Research Gap	27
Statement of the Problem	27
Geographical sketch of the study Area	29
Objectives	31
Research Questions	32
Research Design	32
The Survey Design	32
Research Methodology	33
Data Collection	33
Tools of Data Analysis	34
Chapter Plan	34

<b>Chapter 2. Background and Profile of the Study Area</b>	<b>41-76</b>
Introduction	41
Geomorphology	42
General Geology and Structure	42
Slope of the Area	46
Soil	46
Soil Types Available in Study Areas	52
Drainage	53
Drainage Density	55
Climate	55
Demography	58
Workforce Profile	59
Profile of Sample Households	71
<b>Chapter 3. Agriculture and Agro-Economic Environment in Sikkim</b>	<b>77-121</b>
Introduction	77
The Agrarian Structure	78
History of Agricultural Development in Sikkim	79
Cultivation Calendar of the Nepali Community	87
Cultivation Calendar of the Lepcha Community	89
Cultivation Calendar of the Bhutia Community	90
Agro-Economic activities of selected Gram Panchayat Units (GPUs) of South District	94
Availability of Livestock	102
Availability of Crops and ways of Farming in the Study Area	115
<b>Chapter 4. Land Use and Land Reforms</b>	<b>122-156</b>
Introduction	122
Classification of Land use/ Land Utilization Pattern in Sikkim	122
Land Use Pattern in the Study Area (Gram Panchayat Units)	135
Land Reform in Sikkim	139
Ceiling on Land Holding	142

Ceiling on Agricultural Land	143
Detection of Excess Land	144
Land Holding Pattern	146
<b>Chapter 5. Cropping Pattern</b>	<b>157-191</b>
Introduction	157
Cropping is also determined by Rainfall and Temperature	159
Cropping and Intercropping System	164
Cultivation of Seasonal Vegetables	164
Cultivation of Off-Seasonal Vegetables	165
Fruit Crops	166
Existing Cropping Patterns during Kharif Season	168
Existing Cropping Patterns during Rabi Season	170
Mandarin Intercrops	173
Large Cardamom Agro-Forestry	173
Zero Tillage Cultivation of Cabbage	173
Vegetable Fostering	174
Relay cropping of Ricebean, Urdbean, French bean, Pea, Tomato and Soybean with Maize	174
Legume Crops in Rotation	174
Kothebari (Homestead Gardening)	174
Cropping Pattern of Study Area (15 GPUs)	175
Tools and Equipments	187
Use of Fertilizers in Agriculture	189
<b>Chapter 6. Agricultural Production and Productivity Trends</b>	<b>192-225</b>
Introduction	192
Sikkim's Geography and Agriculture	194
Agrarian Community in Sikkim	194
Major Agricultural Crops	195
Crop Production	195

Crop Productivity	197
Production and Productivity of the Study Area (South district)	202
Crop Combination- Weaver's Method	206
Horticulture in Sikkim	211
Horticulture Transformation	213
Horticultural Crop Production	214
Horticultural Crop Productivity	216
Area Expansion Programme of 2015-16, Department of Horticulture and Cash Crops, South district	221
Transfer of Technology	224
<b>Chapter 7. Mountain Agriculture and Food Security in Sikkim</b>	<b>226-283</b>
Introduction	226
Food Security in Sikkim	226
Poverty Level	230
Individual Food Security and Nutrition	230
Nutritional Status	231
Role of Public Distribution System in Food Security	241
History of the Public Distribution System	242
Targeted Public Distribution System (TPDS) and Antodaya Anna Yojana (AAY): (Seventh Report of the Commissioners to the Supreme Court)	244
Fair Price Shops	248
Integrated Child Development Services (ICDS)	249
Mid Day Meal Scheme	249
Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)	249
National Food Security Act (NFSA)	249
Priority Categories	250
Non-Priority Categories	250
Price of Essential Commodities	251
National Food Security Bill	255
Reform of PDS	256

Livelihood Security	257
Food Habits	259
Consumption of Rice	260
Consumption of Maize	262
Consumption of Wheat	263
Consumption of Millet	264
Consumption of Buckwheat	264
Consumption of Pulses	264
Consumption of Oilseeds	265
Consumption of Vegetables	266
Consumption of Fruits	268
Meat Consumption	269
Consumption of Eggs	270
Consumption of Milk	271
Consumption of Butter	272
Meals	272
Food (Meal Time)	272
Population and Growth and Food Production	278
<b>Chapter 8. Major Findings, Conclusion and Suggestions</b>	<b>284-298</b>
Bibliography	<b>299-309</b>
Appendix	i-xii

## List of Tables

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
1.1	Land Elevation of Sikkim	30
1.2	Five Ranges of Climate in Sikkim	30
1.3	Vegetation Zones in Sikkim	30
2.1	Soil Types and Characteristics	47
2.2	Soil pH (Area in Percent)	50
2.3	Organic Carbon (Area in Percent)	50
2.4	Available Phosphorous (Area in Percent)	51
2.5	Available Potassium (Area in Percent)	52
2.6	The three AESs (Agro-Ecological Situations)	57
2.7	Rainfall Calendar	57
2.8	Distribution of Workers of South District – 2011	60
2.9	Distribution of Male and Female Workers of South District-2011	62
2.10	Distribution of Male Workers of South District -2011	63
2.11	Distribution of Female Workers of South District – 2011	63
2.12	Main Workers Group of Selected GPUs	64
2.13	Periodical Workers Involved in Agricultural Field (in Percentage)	66
2.14	Number of Households Engaged in Rearing of Cattle	66
2.15	Categories of Livestock Reared by Households	67
2.16	Purpose of Rearing of Livestock (in percentage)	67
2.17	Normal Distribution of Income and Expenditure of Villagers per Annum	68
2.18	Annual Income Before and After MGNREGS Programme per Annum	69
2.19	Annual Expenditure per annum (in percentage) of Beneficiaries before and after MGNREGS Programme	70
2.20	Age Group of Respondents (in Percentage)	71
2.21	Respondents' Sex Group (in Percentage)	71
2.22	Religion of Respondents	72
2.23	Caste Category (in Percentage)	72

2.24	Status of Education (in Percentage)	73
2.25	Marital Status (in Percentage)	73
2.26	Sex Group (in Percentage)	74
2.27	Age Group of Respondents' Family Member (in Percent)	74
2.28	Educational Status of Respondents Family Member (in Percent)	74
3.1	Statement Expenditure (1954-1960) (A. Agriculture)	81
3.2	Statement Expenditure (1954-1960) (B. Horticulture)	82
3.3	Budget Expenditure on Agriculture (1975-76 to 1999-00)	83
3.4	Plan Investment in Agricultural Activities (in Percentage)	84
3.5	Month wise Calendar for Agricultural Operations in the State	86
3.6	Agricultural Calendar for Nepali Community	87
3.7	Agricultural Calendar for Lepcha Community	89
3.8	Agricultural Calendar for Bhutia Community	90
3.9	Horticulture Schedule of Cropping	90
3.10	Ecological Zones and Ecological Adaptation in Sikkim	92
3.11	Agro-Climatic Zones	95
3.12	Total Number of Livestock Availability in Five GPUs (Namphing , Legship, Rong-Bul, Tarku & Turung-Mamring)	102
3.13	Total Number of Livestock Availability in Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)	103
3.14	Total Number of Livestock Availability in Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)	104
3.15	Percentagewise Distribution of Livestock in 15 GPUs	106
3.16	Income Generated From Livestock Per Annum in Five GPUs, Set I (Namphing , Legship, Rong-Bul, Tarku & Turung-Mamring)	107
3.17	Income Generated From Livestock Per Annum in Five GPUs, Set II (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)	107
3.18	Income Generated From Livestock Per Annum in Five GPUs,	

Set III (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)	108
3.19 Percentagewise Distribution of Income in 15 GPUs	108
3.20 Income Generated in 15 GPUs from Livestock per Annum	110
3.21 Income Generated from Livestock per Annum (Average) of 15 GPUs	111
3.22 Milk and Drought (Dry Milk) Cow of Five GPUs Set I	112
3.23 Milk and Drought (Dry Milk) Cow of Five GPUs, Set II	113
3.24 Milk and Drought (Dry Milk) Cow of Five GPUs, Set III	114
3.25 Percentagewise Availability of Crops in Study Areas	115
3.26 Traditional Way of Farming	116
3.27 Modern Way of Farming	117
3.28 Households Main Economic Activities and Sources	119
3.29 Agriculture Activities for Livelihood	119
4.1 Old and New Classification of Land	123
4.2 Notification pertaining to agricultural land compensation	125
4.3 Area under Different Land Use in Sikkim ('000 Ha)	126
4.4 Land use Pattern under Operational and Non-Operational Holdings in Sikkim (1976-77 to 2000-01)	127
4.5 Land Use Pattern: East and West District of Sikkim 2005-06 (in Ha)	129
4.6 Land Use Pattern: North and South District of Sikkim 2005-06, (in Ha)	129
4.7 Land Use in Sikkim, 2016	130
4.8 Land Use Pattern of South District (2001-02 &2005-06)	132
4.9 Land Use Pattern of South District (2014-15)	133
4.10 Land Use Pattern in GPUs Set I (Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring)	135
4.11 Land Use Pattern of GPUs Set II (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)	136
4.12 Land Use Pattern of GPUs Set III (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan)	137
4.13 Pattern of Distribution of Cultivated Land (Three Estates)	144
4.14 Pattern of Distribution of Cultivated Land	145

4.15 Area in Operation Holding and Under Tenure and Tenancy Status in Sikkim	146
4.16 Community-wise Distribution of Land in Sikkim, 1976-83 (in Percent)	147
4.17 Community-wise Distribution of Households Possessing Dry Land	148
4.18 Distribution of Households Possessing Dry Land in South District	149
4.19 Community-wise Distribution of Households Possessing Dry Land by Size (in Percent)	150
4.20 Distribution of Households Possessing Dry Land by Size, South District	151
4.21 Distribution of Households Possessing Orchards by Size, South District	152
4.22 Distribution of Land Holdings (South District, 1991)	153
4.23 Per Capita Land Availability in Sikkim, 1971 & 1981 (in Ha)	153
4.24 Per Capita Land Availability in Sikkim, 1991 & 2001 (in Ha)	154
5.1 Agriculture Crops and Cropping Seasons at Different Agro-Climatic Conditions	158
5.2 Actual and Normal Rainfall (mm) of Namthang (South District)	159
5.3 Actual Rainfall of Gangtok (East District) and Namthang (South District)	160
5.4 Average Temperature of Gangtok (E. District) and Namthang (S. District)	161
5.5 South District Rainfall (mm) for Three Consecutive Years (2011-2013)	162
5.6 Altitude wise Distribution of Cultivated Fruits Crops	166
5.7 Main Crops Available in Five GPUs Set I (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)	175
5.8 Average Area and Household Involvement in Different Cropping Pattern of Five GPUs in % (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)	176
5.9 Main Crops Available in Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)	176
5.10 Average Area and Household Involved in Different Cropping Pattern of Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)	177
5.11 Main Crops Grown in Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan)	178
5.12 Percentagewise Average Area and Household Involved in Different	

Cropping Pattern of Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)	179
5.13 Percentage Distribution of Crop Combination in Study Area	180
5.14 Pattern of Mixed Farming in the Study Area (in Percent)	180
5.15 Duration of Fallow (Land Remains Uncultivated) in a Year (in Percent)	182
5.16 Frequency of Cropping in Study Area (in Percent)	182
5.17 Relay Cropping in the Study Area (in Percent)	182
5.18 Traditional Crops versus New Crops (in Percent)	183
5.19 Changes in Production of Rice and Maize (in Percent)	183
5.20 Whether Satisfied With Farm Production (in Percent)	184
5.21 Agricultural Land Taken for Non-Farm Use (Construction of Roads)	184
5.22 Agricultural Land Taken by Factories/Pharmaceutical/Power Line	184
5.23 Agricultural Land Damaged during Landslides	185
5.24 Compensation Given to Farmers for Crops Damage (in Percent)	185
5.25 Agricultural Loan Taken from Different Institutions (in Percent)	185
5.26 Availability of Labourers during Cropping Seasons (in Percent)	186
5.27 Wages Rate in Agricultural Field (in Percent)	186
5.28 Plough Rate per Day in Field (in Percent)	187
5.29 Types of Tools and Equipments Used in Agricultural Farm	188
5.30 Family Members Engaged in Agricultural Activity in the Study Area	188
5.31 Types of Fertilizers Used by Farmers in Study Areas (in Percent)	189
5.32 Changes in Cultivation Practices in Study Areas (in Percent)	189
6.1 Crop Production of Sikkim (1975-76 to 1995-96) in 000' Tons	195
6.2 Crop Production of Sikkim (2005-06 to 2015-16) In 000' Tons	196
6.3 Crop Productivity of Sikkim (1975-76 to 1995-96) Kg/Ha	197
6.4 Crop Productivity of Sikkim (2005-06 to 2015-16) Kg/Ha	198
6.5 Crop Yield Index for East District of Sikkim	199
6.6 Crop Yield Index for West District of Sikkim	199
6.7 Crop Yield Index for North District of Sikkim	200
6.8 Crop Yield Index for South District of Sikkim	200
6.9 Area (in 000'ha) of Major Crops in South District (2000-01 to 2005-06)	202

6.10 Area (in 000'ha) of Major Crops in South District (2010-11 to 2015-16)	202
6.11 Major Crop Production (000' Tons) in South District (2000-01 to 2005-06)	203
6.12 Major Crop Production (000' Tons) in South District (2010-11 to 2015-16)	204
6.13 Productivity (Kg/Ha) of Major Crops in South District (2000-01 to 2005-06)	205
6.14 Productivity (Kg/Ha) of Major Crops in South District (2010-11 to 2015-16)	205
6.15 Percentage wise distribution of average area for the period of three years (2013-14 to 2015-16) for eight (8) different crops of South District	207
6.16 Productivity (Yield Kg/Ha) of Kharif Season Crops in Study Areas 2015-16	209
6.17 Productivity (Yield Kg/Ha) of Rabi Season Crops in Study Areas 2015-16	210
6.18 Horticultural Crops Production in Sikkim (1975-76 to 1995-96)	214
6.19 Horticultural Crops Production of Sikkim (2005-06 to 2015-16)	215
6.20 Horticulture Crops Productivity of Sikkim (1975-76 to 1995-96) In Kg/Ha	216
6.21 Horticulture Crops Productivity of Sikkim (2005-06 to 2015-16) In Kg/Ha	217
6.22 Area of Major Horticultural Crops of South District (2005-06, 2010-11 and 2015-16) in 000' Ha	218
6.23 Production of Major Horticultural Crops of South District (2005-06, 2010-11 and 2015-16) - (in 000' Tons)	219
6.24 Productivity of Major Horticultural Crops of South District (2005-06, 2010-11 & 2015-16) - (in Kg/Ha)	220
7.1 India: Average Intake and Requirement of Food Items (grams/day/capita) 2005-06	231
7.2 Average Intake of Nutrients in Sikkim (Consumption per capita per day) 1997	233
7.3 Average Consumption (g/cu/day) of different Foods in Sikkim	234
7.4 Average Intake of Nutrients (Consumption unit/day) in Sikkim	235
7.5 Per capita and Per Consumer Unit Adjusted Intake of Calorie, Protein and Fat per day of Sikkim (Rural) 2011-12	236
7.6 Per capita and Per Consumer Unit Adjusted Intake of Calorie, Protein and Fat per day of Sikkim (Urban) 2011-12	237
7.7 Percentage of Total Adjusted Intake of Calorie and Protein Derived from Different Groups of Food Items for Households of Sikkim (Rural) 2011-12	238

7.8 Percentage of Total Adjusted Intake of Calorie and Protein Derived from Different Groups of Food Items for Households of Sikkim (Urban) 2011-12	238
7.9 Percentage Break-Up of Calorie Intake over Different Food Groups and Average Intake of Calorie, Protein and Fat per Consumer Unit per Day for Households in Different Ranges of Calorie Intake (per consumer unit per day) in Sikkim (Rural) 2011-12	239
7.10 Percentage Break-Up of Calorie Intake over Different Food Groups and Average Intake of Calorie, Protein and Fat Per Consumer Unit Per Day for Households in Different Ranges of Calorie Intake (Per Consumer Unit Per Day) in Sikkim (Urban) 2011-12	239
7.11 India & Sikkim: Per Capita Intake of Calorie, Protein and Fat (2011-12)	240
7.12 Departmental Distribution of Allocated Rice and Wheat	246
7.13 The quantity allotted by the Ministry under NFSA from January 2016	251
7.14 Wholesale and Retail price of Rice under NFSA	251
7.15 Scheme wise Rate and Scale of Essential Commodities till 31 <sup>st</sup> December, 2015	253
7.16 Scheme wise Rate and Scale of Essential Commodities from 1 <sup>st</sup> January 2016	253
7.17 Latest Policy Master of the Food Civil Supplies and Consumer Affairs Department (2016)	254
7.18 Sources of Food Items	258
7.19 Average Monthly Purchase of Rice From the Market/Household (in kgs)	261
7.20 Consumption of Rice/Day/Family	262
7.21 Percentage of Families Able to Feed Themselves if Allotment of Rice is Withdrawn	262
7.22 Average Production of Maize (in kg)	262
7.23 Consumption Status of Maize	262
7.24 Average Monthly Food Items (Wheat-Maida/Atta) Purchased from the Market/Household (in kg)	263

7.25 Consumption of Wheat (in gm)/Day/Family	263
7.26 Consumption Status of Buckwheat	264
7.27 Average Production of Pulses (in kg)	264
7.28 Average Monthly Purchase of Pulse From the Market/Household (in kg)	264
7.29 Consumption of Pulses (in gm)/Day/Family	265
7.30 Consumption Status of Pulses	265
7.31 Average Production of Oilseeds (in kg)	265
7.32 Consumption Status of Oilseed	266
7.33 Average Production of Beans (in kg)	266
7.34 Average Monthly Purchase of Beans from the Market/Household (in kg)	266
7.35 Consumption of Beans (in gm)/day/family	266
7.36 Consumption Status of Beans	267
7.37 Consumption Status of Chilies	267
7.38 Consumption Status of Brinjal, Tomato and Pumpkin	267
7.39 Average Monthly Other Vegetables Purchased from the Market/Household (in kg)	268
7.40 Consumption of Other Vegetables (Seasonal)/Day/Family	268
7.41 Average Monthly Meat Purchased from the Market/Other Places (in kgs)	269
7.42 Average Meat Consumption/Days in A Week/Household	270
7.43 Consumption of Meat (in gm)/Day/Family	270
7.44 Average Home Production of Milk Per Household/Day	271
7.45 Daily Average of Milk Purchased and Consumed Per Household/Day	271
7.46 Average Monthly Butter (Ghee) Purchased from the Market/Household (in kg)	272
7.47 Three Items in a Meal - Rice, Dal and Vegetables Every Day	272
7.48 Change in Food Habits over Last 12 Months	274
7.49 Afforded to have Balanced Meals over Last 12 Months	274
7.50 Not Enough Money to Purchase Food	274
7.51 Households having Problems in Satisfying Food Needs in Last 12 Months	275
7.52 Food Brought Did Not Last and Did Not Have Money to Purchase	275
7.53 Family Income Spent in Buying of Food	275

7.54 Family Members Remain Hungry Sometimes Being Unable to Buy Food	276
7.55 Sleep without Food at Night	276
7.56 Main Reasons for Food Shortage in a Household	277
7.57 Young Generations Involved in Agriculture Sector	277
7.58 Total Population and Production of Food Grains in Sikkim (1971 to 2011)	279

## List of Figures

<b>List of Figure</b>	<b>Title</b>	<b>Page No.</b>
1.1	Schematic representation of Conceptual Framework of Food Security	15
1.2	Schematic representation of Different Levels of Food Security	16
2.1	District-wise Distribution of Soil pH in Percent	50
2.2	District-wise Organic Carbon Available in Soil (Percent)	51
2.3	District-wise Phosphorous Available in Soil (Percent)	51
2.4	District-wise Potassium Available in Soil (in Percent)	52
2.5	Normal Rainfall (mm) in South District (in Percentage)	57
2.6	Normal distribution of Income and Expenditure of villagers per Annum	68
2.7	Annual Income Before and After MGNREGS Programme per Annum	70
2.8	Annual Expenditure Before and After MGNREGS Programme per annum	70
2.9	Percentage wise distribution of Religion	72
3.1	Budget Expenditure on Agriculture (1975-76 to 1999-00)	83
3.2	Plan Investment in Agricultural Activities (in Percent)	84
3.3	Altitudinal Agro-Climatic Zones of Horticulture in Sikkim	91
3.4	Ecological Zones (Agriculture & Horticulture)	93
3.5	Percentagewise distribution of Livestock in Five GPUs (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)	102
3.6	Percentagewise Distribution of Livestock in Five GPU (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)	103
3.7	Percentagewise Distribution of Livestock in Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam –Rayong & Perbing-Dovan)	104
3.8	Percentagewise Distribution of Livestock in 15 GPUs	106
3.9	Percentagewise Distribution of Income in 15 GPUs	109
3.10	Income Generated of 15 GPUs from Livestock Per Annum	110
3.11	Income Generated From Livestock per Annum (Average) of 15 GPUs	111
3.12	Total Number of Milk and Drought (Dry Milk) Cow of Namphing,	

Legship, Rong-Bul, Tarku & Turung-Mamring)	112
3.13 Total Number of Milk and Drought (Dry Milk) Cow of Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang & Wok-Omchu	113
3.14 Total Number of Milk and Drought (Dry Milk) Cow of Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan	114
3.15 Percentagewise Availability of Crops in Selected Areas	115
3.16 Comparison between Traditional and Modern Ways of Farming	118
4.1 Area under Different Land Use in Sikkim (‘000 ha) as per 1958-60 Survey	126
4.2 Land Use Pattern and Land under operational and non operational holdings	128
4.3 District-wise distribution of Land Use Pattern, Sikkim 2005-06, (in Percent)	130
4.4 Land Use Pattern of GPUs Set I (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)	135
4.5 Land Use Pattern of GPUs Set II (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)	136
4.6 Land Use Pattern of GPUs Set III (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan)	137
4.7 Schematic Presentation of Classification of Land	141
4.8 Percentage wise Distribution of Cultivated Land among three Estates	145
4.9 Area in Operation Holding and Under Tenure and Tendency Status (in percentage)	147
4.10 Community-wise Distribution of Land in Sikkim (1976-83) (ha)	148
4.11 Community wise Distribution of Dry Land by Size (in) Percentage	151
4.12 Households Possessing Dry Land (in percentage)	152
4.13 Per Capita Land Availability in Sikkim in Different Years (in Ha)	154
5.1 Rainfall (mm) of Namthang (South District) 2013-14	160
5.2 Actual Rainfall (mm) of Gangtok and Namthang (2013-14)	161
5.3 Average Temperature (°C) of Namthang and Gangtok (2013-14)	162
5.4 South District Rainfall (mm) For Last Three Years (2011-2013)	163
6.1 Crop Production of Sikkim (1975-76 to 2015-16) in 000’ Tons	196

6.2 Crop Productivity of Sikkim (1975-76 to 2015-16) Kg/Ha	198
6.3 Area (in 000'ha) of major crops in South District (2000-01 to 2015-16)	203
6.4 Production (in 000' Tons) of Major Crops in South Sikkim (2000-01 to 2015-16)	204
6.5 Productivity (in Kg/Ha) of Major crops in South Sikkim (2000-01 to 2015-16)	205
6.6 Productivity (Yield Kg/Ha) of Kharif Season Crops of the study areas of South District (2015-16)	210
6.7 Productivity (Yield Kg/Ha) of Rabi Season Crops of study areas (2015-16)	211
6.8 Horticultural Crops Production of Sikkim (1975-76 to 2015-16) In 000' Tons	215
6.9 Horticulture Crops Productivity of Sikkim (1975-76 to 2015-16) In Kg/Ha	217
6.10 Area (in 000'ha) of major horticultural crops in South District (2005 to 2015-16)	218
6.11 Production (in 000' tons) of Major Horticultural Crops in South district (2005 to 2015-16)	219
6.12 Area (in 000' Kg/Ha) of Major Horticultural Crops in South Sikkim (2005 to 2015-16)	221
7.1 Average Intake and Requirement of Food Items (grams/day/capita) 2005-06 (India)	232
7.2 Average Intake of Nutrients in Sikkim (Consumption/capita/day) 1997	233
7.3 Average Consumption (g/cu/day) of different Foods in Sikkim	235
7.4 Average Intake of Nutrients (Consumption unit/day) in Sikkim	236
7.5 India & Sikkim: per capita intake of Calorie, Protein and Fat	241
7.6 Population Growth and Production of Food grain of Sikkim (1971 to 2011)	279

## **List of Abbreviations**

AD	: Anno Domini
AIDS	: Acquired Immune Deficiency Syndrome
AMSL	: Above Mean Sea Level
AES	: Agro-Ecological Situations
ANNOVA	: One Way Analysis of Variance
APL	: Above Poverty Line
AAAY	: Antodaya Annadan Yojana
BC	: Before Christ
BL	: Bhutia-Lepcha
BPL	: Below Poverty Line
CIP	: Central Issue Price
DBT	: Direct Benefit Transfer
DESME	: Department of Economics, Statistics, Monitoring and Evaluation
EAR	: Estimated Average Requirement
EAAY	: Expanded Antodaya Annadan Yojana
FAO	: Food and Agriculture Organisation
FPS	: Fair Price Shop
GHI	: Global Hunger Index
GIS	: Geographical Information System
GPU	: Gram Panchayat Unit
GPS	: Global Positioning System
HCCDD	: Horticulture Cash Crops Development Department
HDR	: Human Development Report
HH	: Household
HMNEH	: Horticulture Mission for North East and Himalayan
HYV	: High Yielding Varieties
ICDS	: Integrated Child Development Services
ICAR	: Indian Council for Agriculture Research
ICMR	: Indian Council of Medical Research

IFPRI	: International Food Policy Research Institute
KVK	: Krishi Vigyan Kendra
OBC	: Other Backward Classes
MDR	: Multidimensional Report
MGNREGA	: Mahatma Gandhi National Rural Employment Guarantee Act
MMKSA	: Mukhya Mantri Khadya Suraksha Abhiyan
MMAAY	: Mukhya Mantri Antodaya Annadan Yojana
MPCS	: Multi-Purpose Cooperative Society
MSP	: Minimum Support Price
NABARD	: National Bank for Agriculture and Rural Development
NFS	: National Food Security
NPHH	: Non Priority Household
NGO	: Non Governmental Organisation
NVIUC	: National Vegetable Initiative for Urban Clusters
OAP	: Old Age Pension
OPHH	: Other Priority Household
PDS	: Public Distribution System
PHH	: Priority Household
RCSA	: Regional Centre for Southern Africa
RMDD	: Rural Management Development Department
SC	: Schedule Caste
SD	: Standard Deviation
SIMFED	: Sikkim State Cooperative Supply and Marketing Federation Ltd.
SPHH	: State Priority Household
SPSS	: Statistical Package for Social Science
SSEC	: State Social Economic Census
ST	: Schedule Tribe
TPDS	: Targeted Public Distribution System
UNDP	: United Nations Development Programme
UNFAO	: United Nations Food and Agriculture Organisation
VDAP	: Village Development Action Plan

VLW : Village Level Worker  
WHO : World Health Organisation

# Chapter 1

## Introduction to Agro-Economics and Food Security

### Introduction

Agricultural economics, as its title implies is that branch of knowledge which takes into account agriculture and economics together. The study of agricultural economics is of recent origin. Agricultural economics has been written about and many important problems of the agricultural economies have been given considerable thought and solved through organized efforts, but not enough literature exists on many aspects of agricultural economics as a separate discipline. After the economic depression of 1890's some renowned economists like Henry Moore (1911) of the Columbia University and Henry Schultz (1927) of Chicago University had been able to devote attention to make important contribution to agricultural economics by applying quantitative methods. Black brought out a major work in 1926 on production economics in agriculture (Lekhi and Singh, 2001). Similarly, Taylor (1945) has done more than any other writers to shape the development of agricultural economics during the past quarter century. During the last twenty years, agricultural economists have made significant contribution in the analysis of economic development.

### The Conceptual Framework of Agro-Economics and Food Security

Agricultural economics, in simple words, can be defined as an applied phase of economics. In it, attention is given towards all aspects of problems related to agriculture. It helps the farmers to decide what kind of crops and livestock they should raise to maximize their profits. In this form, it is a social science associated with the allocation of scarce farm resources (Lekhi and Singh, 2001:1/5). According to Prof. Goodwin (2004:11), "Agricultural Economics as a social science is concerned with human behaviour during the process of producing, processing, distributing and consuming the products on farms and ranches".

According to Prof. N. Jouzier (quoted from Chauhan 1953:1), "Agricultural Economics is that branch of agricultural science which treats the manner of regulating the relations of different elements comprising the resources of the farmer, whether it is the relations of each other or to human beings in order to secure the greatest degree of prosperity to the enterprise".

Likewise Taylor defines (quoted from Chauhan 1953:2), "Agricultural Economics treats the selection of land, labour and equipments for a farm, the choice of crops to be grown, the

selection of livestock enterprises to be carried on and the whole question of the proportions which all these agencies should be combined”. Prof. Hibbard (quoted from Chauhan1953:4) defines Agricultural economics as “the study of relationships arising from the wealth-getting and wealth-using activity of man in agriculture”. Further, Prof. Gray has defined it as (quoted from Chauhan1953:4) the science in which the principles and methods of economics are applied to the special conditions of agricultural industry”.

Agricultural economics, in addition to general economics and agriculture, covers a variety of fields such as history, geography, mathematics, statistics, sociology, political science etc. These are characterized by the relationship arising amongst them on account of agriculture being followed as a vocation and a way of life. It is with these relationships that the agricultural economists deal. These relations include: i) Relations between different enterprises indicating the choice of farming as an occupation and the relationship between the different branches of farming, a choice between cultivation of crops or animal husbandry, or even between various crops, ii) Problem of selecting a good combination of various factors of production; for example labour vs. capital, iii) Relations of value of different factors of production and the final product, i.e. cost-benefit relationship or the factors of production and price relationship, iv) Commercial relations between farmers and the rest of the economy and even with the outside world, for example, terms of trade, international prices advantages.

The food and fibre system is related to almost every facet of our economy and our environment. As a result, the study of agricultural economics necessarily encompasses a great deal more than just the activities of the farmer. Since the food and fibre system is an important part of our natural environment, some agricultural economists deal with issues of resource conservation, pollution control and water management (Drummond and Goodwin, 2004).

Agricultural economics is the most important part of economics of the primary sector. Earlier, agricultural economics was mainly “descriptive” in nature giving statistics of the agricultural outputs, or about the inputs used or share of different regions etc. “Analytical” part was almost missing. Now this is rigorous theory and highly developed statistical tool of analysis of the performance of the agricultural sector, inter-regional differences, or of the production functions of various crops.

Demographic explosion in recent years has brought tremendous strain on agriculture. Now the question is not merely of “high rate of growth and higher levels of development” but of food self-sufficiency first.

When the subject of study is the individual farm or the farmer, it is termed as micro analysis but when it studies agricultural economy as a whole, it is called as macro – analysis. Agricultural economics has both of them. The farmer deals with the economics of the family

farm unit from the standpoint of its internal operations. This involves a study of budgets; inputs- output ratios, prices and costs faced by the family farm unit.

Further, Jouzier has aptly remarked that the domain of Agricultural Economics covers the examination of each element of production, whether in connection with anyone of the above named relationships in particular or with several of them together, to obtain the greatest net profit. Jouzier looks upon Agricultural Economics as:

- i.) the science which deals with the principles underlying the co-ordination of all the factors in such a way that farmer may be able to get the maximum net profits,
- ii.) the science which deals with the art how to apply these principles on a given farm.

Similarly, the scope of Agricultural Economics in the words of Taylor, “agricultural economics deals with the principles which underline the farmers’ problem of what to produce and how to produce it , what to sell and how to sell it in order to secure the largest net profit for himself consistent with the best interest of society as a whole. More specifically, it treats the selection of land, labour and equipment for a farm, the choice of crops to be grown, the selection of livestock, enterprises to be carried on and the whole question of the proportions in which all these agencies should be combined. These questions are treated primarily from the point of costs and prices”. No doubt Taylor deals with the subject in broader perspective still the whole treatment rests only on the problem of production. But we do not conclude that agricultural economics has nothing to do with the problems of distribution and consumption of farm products. Consumption, processing and distribution economics is an important for farm people as it is for them to understand the economics of their farm production. They are, therefore, part and parcel of the economics of agriculture (Lekhi and Singh, 2001: 1/9).

Agricultural economics is a social science which teaches us how to maximize production, yields outputs and returns from agricultural activities. It studies the principles and analytical methods of economics to seek solutions to the economic problems in agriculture. It teaches us to improve technical production function as well as the economic (marketing) production function and improving the terms of trade, employment intensity and income propagation from the agricultural activities. In a limited way it also teaches how to optimize the inter-face with other sectors, sub-sectors, activities and functions. It is the economics which helps us increasing economics returns per unit of land, per person, per package of inputs and per unit of capital. It is economics of warding off hunger as also making agriculture a tool of further economic development.

Agricultural economics shall study how inputs for farm products are produced and procured, part of the inputs come from the industrial sector but actually their planning can legitimately be regarded part of agricultural economics. The farm management and production economics, farm output-processing, transportation, storage, retailing and services can also be included

within the scope of agricultural economics with reference to border prices, which cover these all. Goodwin and Drummond have made an interesting observation.

“Agricultural economics is quite obviously what agricultural economists do. It studies the entire food and fibre production to consumption system” (Shrivastava, 1996: 7).

### **Agricultural Economics – Applied Science or Pure Science**

There exists a hot controversy over the issue whether agriculture is an applied science or a pure science. Some agricultural economists consider agriculture as an applied science. Froster and Leoger (Lekhi and Singh, 2001:1/6&7) opined that “agricultural economics is an applied science as it is concerned with the identification, description and classification of economic problems of agriculture to the end that these problems may be solved”. Prof, Ashby while favouring this argument remarked, “agricultural economics is a methodological pursuit of knowledge of economic process and organization in agriculture and of their results, for the purpose of stabilizing, adopting or modifying them and if and when necessary, of changing their results”. According to Snodgrass and Wallance, “Agricultural Economics is an applied phase of social science of economics in which attention is given to all aspects of problems related to agriculture” (Lekhi and Singh, 2001:1/7).

Prof. Gray (Lekhi and Singh, 2001:1/7) in his ‘Introduction to Agricultural Economics’ treats it as a branch of the general subject of economics. In this sense, agricultural economics is only one of the many branches of applied economics, such as, labour economics, public economics, monetary economics, household of economics etc. Thus, agricultural economics is merely a phase or field of an immense field called economics in which primary attention is paid to the analysis of the economic problems associated with agriculture.

Thus, from the above quoted studies, it may be said that Agricultural economics as an applied science is concerned with economic problems that are associated with farmer’s effort to make a living. Their problems are varied in character but can be grouped into three categories, namely:

i) production, ii) marketing and iii) financing. Moreover, as an applied science, agricultural economists have to formulate the methods, techniques and procedures through which the problems relating to agriculture may be resolved (Lekhi and Singh, 2001: 1/7).

### **Agricultural Economics – Science or an Art**

Agriculture is the science and an art of cultivation of crops and the raising of livestock and is not only a mode of livelihood but also a way of life. In such an organization, the farmer is called upon to make innumerable choices and decisions involving economic considerations. Agriculture, in general is governed by a number of considerations, physical and biological which are treated by their respective specialist. However, the information so obtained has to be translated into economic terms. For example, the knowledge of agricultural chemistry helps the farmer to know how fertilizers can increase his crop production. On the economic side, it will be necessary to determine whether the value of the additional crop will be more than enough to cover extra costs due to the application of fertilizers. The above analysis elaborates that as a science; it explains the cause and effect relationship between various economic variables operating in agriculture. The relationship which exists in these variables can be used to solve the problems that affect agriculture in one way or the other. In the same way, Agricultural Economics is also an art (Lekhi and Singh, 2001).

### **Food**

Food is the prime ingredient of human life. The food which one eats is helped for digestion and assimilating in the body and used for its maintenance and growth. Food also provides energy in the body for doing work. Man has expressed much thought and foresight in cultivating varieties of grains, fruits, vegetables, nuts and oil seeds and in rearing birds and animals for use as food. The selection of foods best suited for promoting good health has been found out by trial and error by continued use. Use of milk of different mammals as sources of food for infants has been practiced from very early times.

Since foods contain various wide nutrients, they have been broadly grouped under three heads from the untraditional point of views:-

- 1) Energy yielding foods.
- 2) Body building foods, and
- 3) Protective foods (Swaminathan, 1990).

Similarly, food is essential for human existence just like the air we breathe or the water we drink. The food that we eat is utilized in the body and the assimilated substances are used for the growth and maintenance of tissues. A living organism is the product of nutrition. The human being requires more than 45 different nutrients for its well being. Food materials ingested by the body are digested, absorbed and metabolized. Useful chemical substances derived from food by the body are called nutrients. A number of foodstuffs have to be selected to get all the nutrients. The health of a person depends on the type and quantity of food stuff he chooses to make his diet. For sustaining healthy and vigorous life, diet should be planned according to the principle of nutrition. Extensive research works carried out on human beings and an experiment on animal throughout the world has provided us with sufficient knowledge

on nutrition and health. World Health Organization defines health as “The state of complete physical, mental and social well being and not merely the absence of disease - infirmity” (Begum, 1991, 3). A World Bank study of the relation between poverty and hunger quoted an edict by the Emperor When in 113 BC: why is the food of the people so scare? Where does the blame lie? The deficiency is even more remarkable today, because in many countries and in the world as a whole food supplies are believed to be adequate. Yen World Bank study concluded. : The often predicted Malthusian nightmare of population out stripping food production has never materialized. Instead the world faces narrower problems; many people do not have enough to eat despite there being food enough for all. This is not a failure of food production, still less of agricultural technology. It is a failure to provide all people with the opportunity to secure enough food something that is very hard to do in low income countries”. Although one world questions the statement that production growth has never out stripped food production, it is an assessment of the position in many countries today ([www.Unsystem.org](http://www.Unsystem.org)).

Moreover, food is the most basic of human needs and is central to the discussion of human rights and social development. Ensuring food security ought to be an issue of great importance for a country like India where more than one-third of the population is estimated to be absolutely poor and one-half of all children malnourished in one way or another. Food security has been promoted by the United Nations Development Programme (UNDP) and analysts of hunger and famine as the most basic human need and as a central indicator of absolute poverty and physical well-being (Sen and Sengugta 1983). Food Security refers not only to an adequate aggregate supply of food, but also means that “all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life” (FAO). In this sense, food security is a broad concept and implies not only producing sufficient food, but also making food accessible to the entire population throughout the year on a sustainable basis. Food security also connotes freedom from famine and chronic malnutrition and this requires provision of the means whereby all individuals or families can adequately meet their nutritional needs on a daily and annual basis. Food security is a right of every citizen and not merely an aspiration. The ultimate objective of food security, therefore, is to guarantee food to every citizen irrespective of his or her ability to pay. Provision of food security is essential for maintaining peace and social harmony in a country ([www.journalijdr.com](http://www.journalijdr.com)).

However, Article 21 included in the chapter on Fundamental Rights Article 21 of the constitution entitled ‘protection of life and personal liberty’ Says, ‘No person shall be deprived of his life or personal liberty except according to procedure established by law’. Over the years a series of judicial interventions and interpretations have expanded the frontiers of this right to include several other social-economic rights, including the right to food, right to housing and right to work. The interpretation is that the right to life implies life with dignity

and the complementary rights that are mandatory for the realization of this right are also by implication fundamental rights. Since life is biologically impossible without regular nutrition the right to food has been widely recognized by implication as a fundamental right (Saxena, et.al, 2008).

### ***Right to Food***

A world without hunger is one in which adequate food is a human right, like air to breath or water to drink. The minimum expectation for any who live in any country, upheld and enforced by all, for all. As utopian as this may sound there are continuing trends in this direction. The elements for an international recognition of a human right to food co-exist today in the form of the 1948 Universal Declaration of Human Rights, the 1966 International Covenants on Economic, Social and Cultural Rights and for armed conflict in the 1977 protocols to the Geneva conventions assistance in case of widespread disasters that are caused by natural or technological hazards or war. This has been further extended, albeit not always implement to civilians in zones of armed conflict, even when such conflicts are within national borders or are condoned or encouraged by national governments, as in Bosnia, Northern Iraq, Sudan and Somalia. There is growing agreement that no nation, governmental authority or faction has right to store its own or neighboring people ([www.gcrio.org](http://www.gcrio.org)).

### ***Food Security as Right***

Gradually a consensus is building all over the world that food security should be a Right of a citizen in every civilized society. The consensus is moving towards ensuring human security for which food security is an important component. As it is, most of the countries in the region have made commitments to ensure food security at various forums. Yet these are distinct advantages in enshrining it as a Right. Acceptance of food security as a right will make efforts of the states obligatory, transparent and judiciable. In place of an ad-hoc measures it will force the states to evolve a consistent and long policy, measures such as availability of foods, access to food at all times of the year and entitlement to food by raising incomes, will become essential parts of development policies. Even the household of the old and infirm and otherwise incapacitated persons will be able to secure essential food for a 'healthy and productive life'. Food security as a matter of right will impart the necessary 'human face' to development in the poor developing countries. As the discussion in the country studies have suggested either in financial or in administrative terms this goal is unreachable. It will require more imaginative mobilization of resources and more focused attentions by the institutions of state ([www.visitsikkim.com](http://www.visitsikkim.com)).

## **Food Security**

The concept of Food security originated only in the mid-1970s, in the discussions of international food problems at a time of global food crisis. The initial focus of attention was primarily on food supply problems - of assuring the availability and to some degree the price stability of basic foodstuffs at the international and national level ([www.fao.org](http://www.fao.org)).

The initial concept focus, reflecting the global concerns of 1974, was on the volume and stability of food supplies. Food security was defined in the 1974 World Food Summit as: *“availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices”*.

In 1983, FAO expanded its concepts to include securing access by vulnerable people to available supplies, implying that attention should be balanced between the demand and supply side of the food security equation *“ensuring that all people at all times have both physical and economic access to the basic food that they need”*.

In 1986, the highly influential World Bank report “Poverty and Hunger” focused on the temporal dynamics of food insecurity. It introduced the widely accepted distinction between chronic food insecurity, associated with problems of continuing or structural poverty and low incomes, and transitory food insecurity, which involved periods of intensified pressure caused by natural disasters, economic collapse or conflict. This concept of food security is further elaborated in terms of *“access of all people at all times to enough food for an active, healthy life”*. In other words, food security implies “access by all people at all times to enough food for an active, healthy and enjoyable life.

By the mid-1990s food security was recognized as a significant concern, spanning a spectrum from the individual to the global level. However, access now involved sufficient food, indicating continuing concern with protein-energy malnutrition. But the definition was broadened to incorporate food safety and also nutritional balance, reflecting concerns about food composition and minor nutrient requirement for an active and healthy life. Food preferences, socially or culturally determined, now became a consideration.

The 1994 UNDP Human Development Report promoted the construct of human security, including a number of component aspects, of which food security was only one. This concept is closely related to the human rights perspective on development that has, in turn, influenced discussions about food security.

The 1996 World Food Summit adopted a still more complex definition:

*“Food security, at the individual, household, national, regional, and global levels (is achieved) when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”.*

This definition is again refined in The State of Food Insecurity 2001:

*“Food security (is) a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”.*

This new emphasis on consumption, the demand side and the issues of access by vulnerable people to food, is most closely identified with the seminal study by Amartya Sen. Eschewing the use of the concept of food security, he focuses on the entitlements of individuals and households ([www.fao.org](http://www.fao.org)).

Food Security is an important component of human welfare and considered the most important basic requirement of human resource development. Food security as a goal sets before itself, the norms in regards to the availability of food, firstly, this should ensure basic existence of people and at the next level, it should serve the minimum nutritional standards for their active and healthy life. Food and nutrition security are the basic requirements for human life. It plays a vital role in livelihood security in terms of capabilities, assets and activities required for living (Radha, 2009).

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern ([www.fao.org](http://www.fao.org)).

In recent decades, demographic and economic growth have challenged the limits of economic, social and ecological sustainability, giving rise to questions about food security at a global level. Despite technological advances that have modernized the conditions of production and distribution of food, hunger and malnutrition still threaten the health and well being of millions of people around the world.

Access to food is still perceived by many as a privilege rather than a basic human right and it is estimated that about 35,000 people around the world die each day from hunger. An even larger number of people (mainly women, children and the elderly), suffer from malnutrition. Far from disappearing, hunger and malnutrition are on the increase; even in advanced industrialized countries like Canada, each year an estimated 2.5 million people depend on food

banks. About 30 million people in the United States are reported to be unable to buy enough food to maintain good health. The continuing reality of hunger and the unsustainability of current practices, both locally and globally, make food security an essential concern.

According to the United Nations' and Agricultural Organization's (FAO's) widely accepted definition, food security means that food is available at all times; that all persons have means of access to it; that it is nutritionally adequate in terms of quantity, quality and variety and that it is acceptable within the given culture. Only when all these conditions are in place can a population be considered "Food Secure". In recent years, most of the research initiatives for food security have focused on four key components of the FAO's definition:

*Availability:* Providing sufficient supply of food for all people at all times has historically been a major challenge. Although technical and scientific innovations have made important contributions focused on quantity and economics of scale, little attention has been paid to the sustainability of such practices.

*Accessibility:* The equality of access to food is a dimension of food security. Within and between societies, inequities have resulted in serious entitlement problems, reflecting class, gender, ethnic, racial and age differentials as well as national and regional gaps in development. Most measures to provide emergency food aid have attempted to help disadvantaged but have had limited success in overcoming the structural conditions that perpetuate such inequities.

*Acceptability:* As essential ingredients in human health and well being, food and food practices reflect the social and cultural diversity of humanity. Efforts to provide food without paying attention to the symbolic role of food in people's lives have failed to solve security problems. This dimension of food security is also important in determining whether information and food system innovations will be accepted in a country, given the social and ecological covers of its citizens.

*Adequacy:* Food security also requires that adequate measures are in place at all levels of the food system to guarantee the sustainability of production, distribution, consumption and waste management. A sustainable food system should help to satisfy basic human needs, without compromising the ability of future generations to meet their needs; it must therefore maintain ecological integrity and integrate conservation and development ([http\\www.idrc.ca](http://www.idrc.ca)).

The concept of food security in its wider attention comprises of four elements:

- 1) Availability of food,
- 2) Household's entitlement to food,
- 3) Stability in the supply of food throughout the year, and

4) Protection against malnutrition  
(Dev, Kannan and Ramchandran, 2003).

“Food Security has three components”, writes Prof. M.S. Swaminathan. “The first is food availability, which depends on food production and imports. The second is food access, which depends on purchasing power. The third, food absorption, is a function of safe drinking water, environment hygiene, primary health care and education” (Current Science, 25<sup>th</sup> Oct.2001).

Ensuring food security continues to be an issue of vital importance for the developing countries. The concept of food security has undergone considerable change in the recent years. A broadly accepted definition of food security now goes beyond adequate availability of food. It includes “access to adequate food to all people at all times for an active and healthy life”. The aim is not merely to supply adequate quantities of food but to create conditions in which people are capable of feeding themselves self-reliantly with healthy and culturally acceptable food stuff (Vyas, 2005).

“Food security” states the Rome Declaration on World Food Security at the World Summit held in 1996 “exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (Srivastava, Nisha 2003). Economists talk about two types of food insecurity, namely, chronic food insecurity and transitory food insecurity. The latter is caused by fluctuations in agricultural output, which are mainly due to uncertain weather conditions. Given the fact that a large fraction of arable area lacks adequate and assured irrigation facilities, it has to depend on the monsoon. A backward area is characterized by low and wide fluctuations in output, widespread poverty, unemployment and limited opportunities for income generation. In view of these constraints, provision of food security to the poor is crucial for households located in such an area. In the absence of adequate income to buy basic food items from the market, these households would either have to consume less or borrow. In a broad sense, therefore, food security would be essential not only in terms of providing adequate food at a reasonable or low price but also generating enough income either through self-employment in own activities and wage employment provided by the private or state-sponsored programmers (Sarap and Mhamallik, 2003).

Human Development Report is one of the significant reports which emphasizes on Human Security and how it varies from country to country (UNDP, 1994). Actually, human security stands for basic needs like adequate amount of food, health and eradication of poverty. However, one common factor that binds these issues is the central focus upon human being. It identifies seven categories for ensuring human security in the form of Economic Security, Environmental Security, Food Security, Political Security, Community Security, Personal Security and Cultural Security. In order to achieve food security in the new millennium

coordination and cooperation among International organizations, countries (develop, developing and underdeveloped), NGOs /Civil Societies (Self Help Groups), Individuals especially focusing on women were found to be inevitable. Thus inclusion of women, traditional agricultural practices at International forum was the major focus. “Food security is the people’s right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium–sized production, respecting their own cultures and the diversity of peasant, fishing and indigenous forms of agricultural production, marketing and management of rural areas, in which women play a fundamental role” (*Final Declaration of World Forum on Food Sovereignty*, 2001) (14.139.206.50>jspui>handle).

The Atlas of the Sustainability of Food Security in India proposes a “Sustainable Food Security Compact”, a nine-point action plan for every state and union territory. The action refers to stabilizing population, conserving and enhancing land resources, ensuring water security, conserving and restoring forests with community participation, strengthening biodiversity, improving the atmosphere, managing common property resources, intensifying crop and animal production in a sustainable way and forming a coalition for sustainable food security across different states in the country, across different size classes of towns in the states and within different types of towns. Millions of people in India suffer from chronic poverty and inequality leading to deprivation in availing proper nutritious food and moreover an absence in systematic distribution of Central and State schemes worsen the situation. One of the major concerns for this region has been its growing population where issues like food insecurity are proving to be one of the upcoming challenges. The present functioning of Public Distribution System has left large dents in the form of irregularities, errors of Inclusion and Exclusion, leakages etc. These further affect the people at the grass roots level the most. These loopholes raise strong questions on the policies of the government framed by the Central Government and its execution by the various State Governments. About 1.75 billion people across 160 countries suffer from deprivation like health, education and average standard of living which are the three dimensions of Multidimensional Poverty Index (HDR, 2010). There are 920 million people living under 1.25 dollar per day (World Bank, 2008) and estimated 925 million people suffering from chronic hunger (MDR, 2010). Developing countries account for 98 percent of the world’s undernourished people. Two-thirds live in just seven countries (Bangladesh, China, The Democratic Republic of the Congo, Ethiopia, India, Indonesia and Pakistan) and over 40 percent live in China and India alone (FAO, 2010). Nearly half of the world population belonging to undernourished children under age five belongs to South Asia (MDR, 2010).

According to Prof. Lama “elements like availability, accessibility, affordability and acceptability in a sustained manner are underlying factors in ensuring food security to the

common people in general and poor people in particular which also shows a balancing act between supply and demand sides.(Lama, 2010). India ranks 67<sup>th</sup> among 81 countries in Food Security one of the major challenges for a food self sufficient state (GHI 2011, ranks 122<sup>nd</sup> among 138 countries in Gender Inequality Index (HDR, 2010) equality of women plays an important role in minimizing food insecurity, ranks 66<sup>th</sup> among 83 countries in ‘alarming hunger’ and it accounts for 40 percent of total malnourished children in the world (IFPRI, 2008) which shows serious limitations in balancing act. In India, states like Bihar, Madhya Pradesh, Rajasthan, Jharkhand, Orissa, Karnataka, Uttar Pradesh, West Bengal and Chhattisgarh are most affected by poverty, hunger, malnutrition and unemployment, primarily due to corruption and lack of effective governance (14.139.206.50>jspui>handle).

The concept of food security has undergone considerable change in recent years. The first Development Goal seeks to eradicate extreme poverty and hunger. It aims to halve, between 1990 and 2015, the proportion of people –

- i) whose income is less than US\$ 1 a day, and
- ii) who suffers from hunger.

Until the seventies, the concept of food security focused mainly on availability and stability of food. A broadly accepted definition of food security now goes beyond adequate availability of food. It includes ‘access to adequate food to all people at all times for an active and healthy life’. The aim is not merely to supply adequate quantities of food but to create conditions in which people are capable of feeding themselves self reliantly with healthy and culturally acceptable foodstuff - a state of ‘nutritional sovereignty’ (Sagar, 2005).

The concept of food security has evolved significantly over time. The definition of food security adopted at the 1996 World Food Summit held in Rome was as follows:

“Food Security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”.

This definition introduces four main *dimensions* of food security:

- Physical *Availability* of food
- Economic and physical *Access* to food
- Food *Utilization*
- *Stability* of the other three dimensions over time.

*Food availability* addresses the “supply side” of food security and is determined by the level of food production, stock levels and net trade.

From the early 1980s the importance of *food access* was increasingly recognized as a key determinant of food security. Hence, food production is just one of several means that people have to acquire the food that they need.

Food can be accessed through trade, barter, collection of wild foods and community support networks; it can also be received as gift. Actually access to food is influenced by market factors and the price of food as well as an individual's purchasing power, which is related to employment and livelihood opportunities.

The *food utilization* has become increasingly prominent in food security discussions since the 1990s. Utilization is commonly understood as the way the body makes the most of various nutrients in the food. This food security dimension is determined primarily by people's health status.

General hygiene and sanitation, water quality, health care practices and food safety and quality are determinants of good food utilization by the body. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the nutritional status of individuals.

Food security was traditionally perceived as consuming sufficient protein and energy (*food quantity*). The importance of micro-nutrient diet (*food quality*) is now well appreciated.

The phrase "all people, at all times" is integral to the definition of food security, and is key to achieving national food security objectives.

*All people* - Different people are food secure to varying degrees and will be affected by adverse events differently. There must be assessing variations in food security status between different groups of people. Most commonly, humanitarian and development agencies differentiate between groups according to their main livelihood (source of food or income), in addition to other factors such as geographical location and wealth.

*All times* - This recognizes that people's food security situation may change. Even sometimes questions may arise;

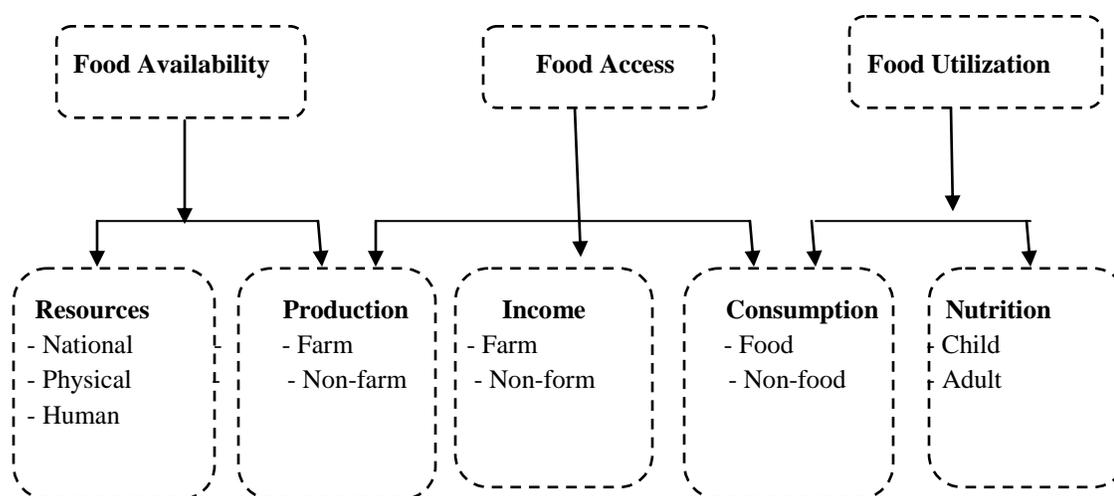
- Your food intake is adequate today?
- Are you still considered to be food insecure?
- Have you inadequate access to food on a periodic basis?

Adverse weather conditions (drought, floods), political instability (social unrest), or economic factors (unemployment, rising food prices) may impact on food security status.

The phrase “at all times” refers to the *stability* dimension of food security. It emphasizes the importance of having to reduce the risk of adverse effects on the other three dimensions: food availability, access to food or food utilization (foodsecuritycluster.net).

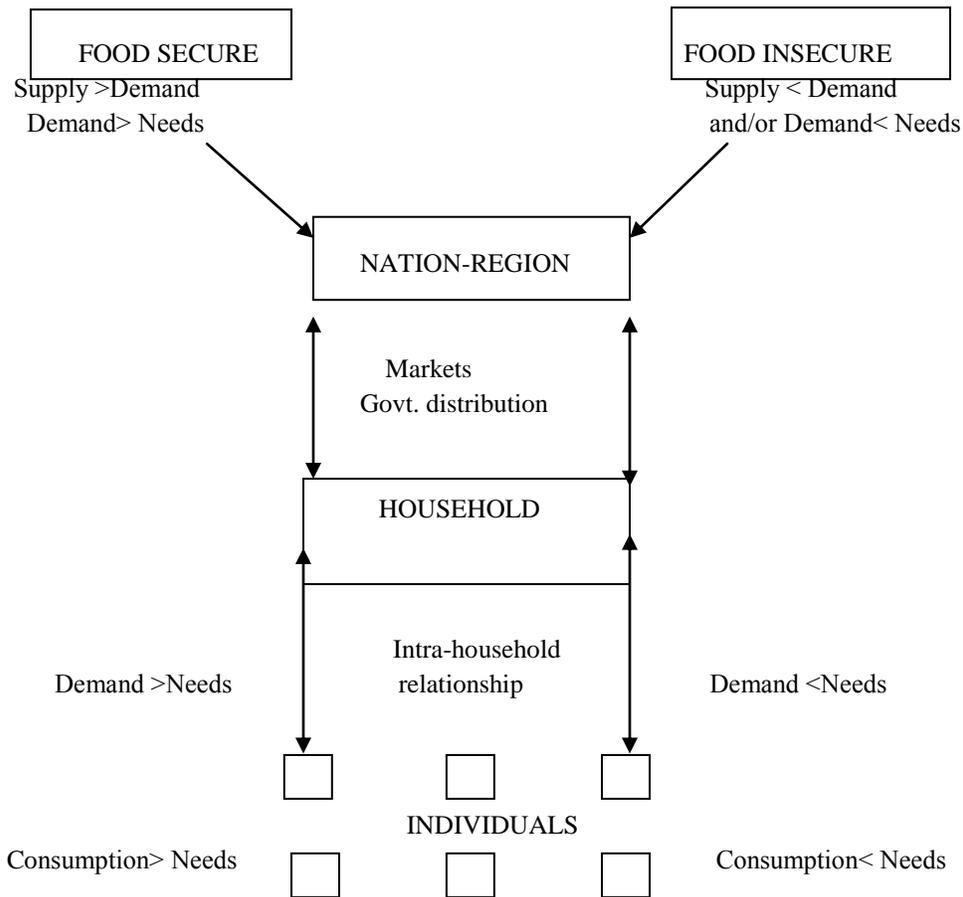
Chung, et al. (1997) summarized the diverse determinants of food security status in a general conceptual framework as indicated in the following chart. It focuses on the links between resources commanded by the households, levels of farm and non-farm production, household income, household and individual consumption, and individual nutrition. He described a conceptual framework of food security and generic indicator categories in the following chart.

**Figure 1.1** Schematic representation of Conceptual Framework of Food Security



Source: Chung et al. (1997)

**Figure 1.2:** Schematic representation of Different Levels of Food Security



Source: [www.fao.org](http://www.fao.org)

With somewhat satisfactory levels of national food security influenced by the production performance of Indian agriculture during the past decades, attention has been shifted from national food security concerns to individual and household food security while household is influenced by both physical access and economic access, food security of individual members of the household is influenced by intra-household allocation of food. Food security of the people will be ensured not only by the increased food production at the national level but also from the increased economic access through increased income levels or from reduced prices. Economic access to food for the poor could be achieved through a mix of employment and income policies for the farm and nonfarm sectors and through a minimum safety net ([shodhganga.inflibnet.ac.in](http://shodhganga.inflibnet.ac.in)).

## Review of Literature

### Literature on Agro-economics

*Drummond and Goodwin (2004)* express their views regarding the agriculture economics. Agricultural Economics deals with decision making within the unique context of the broadly defined food and fiber sector. This book takes a thorough look at agricultural economics from a broad prospective that emphasizes the linkages between and among financial institutions, the macro economy, world markets, government programmes, farms, agribusinesses, food marketing, farm services and the environment. In the chapter of introduction to agricultural economics they stress that the agricultural economics is that part of economics that surveys agriculture in its many fields and farms. The agricultural economics is concerned with the entire food and fiber system, from the inputs used in production all the way through the production, processing, distribution and consumption chain. Further they say that the food and fiber system is related to almost every facet of our economy and our environment.

*Gallup, John Luke, Jeffrey Sachs and Andrew D. Mellinger (1998)* in their paper “Geography and Economic Growth” argue that too little account is taken of basic elements of geography as important determinants of economic growth. Their econometric model suggests areas of complex relationship between geography and economic growth, policy choices and institutions. Their paper finds that location and climate have large effects on income levels and income growth through effects on transport costs, disease burdens and agricultural productivity. There is a disjunction between areas of high economic growth and areas of high population density and high population growth – especially when these latter are far from coastlines or navigable rivers. Much of the population growth projected for the next 30 years will likely occur in these geographically disadvantaged regions. The paper starts from comparative income data suggesting that 1992 Africa per capita income is approximately on par with average per capita GDP in the Europe of 1820.

*Handbook of Agriculture (1987)*: The handbook of agriculture comprises of authentic information on various aspects of agriculture. It covers fields as well as agricultural legislation and control of pests and diseases. Further, it presents a full panorama of Indian agriculture.

*Jhingan (2003) and Dhar (2005)* have conducted a study on different perspectives on role of agriculture in economic development and they sorted out some points:

- i) providing more food to the rapidly increasing population and it becomes source of livelihood;
- ii) role of agriculture for industrial development,
- iii) source of government revenue,
- iv) providing productive employment, and

- v) role of agriculture in economic planning etc. It is concluded that agriculture brings sustainable development for the enhancement of economic condition of the society as well as nation.

*Jordan, Chavez-Mejia & Rayes Regee (2001)* have studied the mountains of Central Mexico that have a long and rich history of agricultural development. They further endeavor to show how agriculture is possible in hilly mountain region.

*Lekhi and Singh (2001)* state that after a long spell of backwardness and stagnation, there have been new strides in transforming latest technology, institutional and agrarian reforms in the country. Their book unfolds in a systematic way the basic issues relating to the growth and problems in Indian Agriculture. The book is divided broadly into three units. Unit I deal with the basic concepts of Agricultural Economics, Unit II makes analysis of various Models of Agricultural Development and Unit III has been devoted to the Development Problems of Indian Agriculture.

*Sikor and Truong (2002)* in their article have examined the effects of agricultural policy on land use. They suggested that the landscape in the commune has been highly dynamic and that this dynamism was partly the result of the agricultural policy.

*Som (1988)* observes that India is a country of villages and its economy is primarily based on agriculture. Approximately 80%, through agricultural production lives in rural sectors with different types of cultivation. Since independence Indian planners and policy makers have greatly concentrated their minds on the advanced technological development in agricultural sector with a view to putting India on the same level with the developed countries of the world.

*Srivastava (1996)* outlines a number of perspectives pertaining to agro-economic studies, such as, how unlimited economic goals can be realized with limited financial, physical, real, technological and human resources. He studies how different degrees of scarcities give rise to different prices. This pricing process, studied with reference to commodity and service (factor) pricing, leads to locatives efficiency and everything is to happen within a time horizon. It is a macro science of promoting growth, stability and redistribution – the cardinal principles of all economic policies. The aims are reducing poverty, of making a country strong in economic terms and of maximizing employment generation and income propagation. He further adds that agricultural economics belongs to the “pain economy”. It helps us in warding off hunger and it is to be kept in view that not being in pain is the true pleasure. The author endeavors to show the relationship between land, resources, production and market to sustain the people in the country.

*Tulachen* (2001) has tried to identify the trends for three integral components of mountain farming systems - production of food grains crops, horticultural and cash crops and livestock. In fact, productivity actually increases for some food grain crops leading to increased food grain production in a few mountain areas over the past 10-15 years. The reasons for this could be:

1. Government policies relatively favourable to production of food grains in an attempt to ensure food security,
2. Most of the fertile valley lands with irrigation are under food grain crops, and
3. Development of road infrastructures could be contributing to timely supply of modern inputs, such as fertilizers, improved seeds and pesticides.

### **Literature on Food Security**

*Bouis and Hunt* (1986) have described the food security of several countries in the Asian region, analyzed the causes, discussed about the food security and identity changes in the programme and policy response that are likely to promote food security at all places.

*Dev, Kannan, and Ramachandran*(2003) have noted that India is often cited as a land of paradoxes. This is certainly true when it comes to food security. Despite a decline in poverty, close to 30 percent of its people are food insecure and one-half of its children malnourished in one-way or another. And yet the country has a stock of more than 60 million tons of food grains stored through governments' procurement. Increased foods prices, shrinkage of area under food grains and escalating food subsidies are now the major concerns with regard to food security, rather than freedom from hunger. Food security has a number of dimensions that go beyond supply and demand. Ultimately, the key question is that of the ability to access and effectively utilize food by all people, at all times, to lead a healthy life.

*De Waal, A. and Tumushade, J.* (2003), in their paper "HIV/AIDS and food security in Africa" have addressed two major issues: 1) the impact of HIV/AIDS on agrarian livelihoods and how it can be mitigated and 2) the implications of the HIV/AIDS epidemic and regional food insecurity occurring simultaneously. This paper on AIDS and food security takes a more dire view of the situation than many, calling it the "new variant famine" that must be researched and understood as the basis for policy and practical responses. How and why the HIV/AIDS epidemic is disproportionately affecting agriculture and particularly the small-holder sub-sector is reviewed extensively in terms of the range of negative effects on rural livelihoods, communities, and social services and the failure of coping strategies.

*Diskin, Patrick* (1995) has authored the paper "Understanding linkages among food availability, access, consumption, and nutrition in Africa: Empirical findings and issues from the literature", Office of Sustainable Development, Technical Paper No.11. Diskin, an economist in Michigan State University's Department of Agricultural Economics, argues that

policymakers are constrained in designing effective food security strategies by a lack of reliable and relevant information concerning the causes of food insecurity and their linkages to nutritional status which leads to designing policies. He cites several examples of well meaning, but flawed, policies leading to unintended consequences. His conclusion is that simplistic notions about the food availability – nutrition pathway need to be replaced with appropriately disaggregated empirical information, carefully identifying the nature, extent and causality among food and nutrition security variables to better understand the primary factors limiting food access, consumption and nutrition.

*Duncan, Alex* (1999) studies “The food security challenge for Southern Africa”. The aim of the paper is to consider what governments should be trying to improve food security in Southern Africa and how they should do it. Food security aims and instruments in Southern Africa are considered against a background of changed international and regional circumstances. These include; i) enhanced focus on macro-economic stabilization, ii) a decline in funding for agriculture, iii) a reduction in government involvement in commercial activities, iv) movements toward greater integration in world markets, v) efforts in Southern Africa to move toward greater cooperation and trade in the region. The author suggests the main roles for governments in the region in promoting food security are; i) creating enabling environments for development , ii) correcting for market failure, and iii) targeted measures to achieve social objectives. More specifically in rural areas, governments need to: i) support household strategies aimed at raising and stabilizing incomes through diversification , ii ) intensification of farming , and iii ) support migration.

*FAO* (1995) has brought out “A synthesis report of Africa: Women, agriculture and rural development” that provides both macro and micro-level information of African women and rural development and includes quantitative examples from three countries in the southern Africa region (Namibia, Tanzania and Zimbabwe). Information on gender inequality in power-sharing and decision-making in terms of membership in rural/agricultural organizations, government positions, local power structures and at the farm level is presented. The conclusion, illustrated with examples from nine African countries, is that women’s participation at all levels is limited and they often are not represented for women’s affairs in each country are summarized in a table. Rural poverty, increases in the proportion of women – headed households and the implications for household income and food security are discussed in brief. Inequalities in women’s access to and participation in economic structures and productive processes is reviewed in eight areas; land ownership, access to credit, extension services and agricultural training, the gender composition of extension departments, and the gender composition of extension service clients. Examples illustrate women’s marginalization in these areas, despite their important role in agriculture. The lack of gendered data on the nature and role of women’s contribution to agriculture is discussed, specifically how it has made women “invisible” to agricultural policies and programs.

*Gladwin, C.H., Thomson, A.M., Peterson, J.S., Anderson, A.S.* (2001) have prepared the report “Addressing food security in Africa via multiple livelihood strategies of women farmers”, *Food Policy*, 26, 177-207. The theme of this paper is that insecurity is primarily a problem of low household income and poverty, not just inadequate food production and that intervention to improve food security should aim to increase women’s incomes and help make their livelihoods move sustainable. The assumption that improving food security should be based on helping women farmers in SSA (Sub-Saharan Africa) to grow more subsistence crops is incorrect. Governments and development projects must seek to improve returns to women’s resources in a broader context, including more opportunities for non-farm micro-enterprises, cash cropping and agricultural labour. The link between agricultural production and access to food is strong because agriculture is the basis of most rural households’ economic systems. But rural Africa women have “multiple livelihood strategies” in order to survive and work toward food security, so agriculture may not be the only or the most important source of income. Women work as farmers, petty traders, food processors and informal labour in order to make ends meet. Having multiple economic irons in the fire is necessary in Africa’s problematical economic context, for married women and for women household heads. Development programs must recognize and support women’s diverse economic roles and not just focus on increasing their food production. Several factors must be considered in planning interventions to improve food security by increasing women’s incomes and making their livelihoods more sustainable. A four-pronged sustainable strategy is recommended, 1) encourage women’s income generating activities and multiple livelihood strategies, 2) complement the foregoing with agricultural research programs aimed at increasing women’s returns to their land, 3) recognize that rural women are not homogeneous group and 4) in the short term, provide the poorest women farmers with productivity-enhancing safely nets to address household food consumption deficits.

*Nathan Associates* prepared a report on (Regional Centre for Southern Africa). The report ‘RCSA Food Security Strategic Option’ responds to a scope of work prepared by the Regional Centre for Southern Africa and is based on theoretical perspectives. This report is divided into three sections corresponding to the categories of enquiry suggested in the proposed food security, according to research questions:

Section 1 contains a synopsis of what is written about food and livelihood insecurity in southern Africa. It notes, that more than one-fourth of the total populations of the six countries most affected by the 2001-02 food emergency remain, as of early 2003, in a state of acute food insecurity; that chronic under nutrition in under-fives presently ranges between one-fourth and one-half of all children in that age group; and that more than half of the total population of the region, i.e. more than 50 million people can be numbered among the chronically food insecure poor.

Section 2 looks at what has been done, is being done, and should be done in the future to improve overall household food security in the region. It notes the changing nature of the domains of food security and livelihood security since the mid-1970s. It suggests a growing consensus around the notion that food security requires – at a minimum – a food system operating to create a sense of assurance among the population that access to adequate food for all individuals and households is a continuing likelihood. Food security policy is intended to maintain the conditions underpinning that assurance over time.

Section 3 focuses specifically on what role RCSA could and should play in the agriculture growth-led, livelihoods focused, development strategy suggested. Recognizing that the bulk of the effort will need to be undertaken and accomplished at local, community, and national levels, there are, nonetheless, a number of areas where RCSA, with its regional mandate, can play an important and sometimes critical role.

*Van Rooyen, Johan, and Howard Sigwele (1999)* have authored the article, “Towards regional food security in Southern Africa: a (new) policy framework for the agricultural sector”. The article argues the importance for food security of agricultural development in Southern Africa. Sustained agricultural performance will play a significant role in the improvement of food security and livelihoods in the region”. However, consideration must be given to the dramatically increasing number of urban food insecure in the region and feeding the urban masses at affordable prices will increasingly become a high priority consideration for agriculture. Household-level poverty reduction, economic development and growth are important components of a food security strategy. Agriculture is key to all of these and the development of a productive agricultural sector will depend on investment in infrastructure and marketing systems as well as in making appropriate technological advances available to farmers.

*Von Barun, J., Hazell, P., Hoddinott, J. and Babu, S. (2003)* have dealt with issues relating to “Achieving long-term food security in southern Africa: International perspectives, investment strategies and lessons”. Von Barun and his team at IFPRI nicely presents some of the approaches that developing countries once threatened by famine used to avert future food crises and embarked on a path towards long-term food security. The paper also argues that for long-term investments to work, the countries must develop the capacity of their public institutions, particularly in the areas of policy analysis, research support, data and information collection and management, analytical capacity for strategy development and planning monitoring and evaluation. Designing the appropriate policies is the key to all the other impact strategies and investments that will effectively place the region on a path to food security.

*Vyas (2005)* tries to examine the results of the efforts to achieve food security particularly the promising practical measures to reach the Millennium Goals. The case study of different countries of Asia has been done to determine food security, so that it can be best understood at

the country level. One important aspect of the process of this study thus involved the selection of the countries for case studies. A specific typology is adopted; two least developed countries (Cambodia and Nepal), two medium-income countries undergoing fast structural changes (Indonesia and Thailand), and one large and fast developing country (India) are selected for the study. The author observes that in most of the countries food security is limited because demand keeps on increasing due to population increase; as such the gap is widening between the needs and the availability of food.

Amartya Sen added a new dimension to food security and emphasized the “access” to food through what we called ‘entitlements’ - a combination of what one can produce, exchange in the market along with state or other society provided supplies. Accordingly, there has been a substantial shift in the understanding of food security, “Food Security at the individual household, regional, national and global levels exists when all people at all times, have physical and economic access to sufficient safe and nutrition food to meet their dietary needs and food preference for an active and healthy life”(FAO 1996). The declaration further recognizes that “Poverty eradication is essential to improve access to food”(Debashis Basu and et.al 2006).

### **Literature on Sikkim’s Agriculture and Food Security**

*Coelho* (1970) in the book *Sikkim and Bhutan* observes that the main sources of Sikkim’s wealth are agriculture and forests. Rice and maize are the main monsoon crops. The other subsidiary crops include millet, buckwheat, barley, pulses etc. The cardamom plantations are of importance due to its export potential. The cultivation of potato is also getting importance. Tea plantation is a new venture. Apples and pineapples are also grown and these are supplied to fruit preservation factory at Singtam. The cattle of local breeds, yaks, sheep and goats are found throughout Sikkim.

*Debnath* (1980) studies the agricultural situations of Sikkim in pre-merger period (before 1975) when nearly 95% of the population depended on agriculture. In 1965-66, the proportion of contribution of agriculture including animal husbandry and forest to the net domestic product was about 80%. The important cereal crops were maize and paddy and still these were dominating. He briefly describes the production situation of millet, cardamom, mandarin orange and potato etc. The paper gives an overview of agriculture in Sikkim.

*Subba, J. R.* (1984) in the book *Agriculture in the Hills of Sikkim* states that the agricultural backwardness of Sikkim is caused by several factors. He points out that some factors, such as, limited area of cultivated land, low productivity, low irrigation facility, limited agro mechanization, slow adoption of high yielding varieties, cultivation of traditional crops, lack of post-harvest technology etc. are the basic hindrances on the way of agricultural progress. For rapid growth of agriculture and rural hill economy, he suggests cultivation of commercial

crops in the mixed cropping, relay cropping, multiple cropping, orchard and garden land cropping, mixed farming and agroforestry. Further, he has mentioned that no system of land utilization classification is followed in Sikkim.

*Bhattacharya* (1984) observes that the northern portion of the country remains pastoral, whereas cultivation is the mainstay of the people of the southern half. The majority of the people of Sikkim seem to have continued shifting cultivation until the late 19<sup>th</sup> century. The change from shifting cultivation to wet cultivation occurred mainly during the later part of the 19<sup>th</sup> century. The Nepalese settlers have since introduced rice on alluvial flats and terraced lower slopes, but the Lepchas, however confined themselves more and more to the cleared patches in secondary jungle to grow mainly maize.

*Choudhuri* (1984) writes that the cultivable land is of two types, the irrigated land or panikheti and non irrigated land or sukhakheti. Cultivation in the area is carried out on terraced fields prepared with great labour by cutting the hill slopes and most of the terraces; especially the panikheti areas are at least 5-6ft.wide and can be ploughed with the help of bullocks. But in areas with steeper slopes of about 40<sup>o</sup>-45<sup>o</sup>, the terraces are rather narrow and breaking of soil is normally done with the help of hoe and other implements. Retention of water in the fields is an important aspect of hill cultivation which requires special measures for giving an inward slope to the terraces.

*Dhamala and Bhowmick*, (1985) in their paper state that during the Chogyal's rule there was feudalism in Sikkim. During late 20<sup>th</sup> century different political parties in Sikkim demanded the abolition of landlordism and its associated vices, such as forced labour, illegal extraction by landlords from tenants and the magisterial power by landlords. It is pointed out that the ceiling on land holdings seeks to remove unequal distribution of landed property and its evils that retard social and economic development of the state. Concentration of property in the hands of a few is bound to adversely affect agricultural production and social cohesion as well.

*Mukhopadhyay* (1988) tries to explain different developmental aspects of Sikkim and further analyzes the different economic activities associated with forestry, hill-agriculture including plantations, horticulture and animal husbandry, industries, transportation, tourism etc. that have led to the development of various land use patterns in the area. Agriculture is mainly practiced in the hillside and valley side slopes of wet terrace, but in the valleys and dry terraces in the upper hills paddy, wheat, maize, millet etc. are raised.

*Subba, T. B.* (1989) has studied the agrarian social structure of Sikkim in different time period. He has analyzed the agrarian society of Sikkim in three phases – pre-British, British and post-British.

*Dasgupta* (1992) in the book *Sikkim: Problems and Prospects of Development* narrates land reforms and development in Sikkim. The land revenue system of Sikkim has undergone various changes. The question of land tenures since 1948-49, changes in land tenure system and the problem of ethnicity have been discussed briefly. The book deals with the problems and prospects of agriculture in Sikkim. The changes of land–use system in Sikkim since 1958-60 to 1980-81 are mentioned but not analyzed. The then agricultural situation of Sikkim and its limitations has been discussed. The book highlights the mixed farming system of Sikkim. It narrates how the poor people of Sikkim supplement their income through the livestock industry. He has discussed various aspects of mixed farming system keeping in mind the agro-climatic conditions. The problems of mixed farming system have also been analyzed and the problems and prospects of non-cereals crops (cardamom and oranges) of Sikkim have been discussed. Besides, the author has commented on forest management and economic development and rightly revealed the causes of deforestation and failure of forestry to integrate with development in other sectors.

*Gupta* (1992) gives vivid description about the development system in Sikkim in relation to the people and their living style during the Chogyal regime and after democracy prevailed in Sikkim. Further he highlights the agricultural society in Sikkim, the control of farmland as the principal key to wealth, stability and power. Majority of the people in Sikkim lives in rural areas and most of them must make a living through agriculture if they are to make a living at all.

*Sontheimer, Sally* (1997) in her paper *Lessons from Sikkim – India* based on the experience of the FAO Technical Cooperation Project aimed at small goat and poultry, entitled ‘Development of Small scale livestock Activities – Sikkim’ reveals a number of important lessons for using participatory, gender–responsive approaches to agricultural development. Further these lessons try to demonstrate how effective such approaches can be in improving rural livelihoods, reducing risk and indebtedness and increasing food security for all the household members.

*Singh & Pandey* (2000) in their paper point out that the majority of workers in the state are engaged in the primary activities; among which agriculture has engaged maximum proportion of population as this is the mainstream of economy of the state. They observe that out of total main workers, 65% are cultivators and agricultural laborers.

*Lama* (2001 & 2003) examines the agricultural backwardness in Sikkim before the merger in 1975. He observes that the agriculture sector is characterized by uncertainty about land tenure rights, negligible public investment and over dependence on traditional technologies. This sector has recorded considerable progress during the last two decades. In the past low

productivity, negligible marketable surplus and other institutional inadequacies, which plagued the economy led to agricultural backwardness. He asserts that Sikkim's economy is mainly dependent on agriculture. Almost 85% of the population of Sikkim lives in rural areas and only the improvement in agriculture can better their lot. Moreover, it is said that agriculture, horticulture, livestock, fisheries and agro-forestry can be integrated to give viable systems to farmers.

*Gaunle* (2002) describes the system of land holding and revenue collection in pre-merger era. Perception on landlord system in Sikkim is that people of Sikkim sustained their melancholy life during Chogyal regime but the key persons during that time were Kazis and Thikadars who collected the revenue from peoples.

*Shrestha* (2005) writes that the climate and seasons of Sikkim are suitable for growing large number of crops, viz. rice, maize, wheat, cardamom, potato, ginger, orange etc. His book attempts to focus on different bills passed in the Legislative Assembly in Sikkim, such as,

- i) The Sikkim urban land (Ceiling and Regulation) Bill, 1976.
- ii) The Sikkim Agricultural Land Ceiling and Reforms Bill, 1977.
- iii) The Sikkim Land (Requisition and Acquisition) Bill, 1977.
- iv) The Sikkim Land (Requisition and Acquisition Amendment Bill, 1978).
- v) The Sikkim Agricultural Land Ceiling and Reforms (Amendment), Bill 1977.
- vi) The Sikkim Agricultural Land Ceiling and Reforms (Amendment) Bill, 1985.
- vii) The Land Acquisition (Sikkim) Amendment Bill, 1992.

*Thirty Years of Sikkim*, (2005): In this book particularly in the chapter on agriculture it has been stated that 1975 onwards the development in agriculture sector took a turn, changing the whole approach to farming. Henceforth, till 1980 infrastructure was created in different spheres of agriculture like establishment of soil testing laboratory, more number of VLW circles was created, land purchased for research & development etc. Regional concept for the development of agriculture and horticulture was adopted and introduced in various agro-climatic zones of the state.

*www.undp.org* highlights that despite the limited cultivable land in Sikkim agricultural development has made considerable progress during the last two decades. The state has attempted to convert the subsistence farming into an economically viable venture by introducing new crops, extending more areas under high-yielding and improved seed varieties, increasing the use of fertilizers and pesticides and expanding the area under double or multiple cropping. Further it observes that as a result of all these measures, the total food grain production has increased from nearly 62,000 tons in 1980-81 to 1, 03,000 tons in 1997-98.

## **Research Gap**

Several writers and scholars have expressed their views and concerns on food security and they discussed the agricultural scenario of different countries, India and state of Sikkim as well. Some writers have focused on the past and present of agricultural situation in Sikkim. But no scholar as such has so far critically examined and written about the agro-economic perspective and food security in Sikkim, and how agro-economics helps in achieving food security. In this research I have tried to explore the virgin topic for the better understanding of rural livelihood standard in Sikkim in relation to agro-economic activities and food security.

## **Statement of the Problem**

Agriculture takes in many forms according to latitude, longitude and social groups. The hill agriculture has been defined as the agricultural practices for production on hill slopes exceeding above 36 percent slope. Almost every system is basically a form of mixed farming, including arable cultivation of cereals and tubers, livestock and intensive use of forests. Food crops, usually grown in valley, terraces and hill slopes supplemented by some animal products, satisfy the basic energy intake of rural population. Over the past several centuries, there was a close relationship between human population growth, expansion in area under subsistence crops and increase in the number of livestock. These intensified the demands on the forest to supply animal fodder, timber fuel wood and land for agriculture. The mountains and hills are highly vulnerable to degradation caused by rapid changes in vegetative resources. The mechanism of crops domestication over generation among hill tribes through trial has been evolved by their own adaptive strategies. They either modified the mountain characteristics (e.g. terracing, plantation crops etc.) to suit their needs or used the system as such in different forms of shifting cultivation relying on the regeneration of soil productivity through natural vegetation without any outside inputs except seeds and human labour.

Hilly areas are generally characterized by fragile environment and hence cultivation of crops have been extremely difficult and very expensive because of difficult terrains, poor road communication, tremendous variations in soils, agro-climates, etc. within narrow range of altitudes. Only a limited area can be brought under cultivation due to constraints put by elements of physical environment such as climate, slope, soil, pests etc. Much larger area can be used as pastures and forests. In spite of physical constraints, cropland in the mountain and hill areas has been considerably increased by human encroachment on forests and grassland.

The initial selections of crops were influenced by climate and natural vegetation. The distribution of biomass depends upon the distribution of solar radiation, temperature and rainfall. The vegetation types vary from equatorial forest to the tundra of the sub-Arctic. Climate is still a dominant factor in agriculture, though human influence has changed the limits of growing particular crops.

Land is the most important natural resource upon which the main economic activities of people in Sikkim are based. It plays vital role where the socio-economic development is limited particularly when economy is largely based on agriculture. More than 65% of the total population of Sikkim is engaged in agricultural activity. However, present level of performance of land in terms of productivity is still very low. Different types of land units have their own production potentials. The capacity of soil is determined by bio-physical condition on the one hand and the use of technology such as irrigation, selection of crops and management of land on the other. If the land is used according to carrying capacity, the productivity can be increased over a long period.

Physical setting of the state makes cultivation extremely difficult and diverse. Altitude, slope, physical aspects, climate, rainfall etc. are important components for agriculture of the state. Bench terracing is a distinctive and important feature which is both expensive and labour oriented.

The rugged topography offers very little of its land for cultivation (estimated as only 11% of the total area of the state) and the cultivated lands are tiny, scattered and fragmented in nature, requiring a large manpower, while production per unit area is very small. The average area of holding is only 1.91 hectares although vary widely, forming four distinct classes. The majority of the farmers belong to the marginal groups and the intensity of land use, irrigated area and cropping intensity decreases with the increase in holding size. Most agriculture is concentrated in the lower mountain reaches primary in the East and South districts. Nomadic high altitude livestock herding (primarily goats, sheep and yaks) is found along the borders with Nepal and Bhutan and in the North district approaching the Tibetan plateau.

Sikkim has very diverse ecological conditions, from sub-tropical to alpine and is endowed with great biological diversity of plants and animals. A wide range of crops can be cultivated in a range of agro-ecological zones, including upland rice, vegetables, pulses, potato and ginger. Its extreme topography and altitude mean that most agriculture is done on narrow terraced benches on very steep slopes. The country is subject to torrential monsoonal rains, which contribute to rapid runoff on the slopes, resulting in landslides and flooding in river bottoms.

Most arable land has already been put under cultivation. Rapidly growing rural population of Sikkim is slowly expanding upwards and bringing steeper forested slopes under cultivation. In addition, demand for cardamom, an export crop, has also contributed to conversion of forests to agriculture. Each village has different endowments of various types of lands and very different patterns of access to public and common lands. Average holding size for poorer household is less than three acres. Most agriculture is rainfed.

The population is diverse in its ethnicity, religions and languages. The ownership of cultivable land as well as cardamom population, was historically been under the controls of Bhutia *kazi* (landlords and aristocrats), which continues to influence the distribution of land and natural resources even today. Nepalese leased lands from the *kazis* and gradually acquired land from the Bhutias and Lepchas. Consequently there is a scarcity of arable land, with fragmentation of holdings and greatly expanded cultivation on very marginal steep slopes. The distribution of income and pattern of poverty are closely linked to land ownership, with Bhutia families tending to be better off than other groups.

Likewise, due to limitations of terrace farming in terms of productivity, irrigation and the scope of extending cultivation highlight the constraints faced by farming for livelihood security. Under these conditions innovative practices in land management and horticulture and floriculture (including marketing and systems and linkages) can be identified as growth sectors.

### **Geographical Sketch of the Study Area (South Sikkim)**

Sikkim state has been divided into four districts according to administrative convenience and regional location as follows:

1. East District
2. West District
3. North District
4. ***South District***. (Study area)

The districts are further fragmented into smaller administrative division as sub-divisions i.e. East district has four sub-divisions viz. i) Gangtok, ii) Pakyong, iii) Rongli and iv) Rangpo. West district has four sub-divisions viz. i) Gyalshing, ii) Soreng, iii) Yuksam and iv) Dentam. North district has four sub-divisions viz. i) Kabi, ii) Dzongu, iii) Mangan and iv) Chungthang. South district also has four sub-divisions viz. i) Namchi, ii) Ravangla, iii) Jorethang and iv) Yangang. There is two tiers system of Panchayati Raj in the state known as ‘Ziila Panchayat’ at the district level and the ‘Gram Panchayat’ at the village level. Each district has one Zilla Panchayat’, which is headed by an ‘Adhyakshya’ and ‘Up-Adhyakshya who are elected from within members of Zilla territorial constituencies. There are 989 Gram Panchayat Wards (including *Dzumsa*) which constitutes 176 Gram Panchayat Units (GPUs). Each district has different numbers of Gram Panchayat Units, such as in East district has 52 GPUs, West district has 55 GPUs, North district has only 22 GPUs (including *Dzumsa*) and in the South district 47 GPUs.

The state of Sikkim has a total area of only 7096 sq. km. and is stretched over 112 km from north to south and 64 km from east to west. It lies in the north-eastern Himalayas between 27<sup>0</sup> 00’ 46’’ to 28<sup>0</sup> 07’ 48’’ North latitude and 88<sup>0</sup> 00’ 58’’ to 88<sup>0</sup> 55’ 25’’ East longitude. Sikkim is known as ‘*Denjong*’ and more rarely ‘*Demojang*’ or ‘*Demoshang*’ which literally means the

‘land of rice’ or ‘valley of rice’. The early European travelers like Samuel Van de putta, Horace Della Penna cited the name ‘*Bramasojan*’ for Sikkim. Simultaneously Desideri also called the country ‘*Bru-me-jong*’, which means ‘the rice country’.

Sikkim is a very small state in the Himalayas with formidable physical features. It is bounded by vast stretches of Tibetan plateaus in the north, the Chumbi valley of Tibet and the kingdom of Bhutan in the east, the kingdom of Nepal in the west and Darjeeling District of West Bengal in the south. Sikkim was known to the Lepchas, the original inhabitants of the state as ‘*Nye-Ma-el*’ or heaven. Tibetans called it ‘*Renjong*’ or ‘*Denzong*’ or ‘the valley of rice’.

The study are, i.e. the South district is located within latitude 27°14'20" N, and longitude 88°18'15" E. The total geographical area of the district is 750sq.km. South district is the 2<sup>nd</sup> largest populated district next to East district of Sikkim. South district though have smaller area is rather thickly populated (www.sikkimsprings).

**Table 1.1: Land Elevation of Sikkim**

Type of land	Elevation of land
Lower Hills	Altitude ranging from 270m to 1500m.
Mid Hills	Altitude ranging from 1500m to 2000m.
Higher Hills	Altitude ranging from 2000m to 3000m.
Alpine Zone	Altitude above 3900m with vegetation
Snow Bound Land	Very high mountains without vegetation and with perpetual snow cover up to 8580m.

Source: Statistical Profile, 2004.

**Table 1.2: Five Ranges of Climate in Sikkim**

Range	Altitude
Tropical	Below 610m.
Sub-Tropical	610m to 1524m.
Temperate	1524m to 2743m.
Sub-Alpine	2743m to 3962m.
Alpine	3962m to 5182m.

Source: Statistical Profile, 2004.

**Table 1.3: Vegetation Zones in Sikkim**

Zones	Altitude
Tropical	From sea level to 1700m.
Temperate	From 1700m to 4300m.
Alpine	From 4300mtrs to 5000m.

Source: Statistical Profile, 2004.

The habitable areas cover up to 2100m, which covers about 23.9% of the total geographical area; settlements are mainly confined to the area lying below 1800m and are generally found concentrated on the southern part of the state, following the wide river valleys and sometimes reaching up to the adjoining ridge tops. Due to the absence of any sizable flat land the distribution of population is sparse throughout the slopes, without forming any village in true sense (Boot, 1988). The population of Sikkim comprises conspicuously three ethnic communities i.e. Nepalese, Lepcha and Bhutia. Sikkim economy is mainly dependent on agriculture. Almost 85% of the population of Sikkim lives in rural areas and only the improvement in agriculture can better their lot. Agriculture, horticulture, livestock, fisheries and agro-forestry can be integrated to give viable farming systems to farmers (Lama, 2003).

Majority of Sikkimese people draw sustenance from agricultural products. Sikkim has very diverse ecological conditions, which on the one hand prevent the adoption of common crops and on the other hand favour cultivation of many kinds of fruits, vegetable both in and off season and also provide a conducive agro-climatic situation for growing commercial crops like cardamom, potato, ginger etc. Agricultural lands are situated at an elevation of 300m to 3000m but most of the cultivated areas are below 1800m. In Sikkim most of the cultivable land is terraced.

In mountain regions like Sikkim, the quantum of land is comparatively less than plains. Hilly areas are generally characterized by fragile environment and hence cultivation of crops have been extremely difficult and very expensive because of difficult terrains, poor road communication, tremendous variations in soils, agro-climates, etc. within narrow range of altitudes. Further, despite modern facilities and control over nature, agricultural pattern is primarily determined by the physical factors like soil and other characteristics like rainfall, availability of soil moisture, duration of sunshine etc. Actually, the agricultural patterns are more dependent on the conditions of terrain, topography and altitude. From the observation, it is understood that each part of the district faces a problem due to variation in different aspects such as physiographic, climate, soil and water. These are the problems which affect the agricultural development in the district.

### **Objectives**

The main objectives of present study lie in following parameters:

- i) To examine the agricultural structure and related characteristics of agriculture through different statistical data pertaining to operational holdings including land utilization, tenancy in terms of leasing, cropping, irrigation status, livestock, agricultural machinery and implements, use of fertilizers, land reforms and land ceiling etc.

- ii) To find out the principal causes and recent trends in food insecurity in the region. Moreover, to know about the state of food insecurity and of rural livelihood security in Sikkim.
- iii) To evaluate the government policies and programme for the benefits of rural poor in general and small and marginal farmers in particular.

### **Research Questions**

Answers to the following questions will be sought in the course of the proposed research:

- i) What is the status of agriculture in Sikkim?
- ii) What is the level of participation of the three major communities in the agro-economy of Sikkim?
- iii) How far the farmers in Sikkim depend on traditional ways of farming?
- iv) What type of land reform policies has been implemented in Sikkim?
- v) What is the socio-economic condition of agricultural labourers?
- vi) Are the common people getting both quality and quantity of food in order to satisfy their needs?
- vii) Can Sikkim ensure sustainable food security for a growing population?

### **Research Design**

The present study is exploratory, quantitative, analytical, and deductive.

### **The Survey Design**

A sampling has been done based on the agro-climatic conditions. On the basis of this out of 47 Gram Panchayat Units in South Sikkim, randomly only 15 Gram Panchayat Units have been selected. These are grouped according to altitude as follows:

1. Between 300-900 metres
  - i. Namphing GPU
  - ii. Legship GPU
  - iii. Rong-Bul GPU
  - iv. Tarku GPU, and
  - v. Turung GPU.
2. Between 900-1500 metres
  - i. Sadam –Suntaley GPU
  - ii. Tinik- Chisopani GPU
  - iii. Namthang- Maneydara GPU
  - iv. Assangthang GPU, and
  - v. Wok- Omchu GPU

3. Nearly 1500-2100 metres
  - i. Borong-Phamthang GPU
  - ii. Barfung-Zarung GPU
  - iii. Paiyong GPU
  - iv. Tinkitam-Rayong GPU, and
  - v. Perbing-Dovan GPU.

### **Research Methodology**

The methodology involves estimating the diversity in the farming system at the village level and conducting a socioeconomic study on the rural livelihoods system among three communities i.e. Nepalese, Lepcha and Bhutia in different spatial unit. Data collection is both on qualitative and quantitative, based on secondary information obtained from existing records from government and non-governmental sources. Likewise, primary information and data are collected from the farmers through questionnaires, focus discussions, field observations and mobile interview.

For data collection different techniques have been used such as:

**Census study** - Agricultural census has been consulted in order to collect different data on agriculture. Agricultural census provides essential information on distribution of operational holdings, tenancy in terms of leasing, cropping and land use patterns, irrigation status, fertilizers, agricultural machinery and implements and flow of credit in the agricultural holdings etc.

**Case study** - Different Gram Panchayat Units (GPUs), were selected according to elevation zones and study was done respectively.

**Interview** - The farmers belonging to different communities in general and government official in particular were interviewed.

**Observation** - Observation as a method includes both 'seeing' and 'hearing'. During the field survey different places as well as problems were observed, which provided support for obtaining the relevant data.

### **Data collection**

The GPU boundary map and satellite image were used to identify GPU on the basis of agro-climatic zones. The questionnaire/ interview schedules were prepared for farmers. These questionnaires consisted of questions related to family information, crops and its productivity,

cropping pattern, land use, income and expenditure, occupation, fertilizers, irrigation, operational holdings, facilities, etc.

The South district has 148 Revenue Blocks, 452 villages, 47 Gram Panchayat Units and 271 Panchayat wards. For the purpose of research only 15 GPUs were selected on the basis of agro-climatic zones. Data were collected through field visit and participation observation. Altogether there were 8,975 households in the 15 GPUs under study, out of which 1,500 households were sampled. To reach the target of above 15 percent, 100 households from each GPU were selected by random sampling method. Surveys were conducted in the year 2015-16.

### **Tools of Data Analysis**

The primary data were collected from the interviews, discussions, observation and mobile phone conversation of the respondent households, and it were crossed tabulated and master tables were prepared from interview schedule and questionnaire. The cartographic and GIS (Geographical Information System) tools were also used to analyze the data.

For analyzing all the data i.e. primary and secondary data SPSS (Statistical Package for Social Science) One Way Analysis of Variance (ANOVA) and Origin Pro8 techniques have been used. Other techniques were also used such as Crop Yield Index (Yang Method), Weaver's Method of Crop Combination, Correlation, Regression Analysis, Figure, Bar Graph, Tables, Maps etc. were also used to represents the data.

### **Chapter Plan**

This study is divided into eight chapters which are given below:

Chapter I – Introduction, Theoretical Framework, Statement of Problem, Review of Literature, Objectives and Methodology

Chapter II – Background and Profile of the Study Area

Chapter III - Agriculture and Agro-economic Environment in Sikkim

Chapter IV - Cropping Patterns

Chapter V - Land Use and Land Reforms

Chapter VI - Agricultural Production and Productivity Trends

Chapter VII - Mountain Agriculture and Food Security in Sikkim

Chapter VIII - Major Findings, Conclusion and Suggestions

## Bibliography

## Appendix

### References

A. De waal and J. Tumushade. 2003. "Report on Northern Associates on RCSA (*Regional Center for Southern Africa*) food strategic option." Available at: <http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf> (Accessed on July 28, 2007).

Agarwal, A.N. 1986. *Indian Agriculture; Problems, Progress and Prospects*. New Delhi: Vikas Publishing House Pvt. Ltd.

Basu, Debashis et.al. 2006. *Agricultural Food Security, Nutrition and Health in North East India*, New Delhi: Mittal Publication: 42.

Bhattacharya, Pranab Kumar. 1984. *Aspect of Cultural History of Sikkim*. Calcutta: K.P. Bagchi and Company.

Began, Raheena.1991. *A Textbook of Foods, Nutrition and Dietetics*. New Delhi: Sterling Publishers Private Limited: 3.

Boot, Debi Prasad. 1988. "Agricultural Land Use and Land Holding Pattern in Sikkim: Some Observations," *Sikkim Through periodical Articles, Reports, Seminar proceedings etc.* Vol.2, CHS: 57-63

Bouis, Howarth and Hunt, Joseph. 1999. "Linking Food and Nutrition Security: Past Lessons and Future Opportunities," In *Asian Development Review: Studies of Asian and Pacific Economic Issues*, Vol. 17, No. 12. edited by Jungsoo Lee.

Chauhan, D.S. 1953. *Agricultural Economics*. Agra, India: Printed at the Modern Press: 1-4.

Choudhuri, Buddhadeb. 1984. "Migration and Agrarian Relations: A study on Darjeeling District" paper presented at seminar on Land Relations and Land Reforms in the Plains and Valleys of North–East India, NEICSSR Shillong, 17<sup>th</sup> -18<sup>th</sup> April.

Choudhury, Maitreyee. 2006. *Sikkim: Geographical Perspectives*. New Delhi: Mittal Publications.

Coelho, V.H. 1970. *Sikkim and Bhutan*, Indian Council for Cultural Relations. New Delhi: Vikas Publications.

Dasgupta, Manas. 2002. *Sikkim: Problems and Prospects of Development*. New Delhi: Indus Publishing.

Dev, Mahendra S., Kannan, K.P., and Ramachandran, Nira. 2003. *Towards A Food Secure India; Issues and Policies* (edited.). New Delhi: Institute for Human Development.

Debnath, J.C. 1980. "Agriculture in Sikkim" In *North Bengal Review*, Vol.1, June.

Dhamala, R. Ranju and Bhowmick, D.J. 1985. "Land Reforms in Sikkim," In *The Himalayas: Profiles of Modernization and Adaptation*, edited by S.K. Chaube. New Delhi: Sterling Publishers Pvt. Ltd.

Dhamala, Ranju, R., Rai, C.D., Dutta, M.S. and Ghatak, Sanchita. 1993. *People of India, Sikkim* Vol. 39, (edited.). Calcutta: Anthropological Survey of India, Seagull books.

Dhar, P.K. *Indian Economy; Its Growing Dimensions*, Kalyani Publishers, New Delhi, 2005.

Drummond, Evan H. and Goodwin, John W. 2004. *Agricultural Economics (eds.)*. Delhi: Pearson Education:11.

Gaunle, Gopal. 2002. *Sikkim Rajtantra Dekhi Prajatantra Sammah* (in Nepali). Namchi, South Sikkim: Nirman Prakshan, Gumpa Ghurpise.

Gorer, Geoffrey. 2005. *Himalayan Village: An account of the Lepchas of Sikkim*. (Second Edition), Varanasi, India: Pilgrims Publishing.

Gupta, Manas Das. 1992. *Sikkim: Problems and Prospects of Development*. New Delhi: Indus Publishing Company.

*Handbook of Agriculture*. 1987. New Delhi: ICAR, Printed at Rachna Printers Pvt. Ltd.

-----2001. *Sikkim Human Development Report*. Mahendra P. Lama (ed.). Delhi: Social Science Press, GoS.

-----2003. *The Glory of New Sikkim*. Mahendra P. Lama (ed.). Gangtok Sikkim: Department of Information and Public Relation, Printed at Kwaloty Stores Sikkim, GoS.

-----2005. *Sikkim: A Statistical Profile 2004-05*. Gangtok Sikkim: Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

Jhingan, M.L. 2003. *The Economics of Development and Planning*. New Delhi: Vrinda Publications Pvt. Ltd.

John Farrington and N.C.Saxena. "Food Security in India." Available at: [www.org.UK/publications/working\\_papers/wp231/wp231-references.pdf](http://www.org.UK/publications/working_papers/wp231/wp231-references.pdf) (Accessed on July 28, 2007).

John Luke Gallup, Jefferey Sachs and Adrew D. Mellinger. 1998. Report on Northen Associates on 'RCSA (*Regional Center for Southern Africa*) food strategic option." Available at: [http://www. Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf](http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf) (Accessed on July 28, 2007).

Johan Van Rooyen and Howard Sigwele. 1999. "Report on Northen Associates on 'RCSA (*Regional Center for Southern Africa*) food strategic option." Available at: [http://www. Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf](http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf) (Accessed on July 28, 2007).

J. Von Barun, P.Hazell, J. Homddinott and S. Babu .2003. "Report on Northen Associates on 'RCSA (*Regional Center for Southern Africa*) food strategic option." Available at: [http://www. Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf](http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf) (Accessed on July 28, 2007).

Jordan, G. Arringe, Chavoj-Mejia and Rayes-Rayee, B.C. 2001. "Agricultural Research for Development in the Mexico Highlands," In *Journal of Mountain Research and Development*, Vol.21, No.1.

Lekhi, R.K. and Singh Joginder. 2001. *Agricultural Economies*. Ludhiana, India: Kalyani Publishers.

Mukhopadhyay, S.C. 1988. "A study in Planning Strategies for Resource Utilization and Development in the Sikkim Himalayas, Sikkim", Seminar paper presented at the Department of Geography, Calcutta University, 18-19 March.

Radha, V. 2009. *Women and Rural Households Food Security*. New Delhi: Serials Publications.

Sagar, Vidya. 2003. "Food Security Issues in a State of Large Agricultural Instability: The case of Rajasthan" In *Towards a food Secure India: Issues and Policies*, edited by S. Mahendra Dev , K.P. Kannan and Nira Ramachandran , New Delhi: Institute for Human Development.

Sarap, M. and Mahamallik. 2003. "Food Security System and Its Operation; A Study of Some Villages in the District of Kalahandi, Orissa" In *Towards a Food Secure India; Issues and Policies*, edited by S. Mahendra Dev, K.P. Kannan and Nira Ramachandran, New Delhi: Institute for Human Development.

Saxena, N.C. et.al. 2008. *Right to Food* (eds.). New Delhi: Human Rights Law Networks, 276.

Shrestha, R.S. 2005. *Sikkim: Three Decades towards Democracy Evolution of the Legislative System*. Gangtok: Sikkim Legislative Assembly Secretariat.

Sikor, Thomas and Troong, Dao Minh. 2002. "Agricultural policy and Land use changes in a Black-Thai commune of Northern Vietnam," Vol. no. 3, 1952-1997, In *Journal of Mountain Research and Development*.

Singh, R.B. and Pandey. 2000. "Sikkim Himalaya: Geo-Ecological System, Socio-Economic Change and People's Perception" In *Sikkim: Society Polity Economy Environment*, edited by M.P. Lama, New Delhi: Indus Publishing Company.

Som, T.K. 1988. "Agrarian situation in India" In *Journal of North-East India Council for Social Science Research*, Vol.12 no. 2.

Srivastava Nish. 2003. "The Paradox of Food Insecurity in a Food Surplus State; A case of Uttar Pradesh" In *Towards a food Secure India; Issues and Policies*, edited by S. Mahendra Dev, K.P. Kannan and Nira Ramachandran, New Delhi: Institute for Human Development.

Subba, J.R. 1984. *Agriculture in the Hills of Sikkim*. Gangtok, Sikkim: Sikkim Science Society.

Subba, J.R. and Upadhyaya, R.C. 1995. *Vegetable Crops of the Himalayan Region*. Gangtok: Akhil Sikkim Limbu Chumlung Association:39.

Subba, T.B. 1989. *Dynamics of a Hill Society: The Nepalis in Darjeeling and Sikkim*. New Delhi: Mittal Publications.

-----1989. "Agrarian Social Structure and Change in Sikkim," In *Social Change*, Vol.19, No.1, March.

Swaminathan, M. 1990. *Handbook of Food and Nutrition*. Bangalore: Bangalore Printing and Publishing Co. Ltd.

-----2001. "Food Security and Sustainable Development," *Current Science*, Vol.81, No.8. , 25<sup>th</sup> October.

Government of Sikkim (GoS). 2005. *Thirty Years of Sikkim Takes Stock of three Decades Statehood*. Gangtok Sikkim: Department of Information and Public Relations, GoS.

Tulachen, Pradeep M. 2001. "Mountain Agriculture in the Hindukush-Himalaya; A Regional Comparative Analysis" In *Mountain Research Development*, ICIMOD, Vol. 21, No. 3.

Vyas, Vijay S. 2005. *Food Security in Asian Countries in the Context of Millennium Goals* (ed.), New Delhi: Academic Foundation, 29.

## **Web Link**

<http://www.Unsystem .org/SCN/archives/scnnews04/ch.3-html> (Accessed on March 28, 2015).

[www.journalijdr.com](http://www.journalijdr.com) (Accessed on 28.03.2015).

<http://ww.gcrio.org/CONSEQUENCES/VOI.2,NO.2/article.1.html> (Accessed on 28.03. 2015).

[www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html](http://www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html) (Accessed 28.03 2015).

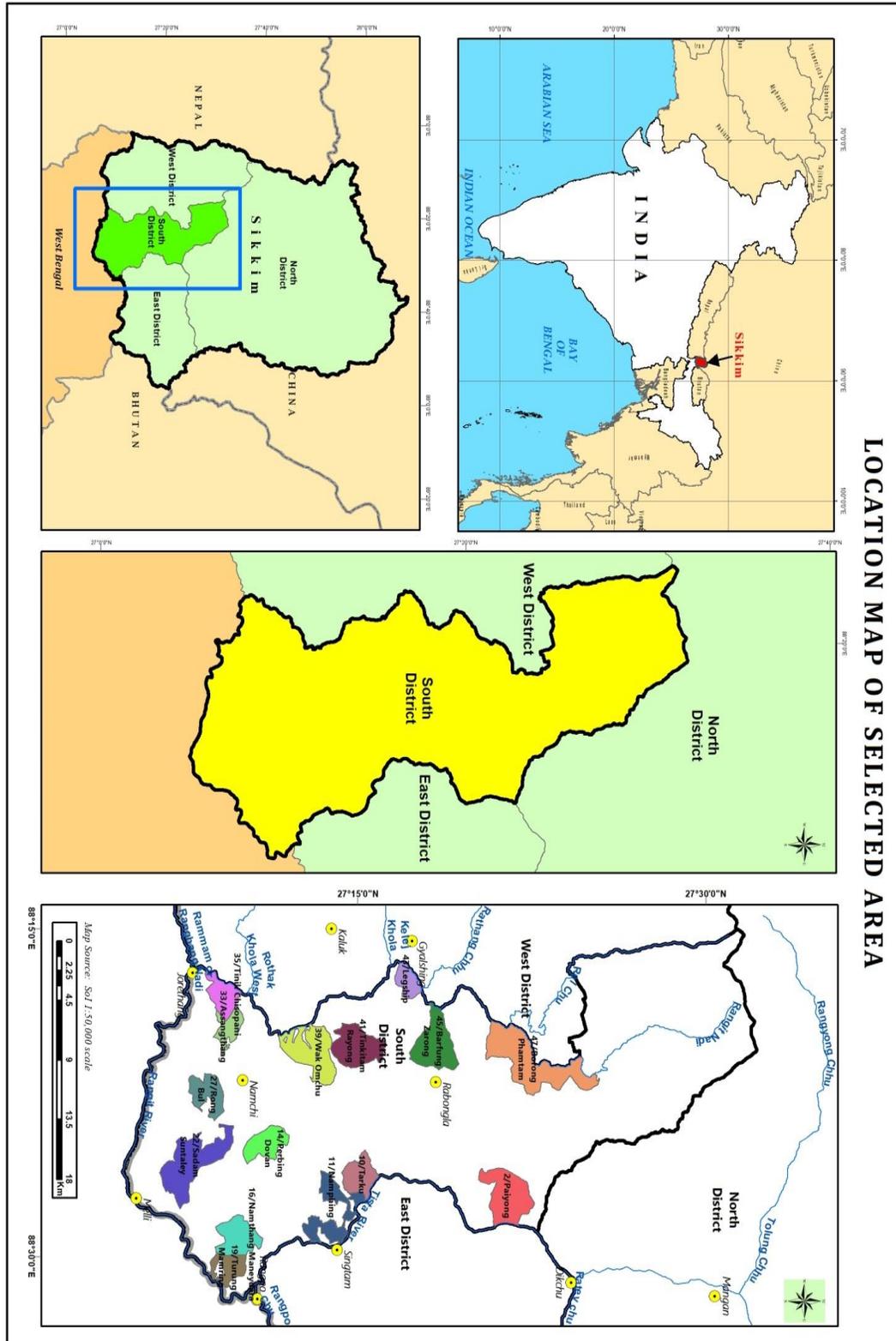
[foodsecuritycluster.net](http://foodsecuritycluster.net) (Accessed on April 13, 2015).

[shodhganga.inflibnet.ac.in](http://shodhganga.inflibnet.ac.in) (Accessed on April 8, 2015).

[www.fao.org/docrep](http://www.fao.org/docrep) (Accessed on April 18, 2015).

[www.fao.org/docrep/005/y4671e](http://www.fao.org/docrep/005/y4671e) (Accessed on September 09,2016).

[14.139.206.50>jspui>handle](http://14.139.206.50>jspui>handle) (Accessed on September 24, 2016)



Map No. 1

# Chapter 2

## Background and Profile of the Study Area

### Introduction

The Sikkim Himalaya is an uplifted and tilted mountainous terrain which is divided into several large elongated sub-parallel tributary valleys like the Rangit, Rangpo Chu, Rang-Rang Chu, Lachung Chu, Ranikhola, Rora Chu, Takchom Chu, Geilkhola, etc. An important feature of the Tista drainage basin is the remarkable way in which geological structure and the character of the underlying rocks are expressed in the landforms. Lineation in the topography has been largely controlled by structural and tectonic elements (Sikkim Study Series, 2004). Sikkim is bounded by high ridges on the North, East and West and gives the appearance of an amphitheatre. To the North, the convex arc of the Greater Himalayas separates the state from Tibetan Highland. A number of peaks, built of crystalline rocks accentuate the demarcation between Tibet and Sikkim. The longitudinal Chola range separates the state from Tibet in the eastern side while the Singalila range, another longitudinal offshoot of the Himalayan arc, marks the boundary between Sikkim and Nepal in the West (Choudhury, 2006;2).

The thumb-shaped state of Sikkim is characterized by wholly mountainous terrain. Almost the entire state is hilly; with the elevation ranging from 280 metres (920 ft) to 8596 metres (28000 ft). The pinnacle of the Khangchendzonga is the highest point. Numerous snow-fed streams in Sikkim have engraved out river valleys in the west and south of the state. These streams combine into the Tista and its tributary, the Rangit. The Tista can be called as the “lifeline of Sikkim”, flows through the state from north to south.

Sikkim, a small Himalayan State lies between 27°00'46" to 28°07'48" North latitude and 88°00'58' to 88°55'25" East longitude and is the second smallest State in India. It has a total area of only 7096 sq km. and is just 114 km long and 64 km wide, but bounded by three neighboring countries i.e. China (220 km long border with Tibet), Nepal (100 km border with Nepal) and Bhutan (30 km border with Bhutan). Sikkim occupies only 0.2 percent of geographical area of the country. But in most of the state, the land is unfit for agriculture because of the rocky, precipitous slopes etc. However, some hill slopes have been converted into terrace farms. Agriculture is mostly concentrated in the lower mountain ranges, primarily in the East and South districts ([www.sikkimsprings.com](http://www.sikkimsprings.com)).

The study area, i.e. the South district is bounded by the latitude 27°14'20" and longitude 88°18'15" E. The total geographical area of the district is 750 sq. km. South district is the 2<sup>nd</sup> largest populated district next to East district of Sikkim. South district though with smaller area is more thickly populated ([www.sikkimsprings.com](http://www.sikkimsprings.com)).

### **Geomorphology**

Geomorphological features have paramount effects on the agriculture practised in different regions. Agriculture is not well developed in mountainous or hilly tracts. Steep slope, rugged topography, immature soil and inaccessibility have discouraged agricultural practices. Longitudinal valleys, intermountain valleys and gentle slope with terraces are the areas where cultivation of some cereals or cash crops is done. Mainly horticulture, animal rearing, sericulture, plantation and agriculture are practised in mountainous regions (Khan, 2001).

Geomorphologically, the state of Sikkim belongs to the upper part of Teesta Basin. The physical landscape of the state owes much to the work of the river Teesta. The structural slope of the land is from north to south; hence all the major rivers of the state have southerly flow. However, rivulets and streams appear from almost every corner of the state and run to all possible directions. The fine network of streams has dissected the land so intricately that there is no sizeable piece of level land anywhere in the state (Choudhury, 2006:4).

Sikkim encompasses the lesser Himalaya, Greater Himalaya, and the Tethys Himalaya. It is essentially a mountainous state without any flat piece of land. The mountains rise in elevation northward. The northern portion of the state is deeply cut into steep escarpments, and except in the Lachen and Lachung valleys, it is not populated. Southern Sikkim is lower, more open, and fairly well cultivated. The physical configuration of Sikkim is also partly due to geological structure. Major portion of the state is covered by Precambrian rock and is much younger in age. The Northern, Eastern and Western portions of the state are constituted of hard massive gneisses rocks capable of resisting denudation. The Central and Southern portion is formed of comparatively soft, thin, slate and half-schistose rocks which denude very easily. The trend of the mountain system is in East-West direction. However, chief ridges run in a more or less North-South direction. The Rangeet and the Teesta which form the main channels of drainage, run nearly north-south. The valleys cut by these rivers and their chief feeders are very deep. The valleys are rather open towards the top, but usually attain a steep gorge like structure as they approach the bed of the rivers. There are 180 perennial lakes at different altitudes. Sikkim also has many hot springs. The perpetual snowline in Sikkim is at approximately 16,000 ft ([sikkim.nic.in](http://sikkim.nic.in)).

### **General Geology and Structure**

The area under investigation covers South District of Sikkim; parts of South Sikkim have been mapped geologically by a number of researchers from time to time. Each researcher, over a

period of time brings out his own stratigraphic classifications. They are yet to arrive at a commonly agreeable consensus because of lack of well-documented markers such as fossils, horizons or features characteristic of these areas. The general stratigraphic succession is as under:

### ***Gondwana***

Pebbles slate, slates, carbonaceous shale coal, sandstone and shale.

### ***Buxa***

Carbon phyllites, slates, calc-phyllite, dolomite/limestone, purple phyllite, dark calcareous slates.

### ***Dalings***

Phyllites, varved phyllite, basic intrusives, green quartzite (fuchsite) serictic and chlonitic phyllite, massive and flaggy quartzite, quartz veins (Land Revenue & Disaster Management, 2012; 169). Quartzite, High grade Gneiss, Cal Gneiss, Granulite with bands of biotic/Graphite schist with pegmatite and aplite veins.

### ***Buxa Formation***

The main rock types in this formation are Dolomites, Purple Quartzites and variegated Phyllite, Pink and Buff coloured Dolomite and Stromatolite bearing Dolomites which belong to the upper most sequence of this formation, Grey to pink Dolomites are exposed along Phalidara, Bagdara, Salibong, Mamley, Pabong and Wok areas. Stromatalite bearing Dolomites occur along Mamley area (Land Revenue & Disaster Management, 2012: 173).

### ***Gondwana Formation***

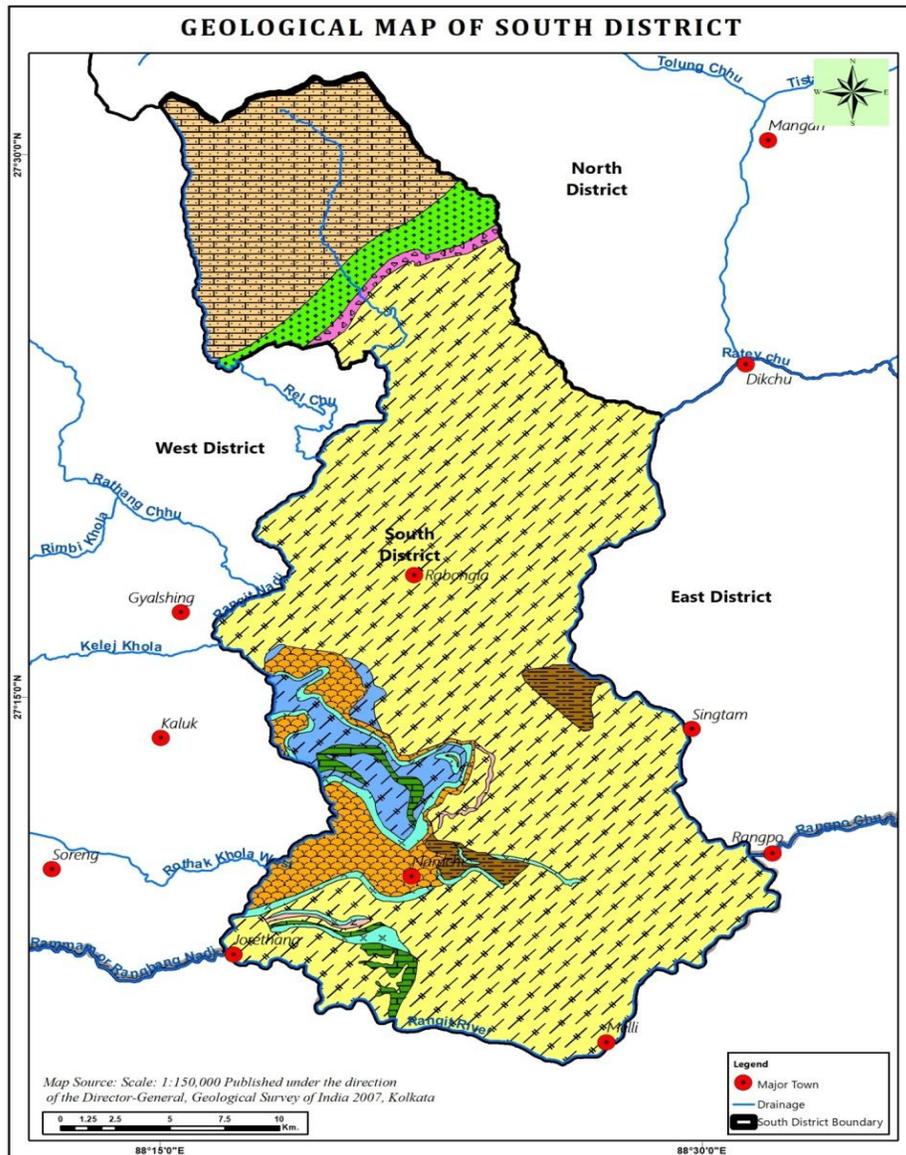
The basal portion of the Gondwana is represented by Pebble bed sequence. The pebbles are mainly of Quartzite, Dolomite, Granite and Phyllite and show sub-angular to rounded shape. The pebble-bed is mainly overlaid by coarse to medium grained sandstone with intercalation of shales with occasional coal seams. The sandstones are massive and well bedded and highly jointed, plant fossils are also found in the shales of Gondwana sequence (Land Revenue & Disaster Management, 2012: 169).

Geologically, the places of South Sikkim like Narak-Jhora, Turung-Bimbong, Kerabari, Turuk, Bul, Jarong, Barfung Hingdam, Kewzing, Ralang, Polot, Borong, and Sada-Phamtam, Mamzing, Majitar to Jorethang comprise of rock sequences belonging to daling series. The rocks are phyllites (ranging from Chloritic, Serictic phyllite to gritty phyllite), quartzite and higher grade metamorphic rocks comprising of Gneisses and Schists.

In South district some of the important minerals have been found like coal, quartzite, base metal, dolomite, etc.

Different types of rocks and minerals have been found in South district. Some of them are quartzite, dolomite, coal, granite, etc. which are not useful for agriculture purpose. The hard rocks in agricultural fields are difficult to break and remove. If there are bands of hard metamorphic rocks on hill slopes the agricultural fields become narrow and difficult to plough. As such, rocky lands are not easy to convert into agriculture land. The soft rock strata, after breaking of materials like phyllites, conglomerates, pebbles/soil etc. are to some extent useful for agriculture. Dolomite is considered as a source of fertilizer in agricultural field. In general, the Buxa formation is better suited for cultivation, compared to the Daling formation.

**Map No. 2**



## Legend

### Geology

-  1 Interbanded chlorite-sericite schist/phyllite and quartzite, 2 Metagreywacke, 3 Pyritiferous black slate, 4 Biotite phyllite/mica schist, 5 Biotite quartzite, 6 Mica schist with garnet, 7 Chlorite quartzite
-  3. Pyritiferous black Slate
-  3. Pyritiferous black slate
-  Banded, streaky migmatite, augen bearing biotite gneiss with kyanite, sillimanite with palaeosomes of staurolite kyanite, mica schist
-  Dolostone, orthoquartzite, purple phyllite slate, chert
-  Granite gneiss (mylonitic)
-  Pebble/boulder slate, conglomerate, phyllite
-  Pebble/boulder slate, conglomerate, Phyllite
-  Quartzite, garnet kyanite sillimanite biotite schist/garnetiferous mica schist, Calc-granulite with intercalations of quartzite, Graphitic schist
-  Sandstone, Shale, Carbonaceous Shale with coal

### **Slope of the Area**

The slope has an important place in order to analyse, particularly hilly and mountainous region pertaining to socio-economic aspects, settlement, development of infrastructure, agriculture milieu etc. The gentle slope is favourable for settlement and agriculture.

South district of Sikkim has symmetrical valleys, ridges, summit cliffs etc. According to Wentworth's Method of Slope Analysis, very high degree of slope is found in the Gram Panchayat Units (GPUs) of Perbing Chuba, Tendong Reserve Forest, Damthang, Ben-Namphrik. Likewise, high slope is found in the GPUs of Turung-Mamring, Kateng- Pamphok, Kolthang-Tokday, Sripatam, Neyam-Manzing etc. and moderate slope is found in GPUs Tinik-Chisopani, Kitam-Manpur, Salghari, Legship Hingdam, Tingmo, Tinkitam Rayong etc. Lastly, the GPUs of Lingee, Paiyong etc have very low degree of slope.

The slopes of the 15 GPUs under study are as follows: Namphing (32 degree), Legship (59 degree), Rong-Bul (37 degree), Tarku (32 degree) Turung-Mamring (33 degree), Sadam-Suntaley (35 degree), Tinik-Chisopani (32 degree), Namthang-Maneydara (32 degree), Assangthang (34 degrees), Wok-Omchu (52 degree), Borong-Phamthang (34 degree), Barfung-Zarung (29 degree), Paiyong (36 degree), Tinkitam-Rayong (36 degrees) and Perbing-Dovan (36 degree). The average slope of five GPUs below 300-900 metres (Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring) is 38 degree. Similarly, average slope of five GPUs between 900-1500 metres (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu) is 45 degree and average slope of five GPUs located at 1500-2100 metres (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan) is 33 degree.

### **Soil**

Sikkim enjoys a wide range of climate, physiography, geology and vegetation that influence the formation of different kinds of soils. Soils occurring in different landforms are studied in respect of their morphology, physical and chemical characteristics. In accordance with the physiographic sequence of the terrain features, 78 soil families were identified in Sikkim and mapped into 69 mapping units. Soils of Sikkim belong to 3 orders, 7 suborders, 12 great groups and 26 subgroups. It is observed that Inceptisols (young soils with weakly developed horizons) are dominant (42.84%) followed by Entisols (weakly developed soils) and Mollisols (soils characteristic of grassland, with a thick, originally rich surface layer) occupying 42.52% and 14.64% respectively ([www.sikkimforest.gov](http://www.sikkimforest.gov)). The soils of the South district in general have been derived from parent rocks such as Sandstone, Phyllite, Schist, Gneisses and colluvial materials. Soils are generally acidic to very acidic in reaction having soil pH between 5.0 and 6.0 ([www.sikkimsprings](http://www.sikkimsprings)).

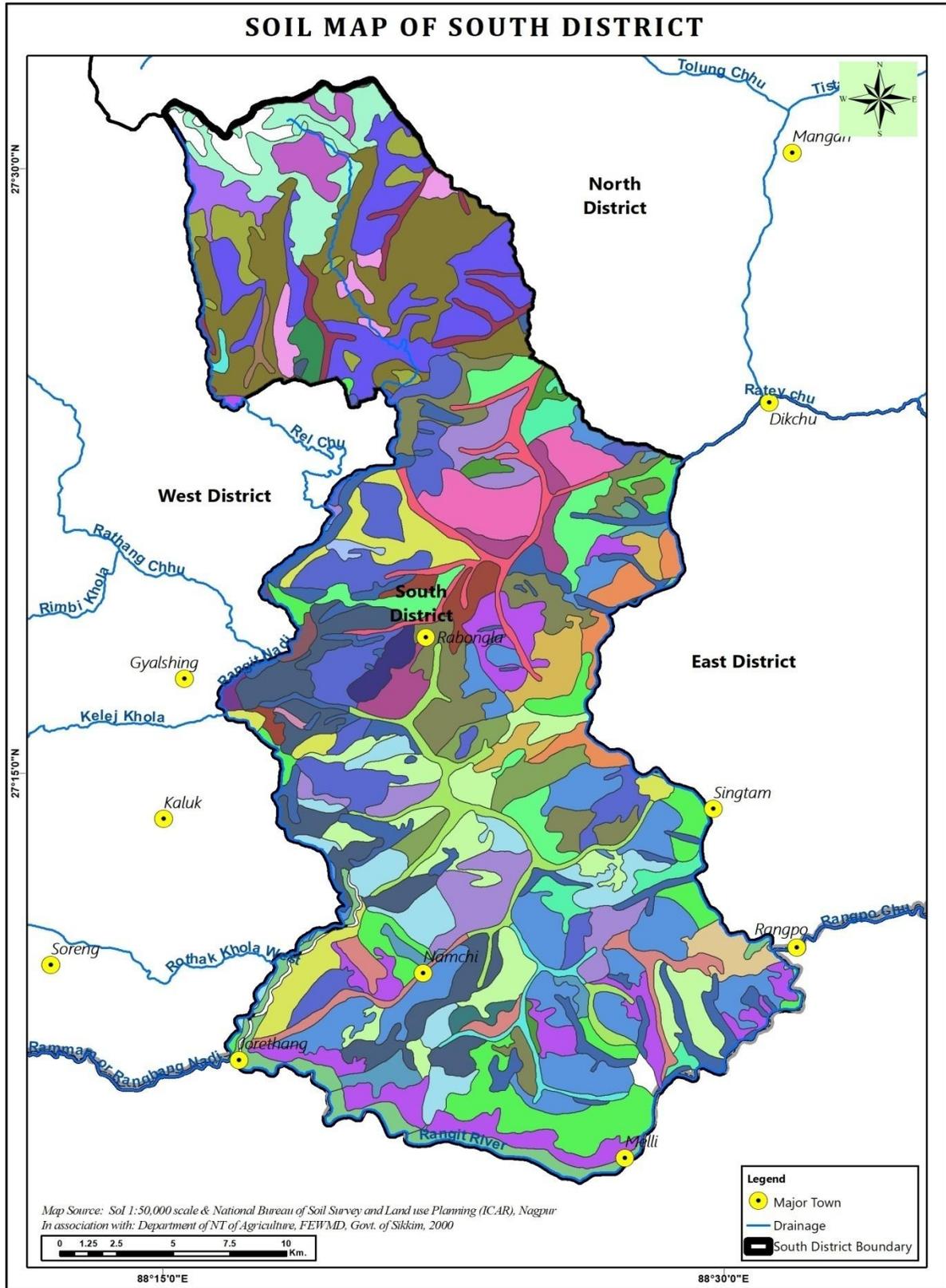
According to National Bureau of Soil Survey and Land Use Planning (Regional Centre, Kolkata), the dominant soils in South Sikkim are Pachic Haplumbrepts, Typic Hapludolls, Umbric Dystrochrepts, Typic Argudolls, Entic Haplumbrepts, Cumulic Hapludolls, Typic Cryorthents, Lithic Udorthents etc.

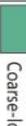
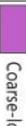
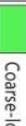
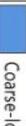
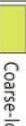
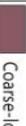
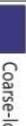
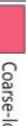
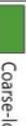
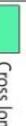
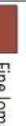
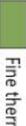
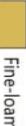
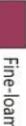
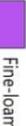
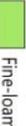
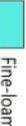
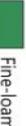
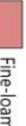
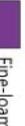
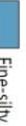
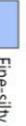
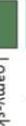
**Table 2.1: Soil Types and Characteristics**

Sl. No	Soil Types	Characteristics
1.	Haplumbrepts and Pachic Haplumbrepts	Soils developed on ridges of 30% slope are deep, somewhat excessively drained, fine loamy surfaces having slight stoniness and moderate erosion. The soil types are predominantly under forest, paddy, and maize to limited extent, soils are acidic and prone to erosion.
2.	Typic Hapludolls and Umbric Dystrochrepts	Soils on ridges on 15-30% are deep excessively drained, coarse loamy to fine loamy surface with slight stoniness and moderate erosion. Soils are moderately acidic and rich in humus contain. These areas are also predominantly under forest, paddy and maize.
3.	Cumulic Hapludolls and Pachic Haplumbrepts	Soils less than 15% slopes are deep well drained, fine loamy soils with loamy surface, slight stoniness and moderate erosion. These areas are under paddy cultivation and some under temperate forest.
4.	Cumulic Hapludolls, Typic Hapludolls etc.	The soils on ridges of steeply slopy hill sides (30-50%) slopes are moderately shallow to deep, well drained, silty to fine loamy soils with slight stoniness and moderate erosion. The soil is acidic and stony surface. They are largely under temperate forest. Alpine forest and some are under cultivation of cereal crops.

Source: kvkeastsikkim.nic.

Map No. 3



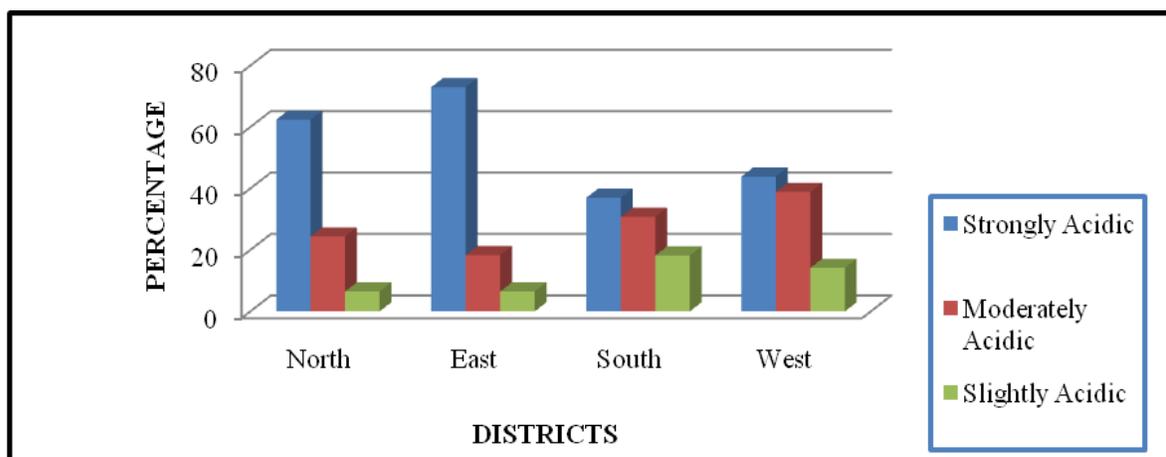
Legend	
South Soil	
TAXONOMIC	
	Coarse-loamy over fragmental, mesic Entic Haplumbrepts & Coarse-loamy over fragmental, mesic
	Coarse-loamy, mesic Typic Haplumbrepts & Loamy-skeletal, mesic Lithic Udorthents
	Coarse-loamy, thermic Cumulic Hapludolls & Fine-loamy, thermic Typic Argiudolls
	Coarse-loamy, thermic Cumulic Haplumbrepts & Fine-loamy, thermic Lithic Haplumbrepts
	Coarse-loamy, thermic Cumulic Haplumbrepts & Fine-loamy, thermic Typic Haplumbrepts
	Coarse-loamy, thermic Pachic Haplumbrepts & Fine-loamy, thermic Umbric Dystrochrepts
	Coarse-loamy, thermic Typic Hapludolls & Fine-loamy, thermic Umbric Dystrochrepts
	Coarse-loamy, thermic Typic Haplumbrepts & Coarse-loamy, thermic Umbric Dystrochrepts
	Coarse-loamy, thermic Typic Haplumbrepts & Fine thermic Umbric Dystrochrepts
	Coarse-loamy, thermic Umbric Dystrochrepts & Loamy-skeletal over fragmental, thermic Entic Hap
	Coarse=loamy thermic Typic Haplumbrepts & Coarse many thermic Lithic Udorthents
	Coarse loamy, thermic Typic Udorthents & Coarse loamy thermic Typic Udorthents
	Coarse loamy over fragmental thermic Typic Udorthents & cross loamy thermic Lithic Haplumbrep
	Coarse loamy thermic Entic Hapludolls & Cross loamy Thermic Dystric Hapludolls
	Coarse loamy thermic Typic Hapludolls & Cross loamy Entic Hapludolls
	Coarse loamy thermic Typic Hapludolls & Cross loamy over fragmental thermic Entic Hapludolls
	Coarse loamy thermic Typic Hapludolls & Cross loamy, thermic Typic Hapludolls
	Coarse loamy, thermic Mollic Udarents & cross loamy thermic Entic Hapludolls
	Coarse loamy, thermic Typic Haplumbrepts & Cross loamy thermic Dystric Eutrochrepts
	Fine loamy thermic Typic Haplumbrepts & cross loamy over fragmental thermic Typic Udorthents
	Fine loamy thermic pachic Haplumbrepts & Cross many thermic Typic Haplumbrepts
	Fine loamy thermic Typic Dystrochrepts & cross loamy, thermic Haplumbrepts
	Fine thermic Umbric Dystrochrepts & Fine loamy thermic Umbric Dystrochrepts
	Fine, thermic Typic Haplumbrepts & Fine-silty, thermic Typic Haplumbrepts
	Fine-loamy over fragmental, thermic Typic Haplumbrepts & Coarse-loamy, thermic Mollic Udarent
	Fine-loamy, thermic Cumulic Haplumbrepts & Loamy-skeletal, Thermine Typic Udorthents
	Fine-loamy, thermic Entic Haplumbrepts & Loamy-skeletal, thermic Umbric Dystrochrepts
	Fine-loamy, thermic Pachic Haplumbrepts & Coarse-loamy thermic Entic Haplumbrepts
	Fine-loamy, thermic Typic Argiudolls & Fine-loamy, thermic Cumulic Hapludolls
	Fine-loamy, thermic Typic Hapludolls & Coarse-loamy, thermic Udorthents
	Fine-loamy, thermic Typic Hapludolls & Fine-loamy, thermic Typic Argiudolls
	Fine-loamy, thermic Typic Haplumbrepts & Loamy-skeletal, thermic Umbric Dystrochrepts
	Fine-loamy, thermic Typic Haplumbrepts & Sandy-skeletal over fragmental, thermic Typic Udorth
	Fine-loamy, thermic Typic Paleudolls & Fine-loamy, thermic Typic Hapludolls
	Fine-loamy, thermic Umbric Dystrochrepts & Loamy-skeletal, thermic Entic Haplumbrepts
	Fine-silty, thermic Pachic Haplumbrepts & Fine-loamy, thermic Typic Dystrochrepts
	Fine-silty, thermic Typic Haplumbrepts & Fine-loamy, thermic Umbric Dystrochrepts
	Loamy-skeletal, isofrigid Lithic Cryorthents & Loamy-skeletal, isofrigid Typic Cryorthents
	Loamy-skeletal, mesic Lithic Udorthents
	Loamy-skeletal, mesic Typic Hapludolls & Coarse-loamy, thermic Mollic Udorthents
	Loamy-skeletal, thermic Cumulic Hapludolls & Coarse-loamy, thermic Typic Udorthents
	Loamy-skeletal, thermic Entic Hapludolls & Loamy-skeletal, thermic Typic Udorthents
	Loamy-skeletal, thermic Lithic Haplumbrepts & Coarse-loamy, thermic Lithic Udorthents
	Loamy-skeletal, thermic Typic Hapludolls & Coarse-loamy, thermic Lithic Udorthents
	Loamy-skeletal, thermic Umbric Dystrochrepts & Loamy-skeletal, thermic Typic Dystrochrepts
	Loamy-skeletal, thermic Lithic Udorthents

The soil status for the districts of Sikkim is given below:

**Table 2.2: Soil pH (Area in percent)**

Sl. No	District	Strongly Acidic	Moderately Acidic	Slightly Acidic
1	North	62.4	24.4	6.5
2	East	73.0	18.3	6.5
3	South	37.0	30.8	18.2
4	West	43.9	38.9	14.2

Source: Agriculture Census & EARAS, 2013-14



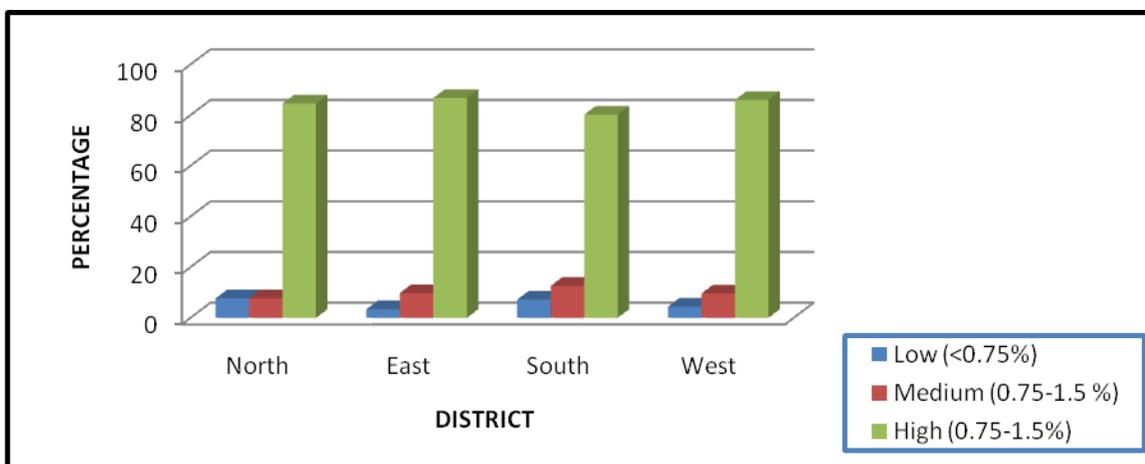
**Figure 2.1: District-wise Distribution of Soil pH in Percent**

It is evident from the above (figure 2.1) that the proportion of acid content in soil is high in every district of Sikkim. The East district has higher strongly acidic content in soil in comparison with other districts. There moderately acidic content in soil comes second. But the moderately acidic soil is more in West district, followed by the South district. Overall pHs in soil in different districts are as follows: In North district 93.3% area is acidic; in East district 97.8% area is acidic; in West district 97.0% area is acidic and in South district 86.0 % area is acidic, which is the lowest among all districts.

**Table 2.3: Organic Carbon (Area in percent)**

Sl. No	District	Low (<0.75%)	Medium (0.75-1.5 %)	High (>0.75-1.5%)
1	North	7.7	7.7	84.6
2	East	3.4	9.8	86.8
3	South	7.2	12.6	80.2
4	West	4.4	9.6	86.0

Source: Agriculture Census & EARAS, 2013-14.



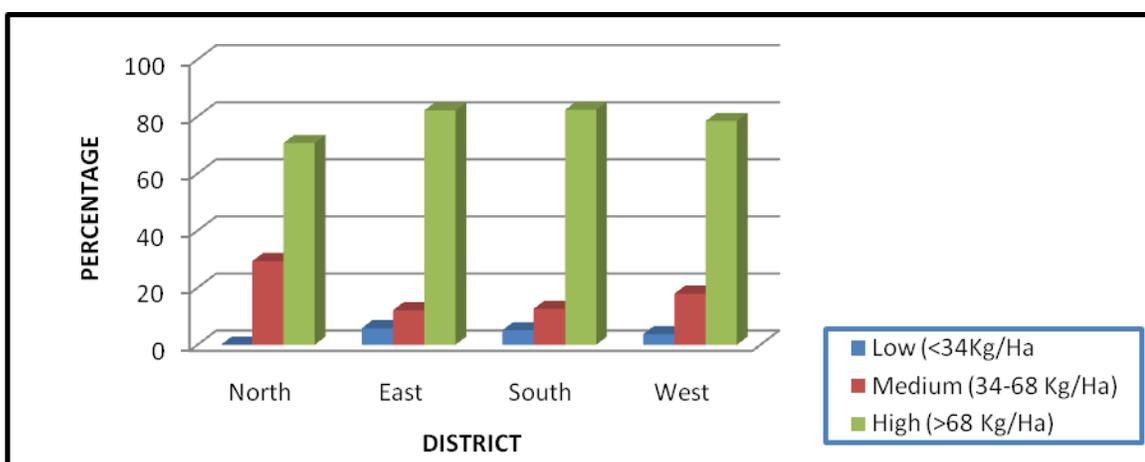
**Figure 2.2:** District-wise Organic Carbon Available in Soil (Percent)

It is evident from the figure 2.2 that the proportion of organic carbon content in soil is high in every districts of Sikkim. In fact, organic carbon content is very high i.e. (>0.75-1.5%) in almost all soil types in Sikkim.

**Table 2.4: Available Phosphorous (Area in percent)**

Sl. No	District	Low (<34Kg/Ha	Medium (34-68 Kg/Ha)	High (>68 Kg/Ha)
1	North	0.00	29.3	70.7
2	East	5.8	12.1	82.1
3	South	5.1	12.6	82.3
4	West	3.7	17.9	78.4

*Source:* Agriculture Census & EARAS, 2013-14.



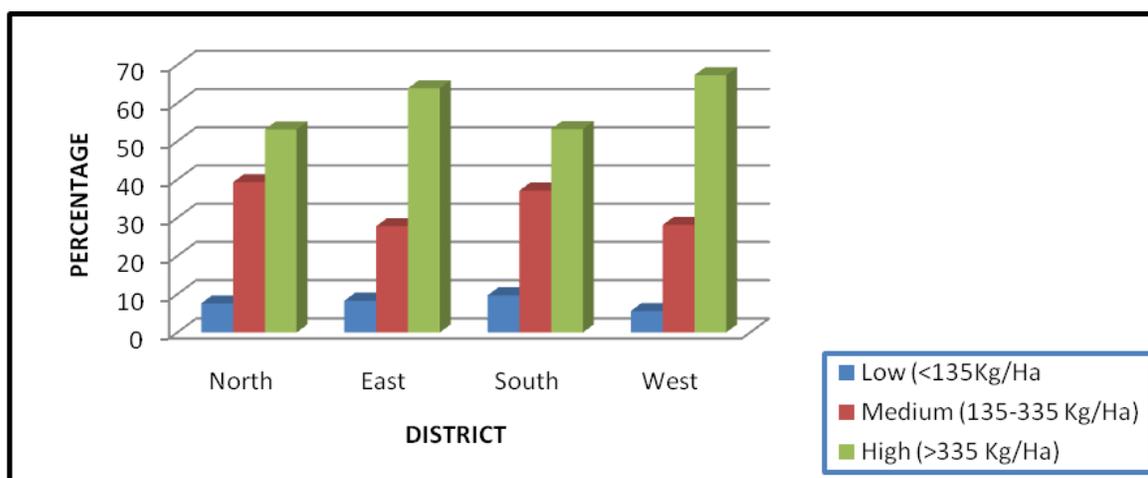
**Figure 2.3:** District-wise Phosphorous Available in Soil (Percent)

It can be observed in the figure 2.3 that the phosphorous (P) content in soil is very high i.e. (>68 Kg/Ha) in all the districts of Sikkim.

**Table 2.5: Available Potassium (Area in percent)**

Sl. No	District	Low (<135Kg/Ha	Medium (135-335 Kg/Ha)	High (>335 Kg/Ha)
1	North	7.6	39.3	53.1
2	East	8.3	27.8	63.9
3	South	9.7	37.1	53.2
4	West	5.6	28.1	67.3

Source: Agriculture Census & EARAS, 2013-14.



**Figure 2.4:** District-wise Potassium Available in Soil (Percent)

It is revealed from the above figure 2.4 that the proportion of potassium (K) available in soil is high in every district of Sikkim, i.e. (>335 Kg/Ha) in almost all soil.

The soil data were collected from different places of South Sikkim by Krishi Vigyan Kendra (KVK), Namthang, South Sikkim and three types of soil were found i.e. sandy loam, clay loam and loam. The area has moderately acidic to acidic soil. The places that have sandy loam soil are Namthang, Rateypani, Melli, Jorethang etc; Damthang, Temi, Rabong, Kewzing has clay loam type of soil and the places like Yangyang, Lingmoo etc. have loam soil.

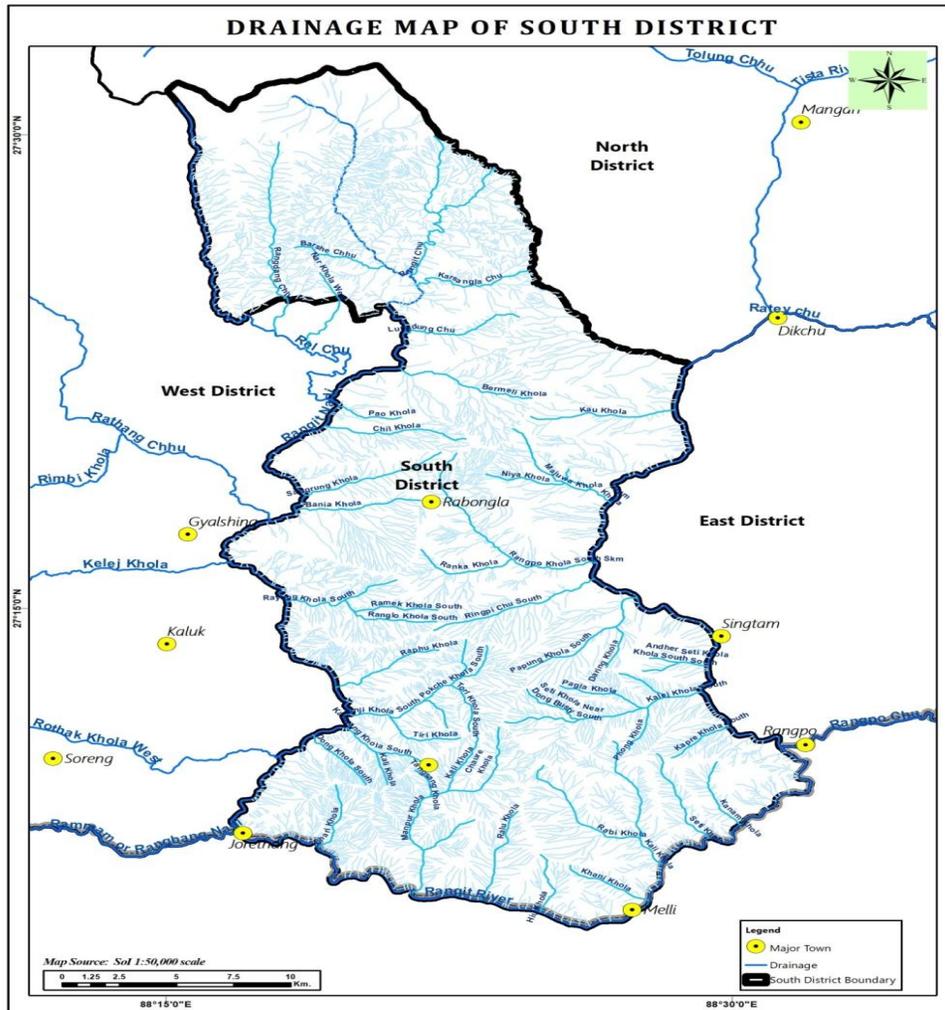
#### **Soil Types Available in Study Areas (15 GPUs)**

The soils which are found in the study area are as follows: Namphing ( red, black and grey), Legship (sandy, black red and loam), Rong-Bul (grey mixed with stones, red and black), Tarku (black), Turung-Mamring (loam, black), Sadam–Suntaley (sandy, black), Tinik-Chisopani (brown and black), Namthang-Maneydara (sandy loam), Assangthang (black and red), Wok-Omchu (red, sandy and black), Borong-Phamthang (clay, black and red), Barfung-Zarung ( sandy, black and red), Paiyong (sandy, brown and red), Tinkitam Rayong (black, clay, and red) and Perbing-Dovan (yellow, red and sandy).

## Drainage

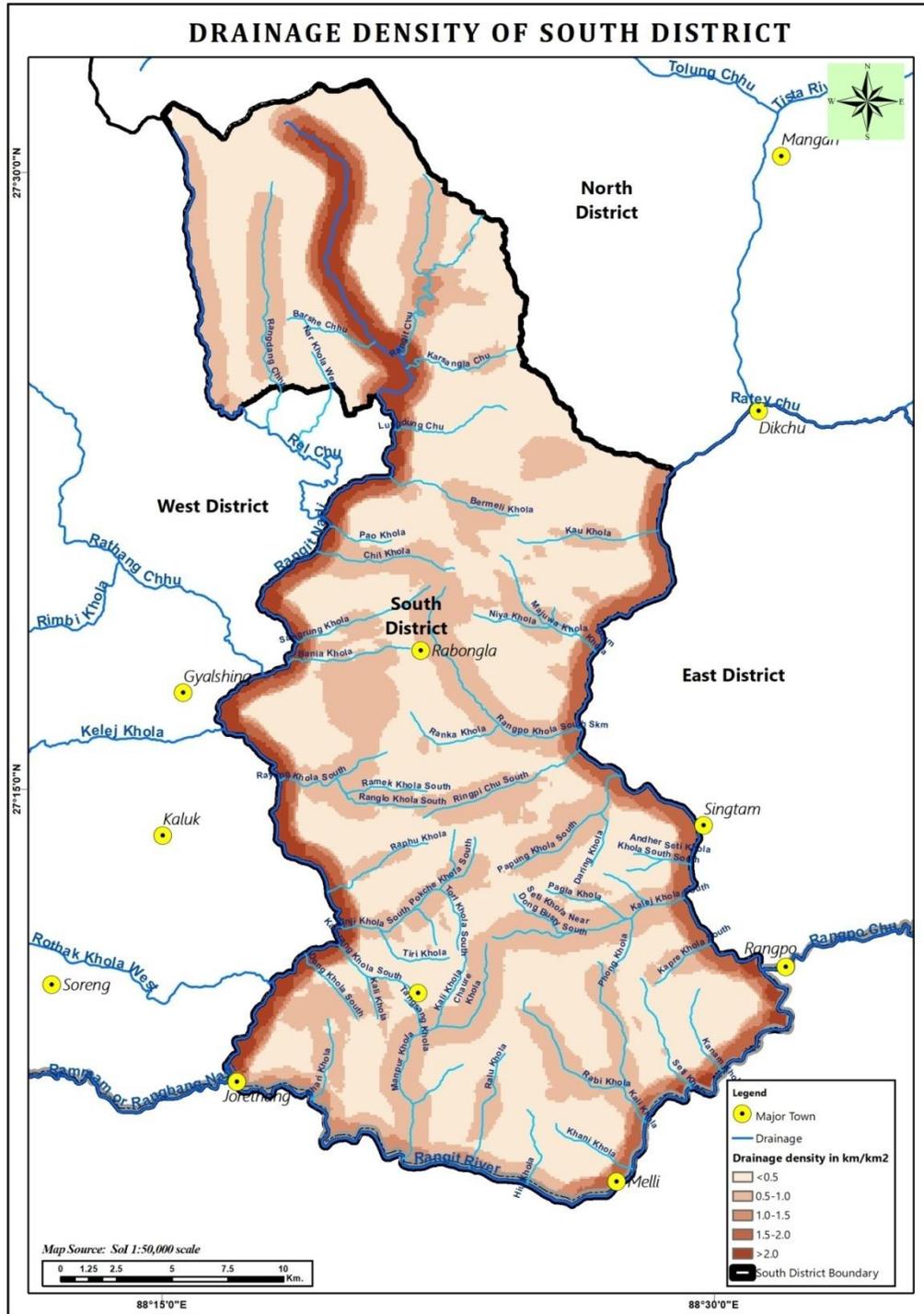
The drainage of the district is controlled by the perennial Teesta and Rangit rivers along with their tributaries. Teesta, the main river that passes through the area originates from the central crystalline zone defined by high mountain ranges which is covered by glaciers. The Teesta and its tributaries drain different parts of the area. The rivers are perennial in nature as they are fed by both snowmelt water and rain water. Rangit, another major river originates from West Sikkim. During its southerly course it receives Melli, Namlong Khola, Rathong Chhu, Kalig Chu, Rayong Chhu, etc. The southerly flowing Teesta is joined by Rangchap Chhu at the extreme north of the South District of Sikkim. The type of drainage is trellis and dendritic. Most of the Kholas have originated from the higher altitudes and flow down by cutting deep gorges in lower altitude where they ultimately join with the main river Teesta (www.sikkimsprings).

Map No. 4



The major tributaries and Sub-tributaries of Teesta in the South district are Kayam Chhu, Rangit Chhu, Lungdung Chhu, Barme Chhu, Rangphap Chhu, Kau Khola, Niya Khola, Ben Khola, Katlej Khola, Kanam Khola, Seti Khola, Rabi Khola, Ralu Khola, Rayong Khola, Pirchu Khola, Tre Khola, and Manpur Khola. (Choudhury, 2006).

Map No. 5



### **Drainage Density**

The drainage density is anisotropic within south district. The very high density (above 2 km/km<sup>2</sup> Dd) is found in the North Eastern part of Ravangla Sub-division. The high density (1.5-2.0 km/km<sup>2</sup> Dd) occurs both in Namchi and Ravangla Sub-division having streams like the Kalej khola, Kau khola, Rangit chhu, etc. The medium density (1.0-1.5km/km<sup>2</sup> Dd) is found in most part of South Sikkim from upper belt to lower belt. The low drainage density (0.5-1.0km/km<sup>2</sup> Dd) is found mostly in western part and to some extent in the southern part of the district and very low drainage density (below 0.5km/km<sup>2</sup> Dd) is found in northern part around Sakkyag and southern part like Mamring, Turung, Jorethang, Sikkip, Kamrang etc.

### **Climate**

Sikkim is a land of great climate contrasts within very short distances. Latitudinally, the state is located within sub-tropical climatic regime. But due to the presence of high mountains, here one can experience climates as varied as temperate, alpine and even arctic types. Elevation plays the prime role in fashioning the climatic types of the state. The differences in climatic types may be imagined from the fact that the altitude of Sikkim ranges from mere 300m to 8,000m above mean sea level (amsl).The climatic diversity is due not only to the differences in altitude but also the configuration of neighboring mountain ranges, which largely affects air movement, precipitation and temperature (Choudhury, 2006).

The climate of Sikkim may broadly be classified into the following types:-

- i.) Subtropical Humid Type: The areas lying below 1500m above mean sea level (amsl) experience subtropical humid type of climate. The temperature ranges between 16°C and 33°C in winter and summer respectively. The average annual rainfall is high, but it varies from place to place (1,500mm to 3,500mm) due to variations in aspect. While Tadong in east Sikkim receives more than 3,000mm of annual rainfall, Namchi in South Sikkim, located at about same elevation, receives only 1,550mm.
- ii.) Semi-temperate Type: This climate is experienced in areas located between 1,500m and 2,000m amsl. Here mean monthly temperatures range from 8°C in winter months to 26°C in summer. Rainfall is usually heavy with a mean annual of 2,400mm.
- iii.) Temperate Type: The hill slopes lying between 2,000m and 3,000m amsl have temperate climate. Here the mean monthly temperatures range from 0°C in winter to 15°C in summer.
- iv.) Snow Forest Type: This climate is experienced between 3,000m to 4,000m amsl. Here temperature ranges between near or below the freezing point to 10°C in winter and summer respectively.

- v.) Tundra Type: This area is having elevation of more than 4,000m but less than 6,000m amsl. Here the temperature is always very low, night temperature often dropping below the freezing point.
- vi.) Arctic Type: The arctic type of climate is prevalent only in the extreme northwestern part of the state where a number of peaks soar high above 6,000m amsl (Choudhury, 2006 :11-13).

Most of the inhabited regions of Sikkim experience a temperate climate, with temperatures seldom exceeding 28°C in summer. The average annual temperature for most of Sikkim is around 18°C.

The habitable areas extend up to 2,100m, which cover about 23.9% of the total geographical area; settlements are mainly confined to the area lying below 1,800m and are generally concentrated in the southern part of the state, mostly along the wide river valleys and sometimes reaching up to the adjoining ridge tops. Due to the absence of any sizable flat land the distribution of population is sparse throughout the slopes, without forming any village in true sense (Boot, 1988). The population of Sikkim comprises conspicuously three ethnic communities i.e. Nepalese, Lepcha and Bhutia. Sikkim's economy is mainly dependent on agriculture. Almost 85% of the population of Sikkim lives in rural areas and only the improvement in agriculture can better their lot. Agriculture, horticulture, livestock, fisheries and agro-forestry can be integrated to give viable farming systems to farmers (Lama, 2003).

The temperature varies according to altitude and slope. In South district maximum temperature ranges between 15°C and 30°C during July and August and the minimum between 2°C and 10°C during December and January. The annual rainfall varies from 2,000mm to 3,000mm. The South district is predominantly agricultural with gross cropped area of 75,000 ha. The irrigated area of the district is about 5,270.14 ha. Maize is the main crop followed by rice, wheat, pulses, potato and vegetables that are predominantly grown in hill terraces. In addition to these, a few cash crops play an important role in the economy of the district.

The South district of Sikkim is divided into three Agro-Ecological Situations (AESs) based on altitude, temperature and type of irrigation like channel, spring irrigation and rain fed situation.

**Table 2.6: The three AESs (Agro-Ecological Situations)**

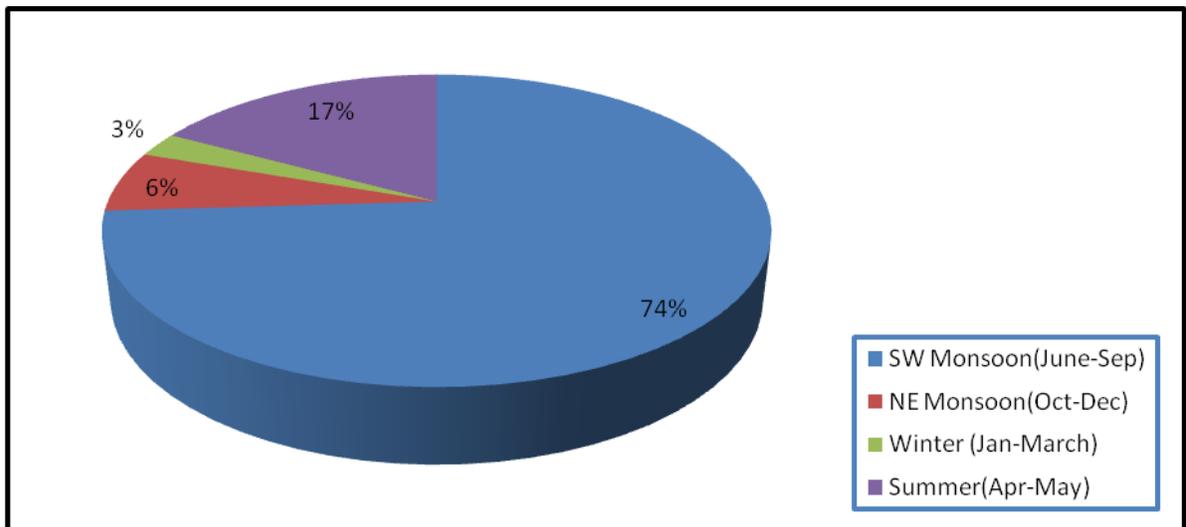
Agro-Ecological Situations	Altitude (in metres)	Temperature	Irrigation System/Facilities
AES I	High Altitude (1501m - 5000m)	Low Temperature (2°C - 20°C)	Rainfed
AES II	Medium Altitude (801-1500m)	Medium Temperature (10°C - 25°C)	Spring Channel
AES III	Low Altitude (300-800m)	High Temperature (12°C - 30°C)	Channel Irrigation

Source: Agriculture Census & EARAS, 2013-14.

**Table 2.7: Rainfall Calendar**

Rainfall	Normal Rainfall (mm)	No. of Rainy Days	Normal Onset	Normal Cessation
SW Monsoon (June-Sep)	658.40	66	2 <sup>nd</sup> week of June	4 <sup>th</sup> week of September
NE Monsoon (Oct-Dec)	56.32	14	3 <sup>rd</sup> week of October	2 <sup>nd</sup> week of November
Winter (Jan-March)	22.72	14	1 <sup>st</sup> week of January	3 <sup>rd</sup> week of March
Summer (April-May)	151.80	19	3 <sup>rd</sup> week of April	3 <sup>rd</sup> week of May
Annual	889.24	113		

Source: agricoop.nic.in.



**Figure 2.5: Normal Rainfall (mm) in South District (in Percentage)**

Fig. 2.5 reveals that in South District, South West monsoon which occurs in the months of June to September brings 74% of rainfall, while summer rainfall before monsoon amounts to

17%. The North East monsoon that occurs during the months of October to December contributes 6%, while the winter months from January to March bring only 3% of rainfall.

South district is the most drought prone district in Sikkim. The Darjeeling hills render this area into a rain shadow area where rainfall is sparse and scare. As such, the Rural Management and development Department, Government of Sikkim along with its flagship programme MGNREGA, has taken various initiatives to preserve and develop water resources, of the state under its Dhara Vikas or Springshed Development Programme ([www.indiawater.org](http://www.indiawater.org)).

### **Demography**

The demographic pattern of an area reflects the level of development in the area concerned. The development of any region, city, town etc. depends largely on the physical and socio-economic factors. Some of the factors which determine the population assume significance in the future pattern of progress and development. Further, the factors like altitude, slope, drainage and sub-soil water table affect population distribution at local level.

Sikkim has four districts according to administrative convenience i.e. East, West, North and South districts. The headquarters of four districts are Gangtok (East), Gyalshing (West), Mangan (North) and Namchi (South). These four districts are further divided into sixteen (16) subdivisions; Gangtok, Pakyong, Rongli and Rangpo are the sub-divisions of East district, Gyalshing, Soreng, Yuksam and Dentam are the sub-divisions of West district, Kabi, Dzongu, Mangan and Chungthang are the sub-divisions of North district. South district has four sub-divisions namely – Namchi, Ravongla, Jorethang and Yangang. These four sub-divisions are further supported by a network of eight Block Administrative Centres. The district has 148 Revenue Blocks, 452 villages, 47 Gram Panchayat Units and 271 Panchayat wards. According to 2011 census the total population of Sikkim is 6, 10,577 and South district has a total population of 1, 46,850; the male population is 76,670 and female 70,180; rural population is 1, 25,651 and urban 2, 11, 99. The density of population is 196 inhabitants per square km and decadal population growth rate from 2001 to 2011 is 11.57%. The district has a sex ratio of 915 females per 1000 males while the literacy rate is 81.4.

Out of the 47 Gram Panchayat Units, 15 Gram Panchayat Units (GPUs) have been selected for study according to agro-climatic zones. The distribution of GPUs according to elevation bands (300-900m, 900m-1,500m, and 1,500-2,100m) is as follows:

- 1) Gram Panchayat Units which fall under 300-900 metres elevation are Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring. The total population of these five GPUs according to 2011 census is 15,339 out of which male population is 7,815 and female population is little less than male population i.e. 7,524. The total number of households of five GPUs is 3,401. The average literacy rate of the GPUs is 82.22 and

average sex ratio of females per 1000 male is 963. The total area of these GPUs is 2817.43 ha.

- 2) Gram Panchayat Units which fall between 900-1500 metres elevation are Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, and Wok-Omchu. The total population of these GPUs according to 2011 census is 13,422 out of which the male population is 7,332 and female population is little smaller in comparison to male i.e. 6,090. The total number of households of five GPUs is 2,655. The average literacy rate is 83.78 and average sex ratio of females per 1,000 male is 830. The total area of these GPUs is 3,261.43 ha.
  
- 3) Gram Panchayat Units which are located above 1500-2100 metres elevation are Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan. The total population of these GPUs according to 2011 census is 14,076 out of which the total male population is 7,298 and female population is little smaller in comparison to male i.e. 6,778. The total number of households in five GPUs is 2,919. The average literacy rate is 77.88 and average sex ratio of females per 1,000 male is 928. The total area of these GPUs is 5785.78 ha.

### **Workforce Profile**

Work is always related to productivity, profitability as well as economic efficiency of the workers themselves or the various sectors, which they represent. A workforce profile would serve to provide sufficient indication of the economic development of a state, as it is essentially the ground level workers who contribute to the production of goods and services and help to sustain a satisfactory life standard for one and all. On the basis of what one is doing or not doing, the population of a place may be distinguished as workers and non-workers, the workers being further grouped as the main workers and the marginal workers. A person who has worked for a period of six months or more is treated as a main worker and the person who has worked for less than six months is a marginal worker. The whole range of cultivators, agricultural labourers, industrial workers and all others engaged in regular form of activities comprise the main workers while the non-workers include students, household dependents, pensioners and casual workers. The main workers are categorised as cultivators, agricultural labourers, workers in the household industry and other workers (Subba, 2008).

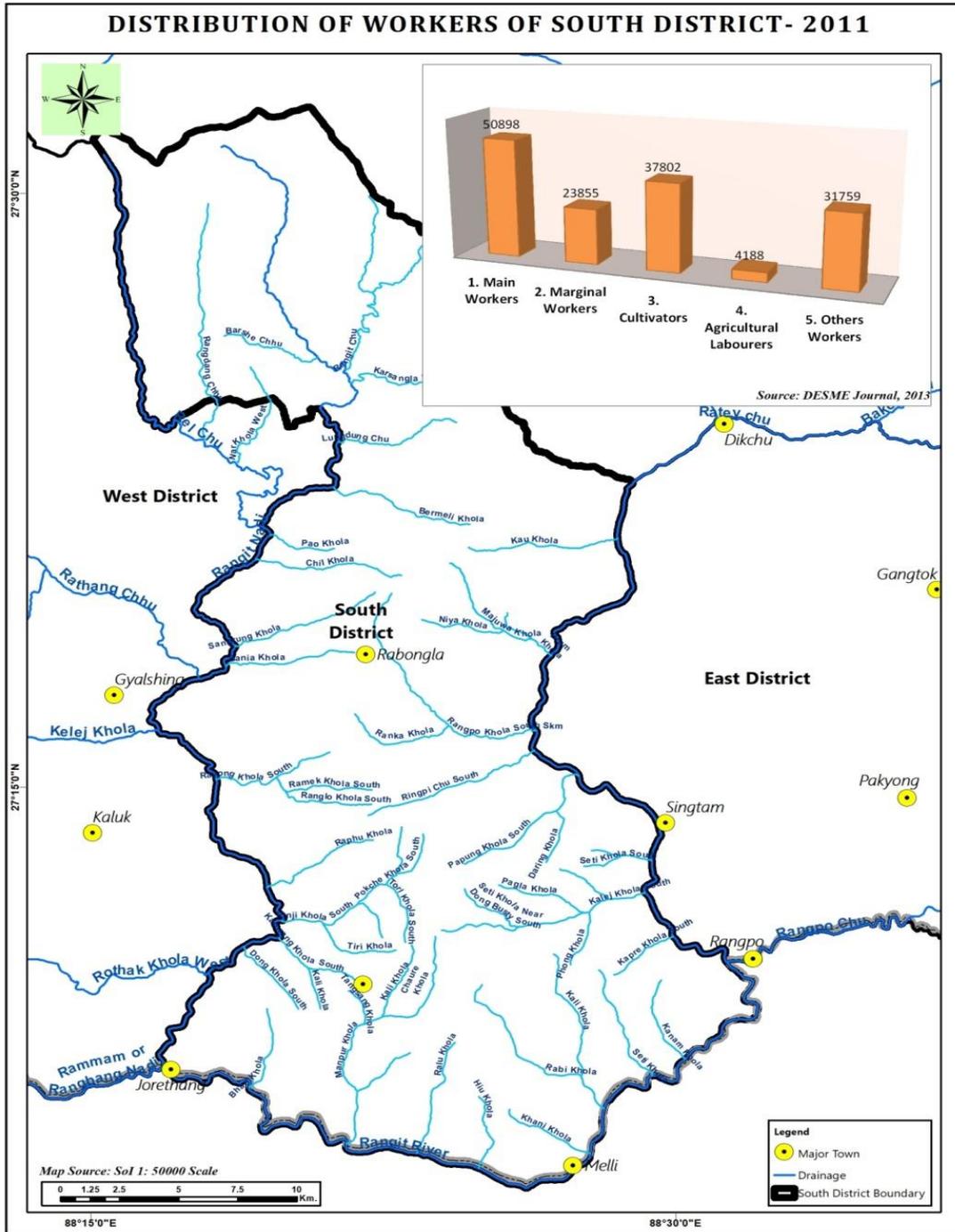
**Table 2.8: Distribution of Workers of South District – 2011**

Sl. No.	Workers Group	Number of Workers	Mean $\pm$ S.D.	Standard Error
1.	Main Workers	50898 $\pm$ 37.6138		15.3557
2.	Marginal Workers	23855 $\pm$ 38.9512		15.9017
3.	Cultivators	37802 $\pm$ 24.1080		9.8420
4.	Agricultural Labourers	4188 $\pm$ 38.1837		15.5884
5.	Others Workers	31759 $\pm$ 31.1319		12.7095
	Total	148502 $\pm$ 36.0388		14.7128

*Source:* DESME, 2013.

The data in table 2.8 show distribution of workers in South district and a comparative data of Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers showing the significant mean  $\pm$ S.D and standard error. It is obvious that topmost workers group is Main Workers which has highest mean  $\pm$ S.D, i.e. 50898 $\pm$ 37.6138 and standard error is calculated as 15.3557. Cultivators come under second position which has significant mean  $\pm$ S.D. of 37802 $\pm$ 24.1080 and standard error is calculated as 9.8420. The other workers groups such as Others Workers and Marginal Workers have significant mean  $\pm$ S.D of 31759 $\pm$ 31.1319 and 23855 $\pm$ 38.9512 respectively, and standard errors are 12.7095 and 15.9017 respectively. According to above data Agricultural Labourers are much less in comparison to other workers group (mean  $\pm$ S.D. 4188 $\pm$ 38.1837).

Map No. 6



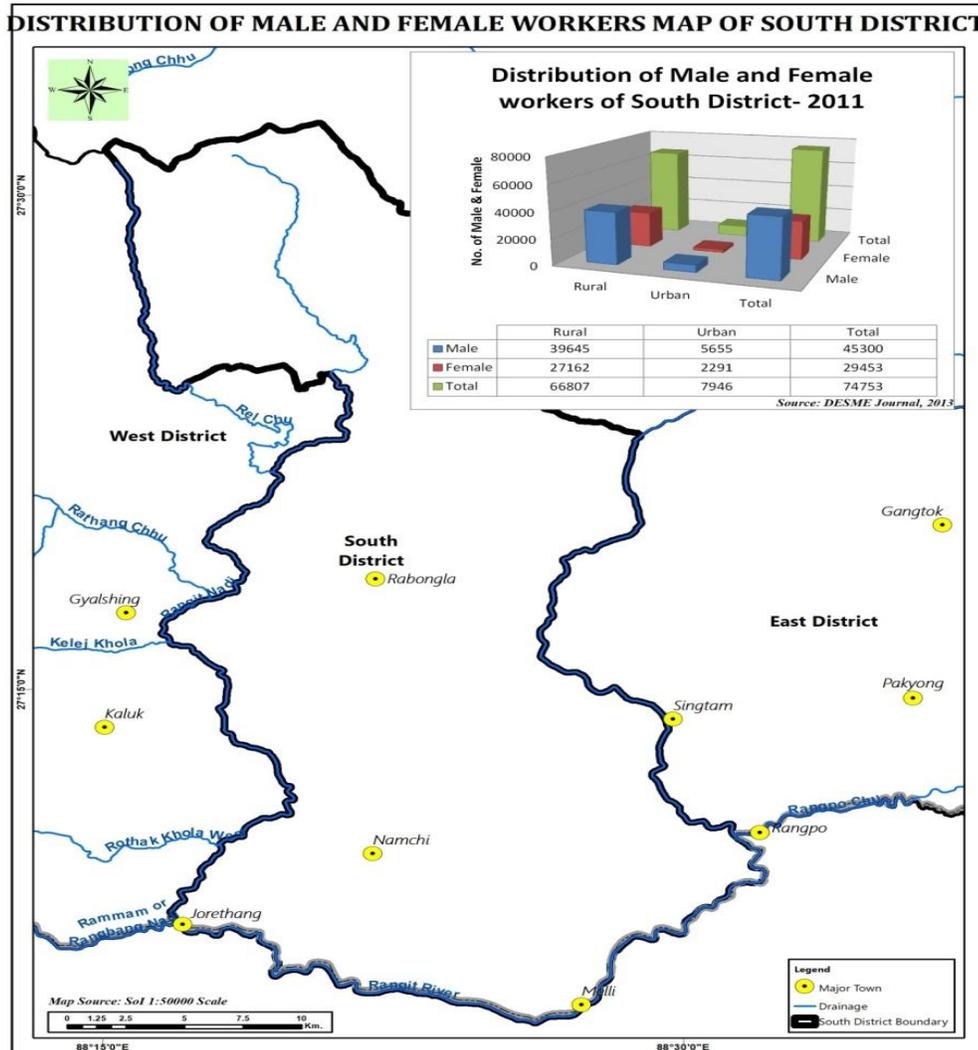
**Table 2.9: Distribution of Male and Female Workers of South District-2011**

Workers	Rural	Urban	Total
Male	39645	5655	45300
Female	27162	2291	29453
Total	66807	7946	

Source: DESME, 2013.

The number of workers in rural areas of South district is much higher than in urban areas. In urban areas people are engaged in secondary and tertiary activities, but in the rural areas most of the people are indulged in different farm and non-farm activities for their livelihood. The percentage of workers in rural areas is 59 percent of male and 41 percent of female. The percentage of workers in urban areas is 71 percent of male and 29 percent of female. The male working group constitutes 61 percent and female 39 percent only. That means overall female working population is less in both rural and urban areas.

**Map No. 7**



**Table 2.10: Distribution of Male Workers of South District -2011**

Sl. No.	Workers Group	Number of Workers	Mean $\pm$ S.D.	Standard Error
1.	Main Workers	35271	$44.1225$	18.0129
2.	Marginal Workers	10029	$19.4833$	7.9540
3.	Cultivators	20808	$15.4660$	6.3140
4.	Agricultural Labourers	2116	$14.4222$	5.8878
5.	Others Workers	21813	$19.2353$	7.8528
	Total	90037	$25.6515$	10.4721

Mean  $\pm$ Standard Deviation has been calculated by using Duncan Multiple Range Test for six data to each group.

Source: DESME, 2013.

The data in table 2.10 show distribution of Male workers group of South district and a comparative data of Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers which shows the significant mean  $\pm$ S.D and standard error. It is found that highest number of workers is in the group of Main Workers which has the significant mean  $\pm$ S.D of  $35271 \pm 44.1225$  and standard error is calculated as 18.0129. The group of Other Workers comes in second position with the significant mean  $\pm$ S.D is  $21813 \pm 19.2353$  and standard error is calculated as 7.8528. The remaining workers groups such as Cultivators and Marginal Workers have significant mean  $\pm$ S.D of  $20808 \pm 15.4660$  and  $10029 \pm 19.4833$  and standard error is calculated as 6.3140 and 7.9540 respectively. According to above data Agricultural Labourers is less in comparison to other workers group (mean  $\pm$ S.D.  $2116 \pm 14.4222$ ).

**Table 2.11: Distribution of Female Workers of South District – 2011**

Sl. No.	Workers Group	Number of Workers	Mean $\pm$ S.D.	Standard Error
1.	Main Workers	15627	$25.6671$	10.4785
2.	Marginal Workers	13826	$22.9695$	9.3772
3.	Cultivators	16994	$34.7735$	14.1962
4.	Agricultural Labourers	2072	$15.9749$	6.5217
5.	Others Workers	9946	$39.2784$	16.0353
	Total	58465	$36.1275$	14.7490

Source: DESME, Journal, 2013.

The data illustrated in table 2.11 show distribution of female workers group of South district. The table shows Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers to show the significant mean  $\pm$ S.D. and standard error. It is found that the

highest number of workers group is Cultivators which show the significant mean  $\pm$ S.D of 16994 $\pm$ 34.7735 and standard error is calculated as 14.1962. The Main Workers group comes second with the significant mean  $\pm$ S.D. of 15627 $\pm$ 25.6671 and standard error is 9.3772. This is followed by the Marginal Workers and Other Workers and their mean  $\pm$ S.Ds are 13826 $\pm$ 22.9695 and 9946 $\pm$ 39.2784, while standard errors are 9.3772 and 16.0353 respectively. The female agricultural labourers group has the lowest mean, i.e.  $\pm$ S.D. 2072 $\pm$ 15.9749 with standard error of 6.5217.

**Table 2.12: Main Workers Group of Selected GPUs**

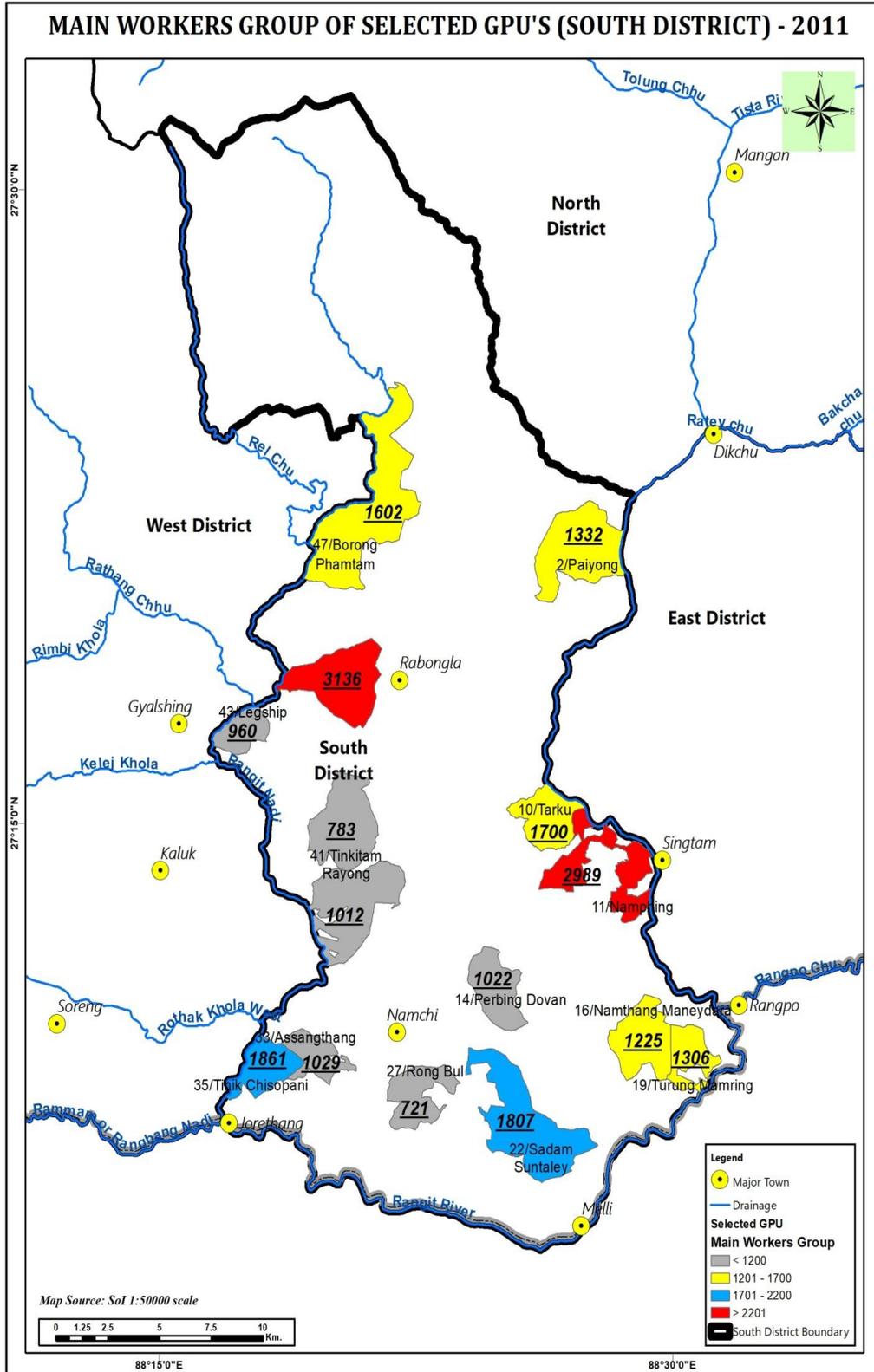
Sl. No.	Gram Panchayat Units (GPUs)	Main Workers Mean $\pm$ S.D.	Standard Error
1.	Namphing	2989 $\pm$ 28.1992	15.5123
2.	Legship	960 $\pm$ 36.3097	14.8234
3.	Rong-Bul	721 $\pm$ 47.0871	19.2232
4.	Tarku	1700 $\pm$ 36.0721	14.7263
5.	Turung-Mamring	1306 $\pm$ 28.1069	11.4746
6.	Sadam-Suntaley	1807 $\pm$ 39.0486	15.9415
7.	Tinik-Chisopani	1861 $\pm$ 39.3649	16.0706
8.	Namthang-Maneydara	1225 $\pm$ 26.3969	10.7765
9.	Assangthang	1029 $\pm$ 28.2418	11.5296
10.	Wok-Omchu	1012 $\pm$ 28.1069	11.4746
11.	Borong-Phamthang	1602 $\pm$ 29.0172	11.8462
12.	Barfung-Zarung	3136 $\pm$ 24.8112	10.1291
13.	Paiyong	1332 $\pm$ 30.2787	12.3612
14.	Tinkitam-Rayong	783 $\pm$ 42.7551	17.4547
15.	Perbing-Dovan	1022 $\pm$ 37.2290	15.1986
	Total	22485 $\pm$ 27.5027	11.2279

Mean  $\pm$ Standard Deviation has been calculated by using Duncan Multiple Range Test for six data to each group.

Source: DESME, 2013.

Map No. 8

MAIN WORKERS GROUP OF SELECTED GPU'S (SOUTH DISTRICT) - 2011



The Barfung-Zarung and Namphing GPU's have higher size of Main Workers because of large number of population. Tinik-Chisopani, Sadam-Suntaley and Tarku GPUs have the almost same number of Main Workers and other GPUs barring two are almost in the same range. The numbers of Main Workers are much smaller in Tinkitam-Rayong and Rong-Bul due to small population and also due to increase in school going children, increase of casual workers, involvement in govt. sector, reluctant to engage in agriculture etc. The percentage of main workers of Sikkim decreased by 6.10 % between 2001 (80.90%) and 2011 (74.80 %) while the non-worker population has been increasing which is a perturbing factor for the State at present. Similarly in rural areas Main Workers reduced by 8.60% from 79.8% in 2001 to 71.20% in 2011.

**Table 2.13: Periodical Workers Involved in Agricultural Field (in Percentage)**

Sl. No.	Months	No. of Farmers
1.	Below 3 Months	6.92
2.	3 Months - 6 months	33.08
3.	6 Months - 9Months	45.36
4.	Above 9 Months	14.64
	Total	100.00

*Source:* Field Survey, 2015-16.

The data given in table 2.13 show the periodical workers in agricultural field of study areas. The farmers engaged in agricultural field for 6 months to 9 months are found to be highest because they have to devote time for land preparation, sowing, transplanting and even harvesting etc. of different crops. If people cannot give their labour in their field for at least 6 to 9 months then it is difficult to produce good crop. From the above table it is understood that 3 to 9 months people of study area remain fully dedicated to agriculture field. In the rest 3 months involvement is less because of dry land.

**Table 2.14: Number of Households Engaged in Rearing of Cattle**

Households' Response in Rearing of Cattle	Percentage
Yes	89.46
No	10.54
Total	100.00

*Source:* Field Survey, 2015-16.

Most of the farmers are engaged in cattle rearing, (89.46 percent), but some farmers (10.54 percent) do not rear cattle due to fewer family members, less time etc.

**Table 2.15: Categories of Livestock Reared by Households**

Sl. No.	Item/Categories of Livestock	No. of Households engaged in Cattle Rearing Mean $\pm$ S.D.	Standard Error
1.	Cow (In Milk)	203 $\pm$ 34.0470	13.8996
2.	Cow (Drought)	62 $\pm$ 35.6089	14.5373
3.	Ox	38 $\pm$ 27.7200	11.3166
4.	Goat/Sheep	169 $\pm$ 34.0646	13.9068
5.	Pig	139 $\pm$ 37.0243	15.1151
6.	Poultry	889 $\pm$ 42.3792	17.3012
	Total	1500 $\pm$ 34.9342	14.2618

Source: Field Survey, 2015-16.

The data of the milk, drought (dry milk) cows, ox, goat/sheep, pig and poultry of study areas are shown in table 2.15 along with the significant mean  $\pm$ S.D and standard error. The highest number of livestock reared by households is poultry having mean  $\pm$ S.D. of 889 $\pm$ 42.3792 and its corresponding error is calculated as 17.3012. This result indicates that the inhabitants of study areas depend on poultry farming to supplement their income/food. The second highest number of livestock reared by households is cow (in milk) and the mean  $\pm$ S.D value is 203 $\pm$ 34.0470 while standard error is 13.8996. Third and fourth come goat/sheep and pig and their mean  $\pm$ S.Ds are 169 $\pm$ 34.0646, and 139 $\pm$ 37.0243, and their corresponding errors are calculated as 13.9068 and 15.1151 respectively. Very few households rear cow (drought) and ox. Animal husbandry is one of the mainstays of a large portion of population in Sikkim. However, due to spatial-temporal changes animal rearing differs from place to place.

**Table 2.16: Purpose of Rearing Livestock (in percentage)**

Sl. No.	Purpose	No. of Households
1.	Self Consumption	1,265
2.	For Sale	186
3.	Other Purposes	49
	Total	1,500

Source: Field Survey, 2015-16.

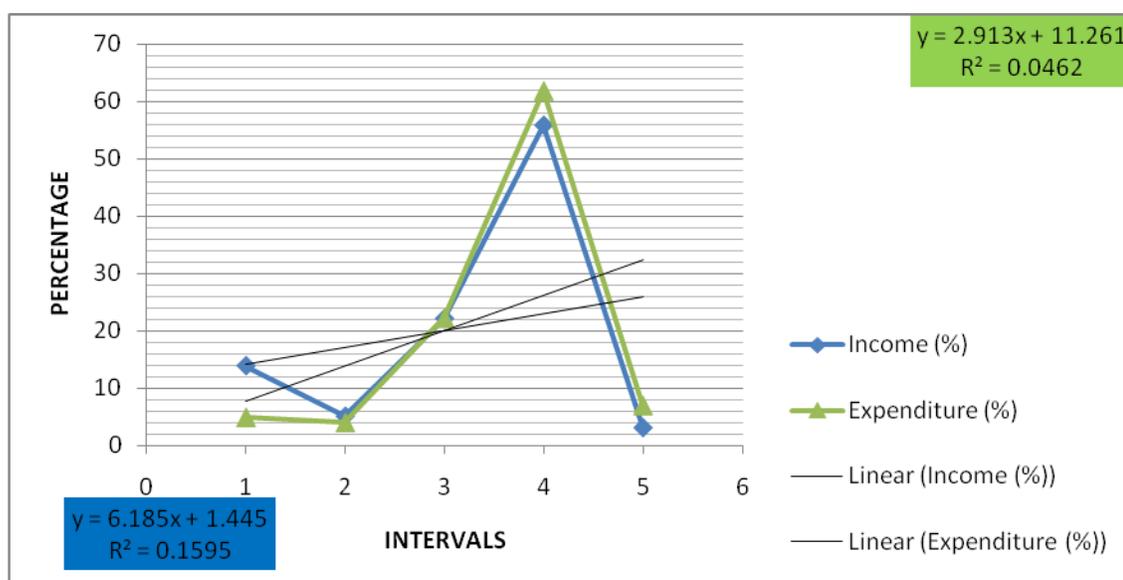
The table 2.16 illustrates the main purpose of livestock rearing in the study areas. The farmers rear livestock either for self consumption or for sale and other purposes. Most of the households i.e. 1,265 rear livestock for self consumption only. To overcome economic problems in the rural areas some people rear livestock for sale which constitutes 186 households. Other purposes include rituals, festivities, etc. for which they rear livestock. However, its quantum and involvement of households are less.

**Table 2.17: Normal Distribution of Income and Expenditure of Villagers per Annum**

Sl. No.	Intervals (In Rs.)	Income (%) Mean $\pm$ S.D.	Standard Error	Expenditure (%) Mean $\pm$ S.D.	Standard Error
1.	Below 10,000	13.88 $\pm$ 8.5557	3.4928	4.96 $\pm$ 3.0331	1.2382
2.	10,000-20,000	5.08 $\pm$ 3.6393	1.4857	4.04 $\pm$ 2.7871	1.1378
3.	20,000-30,000	22.13 $\pm$ 12.3612	5.0464	22.21 $\pm$ 11.6875	4.7714
4.	30,000-40,000	55.85 $\pm$ 33.4966	13.6749	61.77 $\pm$ 39.5062	16.1283
5.	Above 40,000	3.06 $\pm$ 2.3367	.9539	7.02 $\pm$ 4.7010	1.9192
	Total	100.00 $\pm$ 25.3456	10.3473	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.17 shows the normal distribution of Income and Expenditure of farmers per annum and the mean  $\pm$  S.D. and standard errors. Most of the farmers have income between Rs. 30,000-Rs.40,000 and its significant mean  $\pm$ S.D. is 55.85 $\pm$ 33.4966 and standard error is calculated as 13.6749. The income group of Rs.20, 000-30,000 comes second with significant mean  $\pm$  S.D. of 22.13 $\pm$ 12.3612 and standard error is calculated as 5.0464. The income groups of below Rs.10,000, Rs.10,000-Rs.20,000 and Above Rs.40000 have comparatively lower significant means at  $\pm$ S.Ds (13.88 $\pm$ 8.5557), (5.08 $\pm$ 3.6393) and (3.06 $\pm$ 2.3367) and standard error is calculated as (13.88 $\pm$ 8.5557), (1.4857 ) and (.9539) respectively.



**Figure 2.6: Normal Distribution of Income and Expenditure of Villagers per Annum**

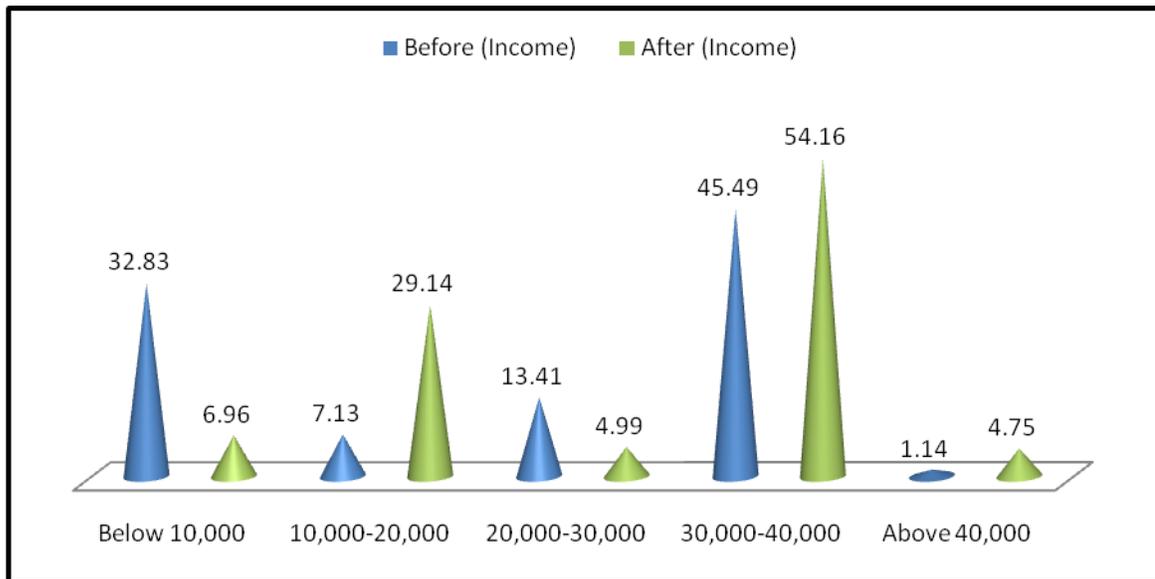
The figure 2.6 shows the income and expenditure of farmers per annum in different intervals. It is clear that the linear 1 and 2 show the regression lines corresponding to different intervals such as Below Rs.10,000, Rs.10,000-Rs.20,000, Rs.20,000-Rs.30,000, Rs.30,000-Rs.40,000 and Above Rs.40,000. The both regression curves show the positive relation in the case of income and expenditure. These intervals show the positive order between income and

expenditure and corresponding straight line equations are  $y=6.185x+1.445$  &  $R^2=0.1595$  and  $y=2.913x + 11.261$  &  $R^2=0.0462$  respectively.

**Table 2.18: Annual Income per annum before and after MGNREGS Programme**

Sl. No.	Intervals (In Rs.)	Before (Income) Mean $\pm$ S.D.	Standard Error	After (Income) Mean $\pm$ S.D.	Standard Error
1.	Below 10,000	32.83 $\pm$ 14.0427	5.7329	6.96 $\pm$ 4.8513	1.9805
2.	10,000-20,000	7.13 $\pm$ 4.4271	1.8073	29.14 $\pm$ 16.1061	6.5753
3.	20,000-30,000	13.41 $\pm$ 8.4380	3.4448	4.99 $\pm$ 2.6076	1.0645
4.	30,000-40,000	45.49 $\pm$ 25.2903	10.3247	54.16 $\pm$ 33.8998	13.8395
5.	Above 40,000	1.14 $\pm$ .7173	.2928	4.75 $\pm$ 3.0331	1.2382
	Total	100.00 $\pm$ 25.3456	10.3473	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.



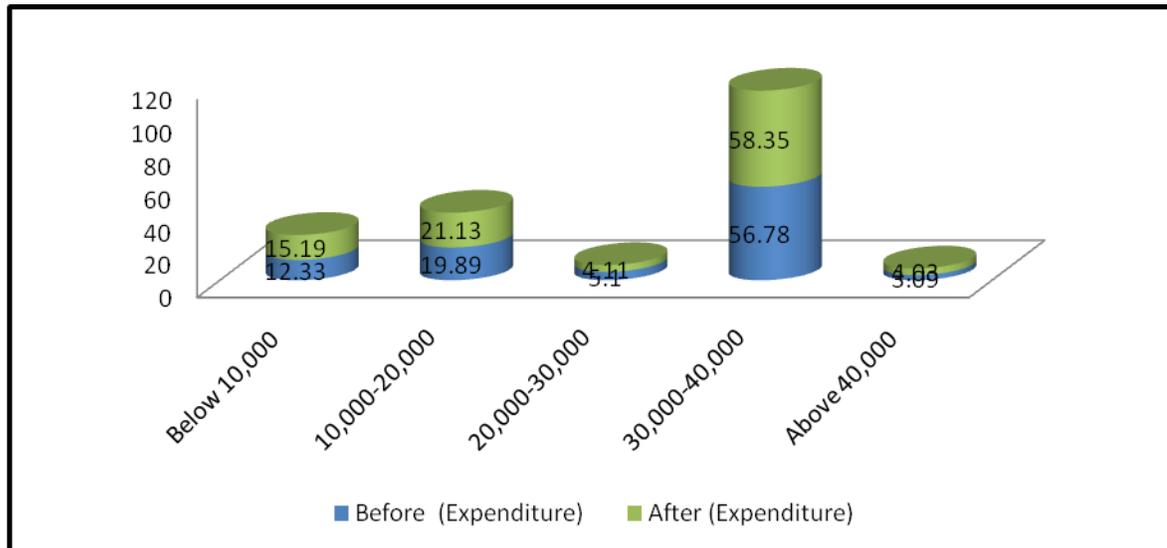
**Figure 2.7: Annual Income Before and After MGNREGS Programme per annum**

The income group between Rs. 30,000 to Rs. 40,000 was increased by 8.67 percent which increased after the implementation of MGNREGS programme. Similarly, income group between Rs.10, 000 to Rs. 20,000 had also increased by 22.01 percent after the implementation of this programme. Other groups show fluctuation in their incomes before and after this programme. The marginal workers are more benefitted in this programme. These workers are disguised types of workers and the implementation of this scheme has ensured job for at least one hundred days in a year.

**Table 2.19: Annual Expenditure per Annum (in Percentage) of Beneficiaries before and after MGNREGS Programme**

Sl. No.	Interval (In Rs.)	Before (Expenditure) Mean $\pm$ S.D.	Standard Error	After (Expenditure) Mean $\pm$ S.D.	Standard Error
1.	Below 10,000	12.33 $\pm$ 8.3810	3.4215	15.19 $\pm$ 11.6790	4.7679
2.	10,000-20,000	19.89 $\pm$ 12.5698	5.1316	21.13 $\pm$ 11.1534	4.5533
3.	20,000-30,000	5.10 $\pm$ 3.5777	1.4605	4.11 $\pm$ 3.0331	1.2382
4.	30,000-40,000	56.78 $\pm$ 37.3737	15.2577	58.35 $\pm$ 36.4965	14.8996
5.	Above 40,000	3.09 $\pm$ 2.1838	.8915	4.03 $\pm$ 1.2372	.5050
	Total	100.00 $\pm$ 25.3456	10.3473	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.



**Figure 2.8: Annual Expenditure Before and After MGNREGS Programme per annum**

There was not much difference in expenditure before and after the introduction of MGNREGS in villages. The interesting point is that whatever income is there juxtapose of expenditure, the income and expenditure has been seen maximum at Rs. 30,000 to 40,000. Therefore, there is a reciprocal relationship between income and expenditure. In the villages expenditures are controlled by income, thus people cannot afford to purchase based on their family requirements and as a consequence they tend to remain satisfied with what they possess at home.

## Profile of Respondents

**Table 2.20: Age Group of Respondents (in Percentage)**

Sl. No	Age Group	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below-30	12.33 $\pm$ 8.3810	3.4215
2.	30-45	36.61 $\pm$ 19.3804	7.9120
3.	45-60	27.89 $\pm$ 15.6588	6.3927
4.	60-75	13.14 $\pm$ 9.0994	3.7148
5.	Above-75	10.03 $\pm$ 7.3484	3.0000
	Total	100.00 $\pm$ 25.3456	10.3473

*Source:* Field Survey, 2015-16.

The age group of respondents' of the study area and the mean  $\pm$ S.D. and standard error are shown in the above table. The age group between 30-45 years has the highest significant mean  $\pm$  S.D. i.e. 36.61 $\pm$ 19.3804 and standard error is calculated as 7.9120. The second age group between 45-60 years has the significant mean  $\pm$  S.D. 27.89 $\pm$ 15.6588 while the standard error is calculated as 6.3927. The respondents between 60-75 years and 15-30 years are almost same in number and their significant mean  $\pm$ S.Ds. are 13.14 $\pm$ 9.0994, 12.33 $\pm$ 8.3810, and standard errors are calculated as 3.7148 and 3.4215 respectively. The lowest number is seen in the age group of above-75years with mean  $\pm$  S.D. of 10.03 $\pm$ 7.3484.

**Table 2.21: Respondents' Sex Group**

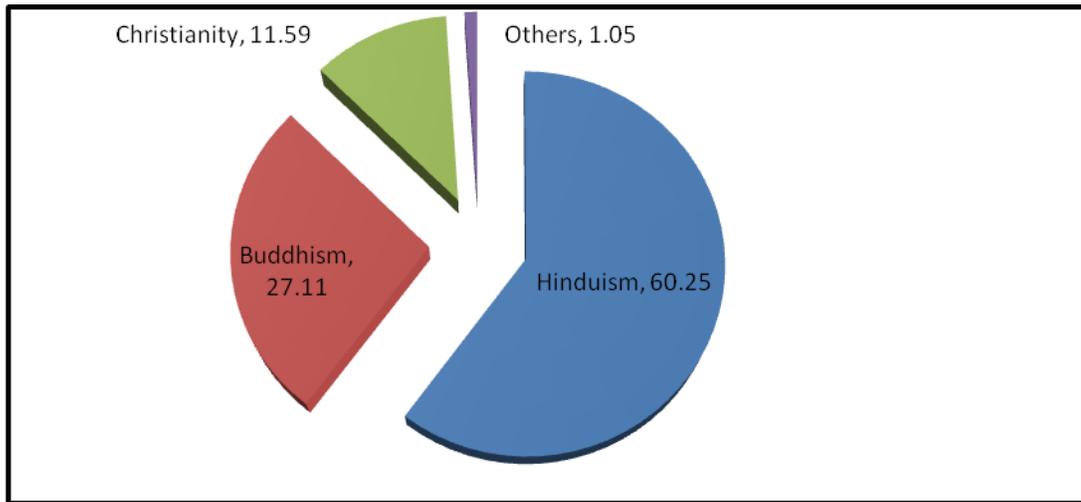
Sl. No.	Sex Group	Percentage
1.	Male	78.36
2.	Female	21.64
	Total	100.00

*Source:* Field Survey, 2015-16.

**Table 2.22: Religion of Respondents**

Sl. No.	Religions	Percentage
1.	Hinduism	60.25
2.	Buddhism	27.11
3.	Christianity	11.59
4.	Others	1.05
	Total	100.00

Source: Field Survey, 2015-16.



**Figure 2.9:** Percentage wise Distribution of Religion

Hindus are more than other religious followers in study area.

**Table 2.23: Caste Category (in Percentage)**

Sl. No	Caste category	Percentage Mean $\pm$ S.D.	Standard Error
1.	ST	31.49 $\pm$ 23.2206	9.4798
2.	BL	11.16 $\pm$ 7.3484	3.0000
3.	SC	8.06 $\pm$ 5.2153	2.1291
4.	CENTRAL OBC	15.13 $\pm$ 8.1240	3.3166
5.	STATE OBC	32.01 $\pm$ 19.7180	8.0498
6.	GEN	2.15 $\pm$ 1.2724	.5194
	TOTAL	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.23 illustrates the Caste categories in the study area along with their significant mean  $\pm$ S.D. and standard errors. The caste category of State OBC has the highest percentage and it has significant mean  $\pm$  S.D. of 32.01 $\pm$ 19.7180 and standard error is calculated as 8.0498. The second category belongs to ST and it has significant mean  $\pm$  S.D. of

31.49±23.2206 and standard error is calculated as 9.4798. The State OBC and ST have almost same percentage. The Central OBC is in third position and it has significant mean ± S.D. of 15.13±8.1240 and standard error is calculated as 3.3166. The BL, SC and General categories have significant mean ± S.D. (11.16±7.3484), (8.06±5.2153) and (2.15±1.2724) and standard errors of 3.0, 2.1291 and .5194 respectively.

**Table 2.24: Status of Education (in Percentage)**

Sl. No	Educational Qualification	Percentage Mean ±S.D.	Standard Error
1.	Illiterate (Non-literate)	13.92±7.3484	3.0000
2.	Primary	34.52±20.0499	8.1853
3.	Secondary	26.18±16.8166	6.8653
4.	Higher Secondary	16.21±12.9151	5.2725
5.	Graduation	7.98±5.4772	2.2360
6.	Above Graduation	1.19±.5918	.2416
	Total	100±25.3456	10.3473

Source: Field Survey, 2015-16.

The Educational Status of the study areas and the significant mean ±S.D. and standard error are shown in above table. As for the overall literacy level among the respondents, Primary education is higher and it has significant mean ± S.D. of 34.52±20.0499 and standard error is calculated as 8.1853. It can also be observed that Secondary level of education comes second after Primary and it has significant mean ± S.D. of 26.18±16.8166 and standard error is calculated as 6.8653. In the third, fourth and fifth levels are Higher Secondary, Illiterate (Non-literate) and Graduation with significant mean ± S.D. of 16.21±12.9151, 13.92±7.3484 and 7.98±5.4772) respectively. The lowest percentage of respondents is that of above Graduation. Literacy and schooling are important indicators of the quality of life, which help to measure the poor's ability to take advantages of the income-earning opportunities, which in turn, may influence food intake and health-seeking behavior (Radha, 2009).

**Table 2.25: Marital Status (in Percentage)**

Sl. No	Marital Status	Percentage
1.	Married	82.10
2.	Single	11.76
3.	Widow	6.14
4.	Divorcee	0.00
	Total	100.00

Source: Field Survey, 2015-16.

Majority of the respondents are married (82.10 percent). Second comes the respondents who are single (11.76). In the third place are the widows. There is no divorcee among respondents.

**Table 2.26: Sex Group (in Percentage)**

Sl. No	Sex Group	Percentage
1.	Male	53.67
2.	Female	46.33
	Total	100.00

Source: Field Survey, 2015-16.

The above data show that the number of male member is higher (53.67) than the females in the family of respondents (46.33 percent).

**Table 2.27: Age Group of the Respondents' Family Members (in Percent)**

Sl. No	Age Group	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below-15	15.56 $\pm$ 11.5238	4.7046
2.	15-30	44.13 $\pm$ 21.9636	8.9666
3.	30-45	18.46 $\pm$ 11.0995	4.5313
4.	45-60	14.69 $\pm$ 10.4307	4.2583
5.	Above-60	7.16 $\pm$ 5.5497	2.2656
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The age composition of the members of the respondent families affects the maintenance of the household. A “bulging age distribution” may exert an influence by its effect on the ration of dependents to productive elements in the working population” (Radha, 2009). The age group of respondents' family members and the significant mean $\pm$  S.D. and standard errors are shown in table 2.27. The highest population is in the age group of 15-30 years and the significant mean $\pm$  S.D. is 44.13 $\pm$ 21.9636 and standard error is calculated as 8.9666. The population between 30-45 years age group is second highest and significant mean $\pm$  S.D. is 18.46 $\pm$ 11.0995 and standard error is calculated as 4.5313. Next comes age group of below 15 years and it has significant mean $\pm$  S.D. of 15.56 $\pm$ 11.5238 and standard error is calculated as 4.7046. A very small population is above 60 years of age in sample areas.

**Table 2.28: Educational Status of Respondents Family Member (in Percent)**

Sl. No	Educational Qualification	Percentage Mean $\pm$ S.D.	Standard Error
1.	Illiterate (Non-literate)	2.11 $\pm$ .1574	.0642
2.	Primary	16.03 $\pm$ 12.9460	5.2852
3.	Secondary	22.95 $\pm$ 12.6491	5.1639
4.	Higher Secondary	30.71 $\pm$ 19.8191	8.0911
5.	Graduation	18.27 $\pm$ 14.5327	5.9329
6.	Above Graduation	9.93 $\pm$ 6.8410	2.7928
	Total	100 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.28 illustrates the Educational Status of members of respondents' families in the study areas and the significant mean  $\pm$ S.D. and standard errors. The table shows the overall literacy level among the respondents' family members, and it is observed that the higher secondary education has significant mean  $\pm$  S.D. of  $30.71 \pm 19.8191$  and standard error is calculated as 8.0911. It can also be observed from the above data that secondary level of education obtained by respondents' members comes second after higher secondary and its significant mean  $\pm$  S.D. is  $22.95 \pm 12.6491$  and standard error is calculated as 5.1639. In third, fourth and fifth literacy level of the respondents family members such as graduation, primary and above graduation and it has significant mean  $\pm$  S.D. are  $(18.27 \pm 14.5327)$   $(16.03 \pm 12.9460)$  and  $(9.93 \pm 6.8410)$  respectively. The illiterate (non-literate) category has the lowest percentage in the sample area.

## References

Boot, Debi Prasad. 1988. "Agricultural Land Use and Land Holding Pattern in Sikkim: Some Observations," *Sikkim Through periodical Articles, Reports, Seminar proceedings etc.* Vol.2, CHS: 57-63

Choudhury, Maitreyee. 1998. "An outline of the physical geography of Sikkim," In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.

----- 2006. *Sikkim: Geographical Perspectives*. New Delhi: Mittal Publications: 57.

-----2004. "State of Agriculture in Sikkim" In *The Himalayan Miscellany*, Vol.15. CHS, University of West Bengal: 25-34.

GoS (Government of Sikkim). 2001. *Sikkim Human Development Report*. Mahendra P. Lama (ed.). Delhi: Social Science Press, GoS.

-----2003. *The Glory of New Sikkim*. Mahendra P. Lama (ed.). Gangtok Sikkim: Department of Information and Public Relation, Printed at Kwality Stores Sikkim, GoS.

-----2004. *Sikkim Study Series, Geography & Environment*. Mahendra P. Lama (ed.), Volume-I, Department of Information and Public Relation, GoS: 26-27.

-----2011. *Village Development Action Plan; A Plan For Realizing of A Poverty Free Sikkim*. Gangtok Sikkim: Department of Rural Management and Development, GoS.

-----2013. *Sikkim: A Statistical Journal 2013(Draft)*. Gangtok Sikkim: Department of Economics, Statistics, Monitoring & Evaluation (DESME), GoS: 61.

-----*Strategic Research and Extension Plan of South District*. South Sikkim: Department of Food Security and Agriculture Development, GoS: 50.

-----2014. *Hand Book on Agriculture Sikkim 2013-14*. Gangtok Sikkim: Department of Food Security and Agriculture Development and compiled by Agriculture Census & EARAS Unit, GoS: 28-30.

-----2012. *Inventory and GIS Mapping of Landslides in North, East, West and South Sikkim and Its Mitigation*. Gangtok Sikkim: Department of Management Authority, Land Revenue & Disaster Management and Sikkim State Disaster, GoS: 3-174.

Khan, Nizamuddin. 2001. *An Introduction to Physical Geography*. New Delhi: Concept Publishing Company: 14.

Radha, V. 2009. *Women and Rural Households Food Security*. New Delhi: Serials Publications: 73-80.

Subba, J.R. 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 60.

### **Web Links**

[www.wikipedia.org/wiki/sikkim](http://www.wikipedia.org/wiki/sikkim) (Accessed on September 06,2010).

[www.sikkimforest.gov.in](http://www.sikkimforest.gov.in) (Accessed on February 20, 2016).

[www.sikkimsprings.org](http://www.sikkimsprings.org)-(Accessed on February 20, 2016).

[sikkim.nic.in>sws>sikk\\_geo](http://sikkim.nic.in>sws>sikk_geo) (Accessed on February 20, 2016).

[www.agricoop.nic.in](http://www.agricoop.nic.in) (Accessed on February 20, 2016).

[www.indiawater.org](http://www.indiawater.org)(Accessed on February 21, 2016).

[www.sikkimsprings.org>south\\_sikkim](http://www.sikkimsprings.org>south_sikkim) (Accessed on February 20, 2016).

[www.kvkeastsikkim.nic.in](http://www.kvkeastsikkim.nic.in) (Accessed on February 24, 2016)

# Chapter 3

## Agriculture and Agro-Economic Environment in Sikkim

### Introduction

Agriculture is the main occupation of the inhabitants of Sikkim and it forms the very basis of the socio-cultural pattern of the territory. The economy of Sikkim was a pure primitive form before the British took over the administration of the state. Actually, it was inflexibly traditional in its pattern and showed no signs of modernism whatsoever. With no elementary technological basis for agriculture, people had to gather their food from the vicinity of jungles during the flaccid season. In the surrounding areas there was limited supply of basic food items and it has always relation with their life in terms of economic aspects of primitive society.

People of Sikkim led a very primitive life and the original inhabitants were not agriculturists. They were dependent on nature for wild roots, fruits, fishes and flesh etc. When Bhutias penetrated into Sikkim they initiated semi-pastoral and sedentary farming and ploughed the land wherever they encountered flat pieces of land. Actually, settled agriculture started in Sikkim only after the entrance of Nepalis. These people were innovative, hard working, energetic and therefore cleared large tracts of forestlands and prepared the land that became fit for agriculture (Khawas, 2012:193).

The agro-ecosystems are innovated, adapted, managed and evolved over 600 years by traditional communities in antiquity, initially by aboriginal Lepchas and Limboos (now under ethnic group Nepali), followed by Bhutias after 1275 AD and later on by other Nepalese (Rai, Yakha, Gurung, Mangar, Tamang, Sunuwar, Thakuri, Bahun, Chettri, Kami, Damai, Sarki, Majhi, Newar, Sherpa, Thami, Bhujel, Jogi) after 1774 onwards through the generations to the present state. Mass clearing of forest area for agricultural use was accelerated during the British protectorate period (1817-1947 AD) mainly after the policy of Nepali settlement in Sikkim for revenue rising by Mr. J.C. white (1889 to 1908 AD), while the terrace cultivation system was accelerated since the Maharaja of Sikkim Sedkeong Tulku's time, i.e. 1914 AD onwards. The traditional shifting agriculture system and practice over centuries gradually conversed into sedentary system which is still continuing. The mixed system is a combination of compartments such as agro-forestry, forestry, livestock, and parcel of agricultural land forming together a unit mountain garden-based farming system. In the recent times, remains of

shifting cultivation are rarely observed in the form of *Khoriya* in Dzongu North Sikkim (Lepcha reserved area) and elsewhere (Subba, 2008).

The aborigines of the land, the Lepchas were originally nomads who spent their time hunting for food (*Sikkim A to Z* (2010) Land distribution and land revenue contribution according to the three major ethnic groups in the State, namely Bhutias, Lepchas and Nepalis, is highly uneven. In 1983, the Nepalis owned almost 59 percent of the total cultivated land and contributed almost 64 percent of the total land revenue generated in the State. In contrast, the land share of the Bhutias and Lepchas was 20 percent each and their land revenue contribution was 19 percent and 16 percent respectively (Lama, 2001).

### **The Agrarian Structure**

Sikkim has three-tier agrarian structure comprising landowners, sharecroppers and agricultural labourers. The different types of landowners, sharecroppers and the agricultural labourers in Sikkim may be classified as follows:

1. Landowner or *Bustiwalla*:
  - i. Absentee landowner
  - ii. Non-cultivating landowner
  - iii. Cultivating landowner
  - iv. Cultivating landowner-cum- sharecropper/agricultural labourer.
2. Tenants (*Pakhurey*)/ Sharecroppers (*Adhiadar, Kutdar* and *Chakhurey*):
  - i. Sharecroppers
  - ii. Sharecroppers-cum-landowner
  - iii. Sharecroppers-cum-agricultural labourer
3. Agricultural labourer or *Khetala*:
  - i. Labourer
  - ii. Labourer -cum-landowner
  - iii. Labourer -cum-sharecropper

The absentee landowners who do not live in the *busti* or village employ *pakhureys* or sharecroppers who cultivate the land either as *adhiadar* or as *kutdar*. The non-cultivating landowners live in the village but do not take part in the production system. Usually they give their land on lease to *pakhureys* who cultivate land on the basis of contract. The cultivating landowners are usually small farmers who cultivate their land themselves or employ agricultural labourers. The cultivating landowners-cum sharecroppers/labourers are marginal labourers, but only temporarily (Choudhury, 2004: 26).

There are different categories of tenant or *pakhurey* in Sikkim. Those who cultivate land in lieu of 50% of the total produce are called *adhiadars*. The *adhiadars* enjoy some amount of liberty in raising subsidiary crops that they may not have to share with the landowner. But the system of *adhiadar* is prevalent to a very limited extent. The *kutdars* are those tenants who pay

money for rent. They also have to bear some other duties imposed by the landowners. Quite often the rent of land is fixed verbally and renewal or revision of contract depends upon the will of the landowner. In other words, there is no fixed agreement on the lease of land in case of the *kutdar*, and the landowner may drop a *kutdar* at his will. The tenants of the monastery estates are known as *chakhurey*. The *chakhureys*, in addition to cultivating the land taken on lease from the monasteries, have to contribute manual labour. Renewal of their contracts depends entirely upon the mercy of the lamas of the concerned monastery. The tenants or the sharecroppers mostly cultivate their land themselves. Exchange of labour is quite common among the sharecroppers. They exchange labour in lieu of labour at their convenience. Sometimes they engage the agricultural labourers or *khetala*, especially when the land taken on lease is large and the size of family is small. Since the sharecroppers are also found to be landowners, it is quite common for them to engage labourers (Choudhury, 2004:26).

The agricultural labourers or *khetalas* perform all sorts of work decided by their employers. They are employed on daily wage or contract basis. The labourers employed on contract basis are usually paid in kind. In most cases the contract labourers get a share of the produce, the amount of which is stipulated by his employer. The well-to-do landowners employ labourers who perform both household work and agricultural operations. They are paid both in cash and kind. Besides, there are labourers who are engaged to perform all sorts of work including ploughing, sowing, harvesting throughout the year in lieu of food and shelter but do not get any wage (Choudhury, 2004:26).

### **History of Agricultural Development in Sikkim**

Among other land resources agricultural land has played a crucial role since time immemorial. Due to alarming rate of increasing population pressures on land and constantly growing demands of food and raw materials, the history of agricultural development in the district and state as a whole can be flashed back to the beginning of planned economic development in Sikkim. The first planned period is visualized in 1954 with the support of a technical team of planning commission of India. Planned development of agriculture in Sikkim started in early fifties during the rule of the last king of Sikkim, Late Palden Thopdun Namgyal. It was seven years planned period of state from 1954 to 1961. Through this period, a split Directorate of Agriculture and Horticulture was formed. The Directorate of Agriculture started functioning in Sikkim in 1954 under the leadership of Dr. K.L. Narsingham as the first Director of Agriculture and Animal Husbandry. These first seven years plan was confined by three five years plan viz. 1961-66, 1966-71 and 1971-76. At the time of three five years plans the main focus was on the infrastructural development, except some improvement in the land tenure system.

Agricultural development in the districts as well as the state as a whole had gained momentum immediately after the merger of Sikkim with India. The department of Animal Husbandry was

separated from the Directorate of Agriculture in 1974. After the formation of new state this started experimenting with regional concept of agricultural development in the fifth plan period. The state, in order to run the department, was divided into nine Regional Centres and a number of sub-centres as well as V.L.W. circles. The policies like regional concept of agricultural development were initiated, dividing the whole state into various regional centres. The south district had been divided into two regional centres and one sub-regional centre with 20 VLW centres.

The Seven Year Development plan of Sikkim had specific schemes for Agriculture & Rural Development and Horticulture. The government of Sikkim allocated Rs. 12, 99,983/- for the scheme of Agriculture & Rural Development and Rs. 11, 20,075/- for Horticulture during the first plan period. The first seven-year plan was followed by eight successive five-year plans during the period 1961-2001. By the time Sikkim became a state of Indian Union (May 1975), the fourth plan of Sikkim was nearing its completion. There was a massive increase in the budget allocation for agriculture and allied activities. The fifth plan allocated Rs. 16,08,27,000/- for agricultural development in the state. Ever since the merger of Sikkim with India, separate head wise attention to crop husbandry, soil and water conservation, animal husbandry, dairy development, fisheries, forestry and wildlife, food, storage and warehousing, agricultural research and education, marketing and quality control, and co-operation accelerated development in the agriculture sector. The quantum leap can be assessed from the fund allocation for agriculture in the annual plan of Sikkim during the year 2001-02. The total lay out for annual planning in the sector of agriculture and allied activities in the year 2001-02 was to the tune of Rs. 25,55,00,000. As an outcome of planned economic development, agriculture sector has become one of the most well-established and well-organised sectors in the state of Sikkim (Choudhury, 2004:25).

Before the merger in 1975, the agriculture sector was characterized by uncertainty about land tenure rights, negligible public investment and over-dependence on traditional technologies. This sector has recorded considerable progress during the last two decades. In the past low productivity, negligible marketable surplus and other institutional inadequacies which plagued the economy, led to agricultural backwardness. Some of the reasons which are responsible for agricultural backwardness in Sikkim in pre-merger period are the physical features of the state necessitating terrace cultivation, extreme concentration in land-holding patterns, low cropping intensity due to mono-cropping, outmoded technologies of production, inadequate thrust on agriculture in terms of investment and planning, inadequate infrastructure support in transportation, communication, irrigation, technical research and marketing etc. (Lama, 2001). The details of the investment on agriculture and horticulture during the period 1954 to 1960 are presented below:

**Table 3.1: Statement Expenditure (1954-1960)**  
**A. Agriculture and Rural Development**

Sl. No.	Different Sectors of Expenditure	Total Expenditure (in Rs.) Mean $\pm$ S.D.(Standard Deviation)	Standard Error
1.	Demonstration Farms at Gangtok	5,41,449 $\pm$ 11.9163	4.8648
2.	Demonstration Farm at Lachung	11,482 $\pm$ 15.4531	6.3087
3.	Seed Certification Farm, West District	73,452 $\pm$ 29.3734	11.9916
4.	Cardamom Installation of an Entomological and Pest Control Lab.	1,849 $\pm$ 25.0519	10.2274
5.	Training	14,040 $\pm$ 21.6333	8.8317
6.	Agriculture Loans	49,209 $\pm$ 33.3586	13.6189
7.	Agriculture Information Service, Staff, Equipment	5,000 $\pm$ 35.8664	14.6424
8.	Acquisition of Land for Cardamom Nurseries	2,349 $\pm$ 32.2676	13.1732
9.	Fair Price Shops	2,04,198 $\pm$ 58.4260	23.8523
10.	National Extension Service Organization	3,96,955 $\pm$ 35.0314	14.3015
	Total	12, 99,983 $\pm$ 17.0080	6.9761

*Source: J.R.Subba, 1984.*

The table 3.1 shows percentage wise distribution of expenditure on Demonstration Farm at Gangtok, Demonstration Farm at Lachung, Seed Certification Farm, West District, Cardamom Installation of an Entomological and Pest Control Laboratory, Training, Agriculture Loans, Acquisition of Land for Cardamom Nurseries, Fair Price Shops and National Extension Service Organization in table. The highest Expenditure was recorded in Demonstration Farms at Gangtok sector (41.65 percent). Second highest expenditure sector is National Extension Service Organization (30.54 percent). The third position is occupied by Fair Price Shops (15.71 percent) and rests have less than 10 percent of expenditure.

**Table 3.2: Statement Expenditure (1954-1960)**  
**B. Horticulture**

Sl. No.	Different Sectors of Expenditure	Total Expenditure (in Rs.) Mean ±S.D. (Standard Deviation)	Standard Error
1.	Staff Quarters	34,613±37.4058	15.2708
2.	Pay of Staff etc	81,262±60.3523	24.6387
3.	Cost of Equipment, Seed, Fertilizers, Insecticides etc.	1,74,439±34.3918	14.0404
4.	Rent of Store, Godowns for Manure etc.	2,393±44.7794	18.2811
5.	Loans to Fruit Growers	300±68.9260	28.1389
6.	Training	1,863±28.0285	11.4426
7.	Fruit Preservation & Canning Factory	7,05,224±41.6173	16.9901
8.	Horticultural Nurseries	25,221±52.8053	21.5576
9.	Plant Protection – cum Horticultural mobile items	94,760±26.2754	10.7269
	Total	11, 20,075±52.5753	21.4637

*Source:* J.R.Subba, 1984.

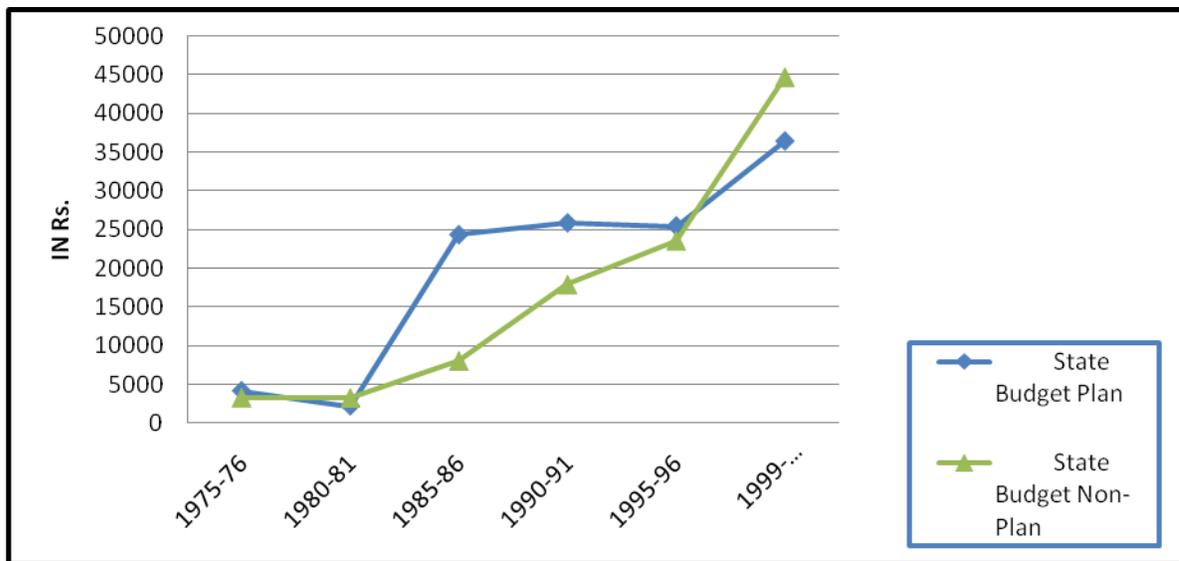
The table 3.2 shows that the highest expenditure is recorded in Fruit Preservation & Canning Factory sector, the significant mean is 7,05,224±41.6173 and its corresponding error is calculated as 16.9901. The second highest expenditure sector comprises of the Cost of Equipment, Seed, Fertilizers, and Insecticide etc. which has the significant mean ± S.D. of 1,74,439±34.3918 and standard error is 14.0404. The other sector of expenditure are Plant Protection–cum Horticultural Mobile Items (mean ± S.D 94,760±26.2754 and standard error as 10.7269), Pay of Staff etc. (mean, S.D. 81,262±60.3523 and standard error as 24.6387), Staff Quarters (mean ± S.D 34,613±37.4058 and standard error as 15.2708). The lowest expenditure sector, i.e. Loans to Fruit Growers shows the significant mean ± S.D. is 300±68.9260 and standard error is calculated as 28.1389.

In the post-merger period, the strategy was to provide a package of services aimed at consolidating peasant economy. This covered land reforms, agricultural credit and marketing, provision of inputs like seeds, fertilizers, minor irrigation, and encouragement to horticulture and cash crops. Thus, despite the limited cultivable land in Sikkim, agricultural development has made considerable progress during last two decades (Lama, 2001).

**Table 3.3: Budget Expenditure on Agriculture (1975-76 to 1999-00)**  
(In Rs.000)

Year	State Budget			
	Plan Mean±S.D. (Standard Deviation)	Standard Error	Non-Plan Mean±S.D. (Standard Deviation)	Standard Error
1975-76	4128±45.1043	18.4137	3304±48.5592	19.8242
1980-81	2190±48.8917	19.9599	3247±38.8690	15.8682
1985-86	24300±64.6436	26.3906	8047±32.5515	13.2890
1990-91	25825±48.0707	19.6248	17885±52.3717	21.3806
1995-96	25440±45.0066	18.3738	23557±37.2182	15.1943
1999-2000	36400±64.9461	26.5141	44675±42.1663	17.2143

Source: Lama, 2001.



**Figure 3.1:** Budget Expenditure on Agriculture (1975-76 to 1999-00)

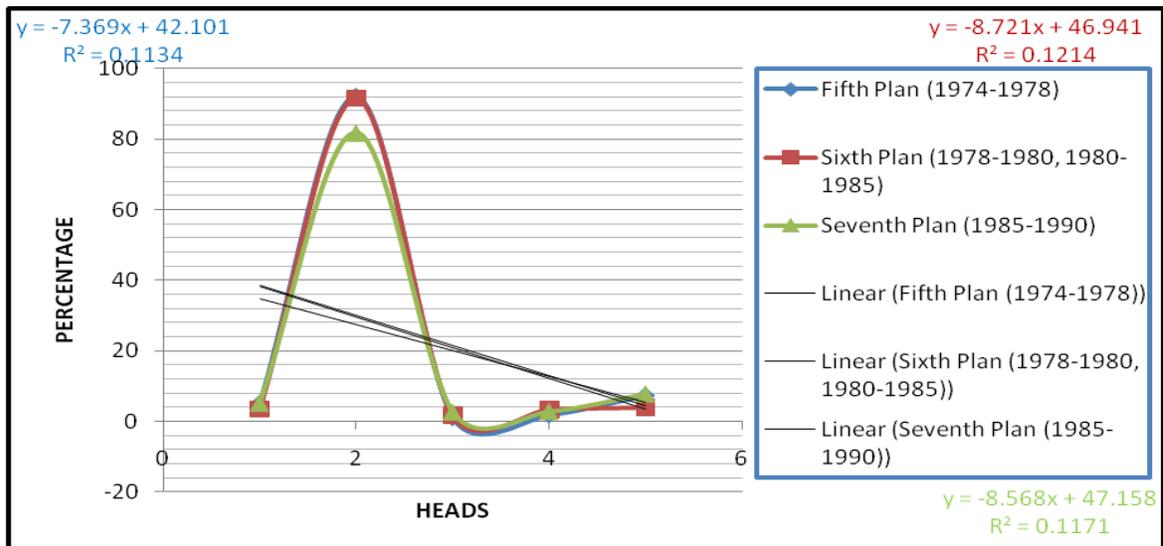
The Budget Expenditure on Agriculture (1975-76 to 1999-00) in different Plan and Non-Plan year, the comparison between State Budget Plan and Non-Plan year 1975-76, 1980-81, 1985-86, 1990-91, 1995-96 and 1999-2000 shows the positive aspect for agriculture development. From the above figure it is clearly seen that Budget Expenditure (State Budget) on Agriculture in both Plan and Non-Plan period increasing in every five year plan (1975-76, 1980-81, 1985-86, 1990-91, 1995-96 and 1999-2000). The Plan budget from 1975-76 to 1999-2000 increased by 781 percent and Non-Plan budget increased by 1252 percent.

**Table 3.4: Plan Investment in Agricultural Activities (in Percentage)**

Heads	Fifth Plan (1974-1978)	Sixth Plan (1978-1980, 1980-1985)	Seventh Plan (1985-1990)
Research & Education	4.98	3.42	5.10
Crop Husbandry	92.14	91.55	81.77
Storage & Ware Housing	1.03	1.64	2.58
Agriculture Marketing & Quality Control	1.82	3.38	2.76
Soil & Water Conservation	7.30	3.90	7.76

Source: Lama, 2001.

Although planned agricultural development in Sikkim was started during 1954-55, it gained momentum only in 1976-77, that is during the fifth five year plan. The Plan Investment (1974-1990) on Agriculture in different heads, Research & Education, Crop Husbandry, Storage & Ware Housing, Agriculture Marketing & Quality Control, Soil and Water Conservation is shown in table 3.4. It is noticed that the highest Plan Investment was done on Crop Husbandry, followed by Soil and Water Conservation, and Research and Education.



**Figure 3.2: Plan Investment in Agricultural Activities (in Percent)**

The figure 3.2 shows the percentagewise plan investment in agricultural activities in different heads. The linear 1, 2 and 3 show the regression lines corresponding to different heads such as Research & Education, Crop Husbandry, Storage & Ware Housing, Agriculture Marketing & Quality Control, Soil and Water Conservation. The first and second regression curves are highly significant in the case of Crop Husbandry. The Storage & Ware Housing curves show the negative decreasing order and corresponding straight line equations are:

$Y = -7.369x + 42.101$ ,  $R^2 = 0.1134$ ,  $y = -8.721x + 46.941$ ,  $R^2 = 0.1214$  and  $y = -8.568x + 47.158$ ,  $R^2 = 0.1171$  respectively.

Like other hilly and mountainous areas, the question of land has been central to the political economy of Sikkim, both because it is scarce and because of historical factors. For many centuries, feudalism had a stranglehold over land and society. Land rights were vested primarily in the nine Kazi (feudal lords) families, with each region rigidly separated from the others. Accordingly to the 1991 Census, Sikkim was predominantly rural with nearly 91 percent of the population living in villages (Lama, 2001). Sikkimese agriculture has to be seen in the context of larger Himalayan geography and environmental specificities therein. Physiography of the region has made agricultural conditions extremely diverse. Agriculture is greatly impacted by altitude and slope aspect. Agricultural fields are invariably terraced all over Sikkim Himalaya. The natures of terrain and varied micro climatic conditions influence agriculture in Sikkim to a great extent (Khawas, 2012).

In the present scenario, agricultural land use covers about 11.13% of the total geographical area of the state. Out of the total agricultural land, 82.1% land is under crops, 9.5% under fallow and 8.4% land is not very well recognized and considerable progress has been realized within past few years in this direction. This has apparently been the result of the planners and administrators, who vividly envisaged the need for having rapid agriculture development in hilly areas. The agricultural universities, I.C.A.R. research complexes and the state Departments of Agriculture have been playing major role in transforming the economy of hill people. Only a beginning has been made and more needs to be done to have meaningful development in hilly region. The concerted efforts made in evolving suitable land-use patterns for developing hill economy have paid good dividend and the concept of agro-forestry, agri-horticulture, silvi-pastoral etc., systems of land use are gradually becoming popular amongst cultivators. Also, cropping system like intercropping, relay cropping and multiple cropping have replaced traditional farming in many areas. Further the cultivation of commercial crops like seed potato, off season vegetables, ginger, turmeric, etc have been gradually gaining ground. The stage has been set for the progress in the right direction and thereby requires further promotion and encouragement.

The agricultural lands are situated within the elevation of 300m to 3000m above mean sea level. However, most of the cultivated area is located within 1800m (Choudhury, 2004).

The Agriculture and Horticulture Department has prepared a month-wise calendar for the cultivation of different crops in Sikkim. According to the calendar, the concerned department and the farmers plan for cropping of different crops from time to time; departmental experts sometimes train the farmers according to the calendar.

**Table 3.5: Month wise Calendar for Agricultural Operations in the State**

Area	Climate	Altitude (M)	Ecological Adaptation	Crops	
				Agriculture	Horticulture
Lower Hills	Tropical	300-500	Wet & Dry Agriculture, Sedentary Farming, Livestock, Horticulture	Rice, Maize, Millet, Wheat And Mustard, Pulses, Soybean, Vegetables, Potato.	Guava, Lime, Lemon, Ginger, Oranges
	Sub-Tropical	500-1500			
Mid Hills	Temperate	1500-2000	Wet And Dry Agriculture, Slash And Burn Agriculture Or Rotational Dry Collection Of Minor Forest Produce, Horticulture	Paddy, Maize, Millet, Wheat, Soybean, Potatos, Vegetables, Ginger	Mandarin (Orange), Large Cardamom, Plum, Peach, Peas.
High Hills	Temperate	2000-2700	Dry Agriculture, Bhutias Transhumance	Maize, Barley, Vegetables, Sweet Potato	Apple, Plum, Peach, Peas.
High Hills	Sub-Alpine	2700-4000	Yak Herding, Horticulture, Pastoral Economy, Wool, Cheese, Butter, Hides, Apple	Potato	Apple
	Alpine	4000-5000	Potatoes Are Commercial Commodities		
Very High Hills	Alpine	Above 5000	Lachenpa and Lachungpa Transhumance Groups Visit the Area; Lachenpa Grows vegetable And Potato at higher elevation.	Mainly Used For Seed Potato, Vegetables	Pasturage

Source: Agriculture & Horticulture Department, Government of Sikkim.

The above table (3.5) shows the month wise calendar prepared by the Agriculture and Horticulture department, Govt. of Sikkim wherein the time frame is stipulated for the Preparation of the Soil, Sowing and Transplanting, Irrigation & Interculture and Harvesting & Threshing for different crops and vegetables in Rabi and Kharif seasons. The suitable months for cropping of different crops in the case of Sikkim are January, February, March, April, May, June and July only and rest five months i.e., August, September, October, November and December according to agriculture and horticulture calendar are not suitable due to lack of irrigational facilities.

Sikkim contains within its borders a variety of non-tropical and geographic environments from the low snow tree outer hills to the high peaks with permanent snow and glaciers. Within its habitable portions, different social, religious, linguistic and ethnic groups co-exist practising different types of agriculture and pastoral activities. As one moves northwards, valley floors and mountain peaks increase in altitude, the terrain becomes more rugged and the climate drier and more temperate, the vegetation changes from Sal forest to rhododendrons and conifers and finally to grass above timber line. Such a transition can sometimes be seen even on a single mountain side in any of the ecological zones (<http://www.envis.nic.in>).

It is observed that the agricultural as well as horticultural crops had important stand from lower hills i.e. from 500m up to very high hills of above 3000m. The tropical, subtropical to temperate region has occupied important place for the cultivation of different crops in Sikkim. But in the sub-alpine to above alpine region, few crops can be sown due to cold climate.

In addition to the above described agricultural calendar the farmers of three communities i.e. Lepcha, Bhutia and Nepali have their own calendar for the cultivation of different crops.

### **Cultivation Calendar of the Nepali Community**

According to the cultivation Calendar of Nepali community in Sikkim, it is found that they have their own calendar for the cultivation of different crops in agriculture which they follow and apply in their farms since ancient times.

**Table 3.6: Agricultural Calendar for Nepali Community**

<b>Crops</b>	<b>Agricultural Activities in Different Elevation</b>	<b>Months (in Nepali Calendar)</b>
1. Paddy	<i>Upper Belt</i>	
	1. Land Preparation	Baishak (April-May)
	2. Transplanting	Ashad (June-July)
	3. Weeding	Badau (August-Sep)
	4. Inter culture	Asoj (Sep-Oct)
	5. Harvesting	Mongsir (Nov-Dec)
	<i>Lower Belt</i>	
	1. Land Preparation	Jet (May-June)
	2. Transplanting	Srawan (July-August)
	3. Weeding	Badau (August-Sep)
4. Inter culture	Asoj (Sep-Oct)	
5. Harvesting	Mongsir (Nov-Dec)	

<b>2. Maize</b>	<i>Upper Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing</li> <li>2. Weeding</li> <li>3. Dohoro/Dafey</li> <li>4. Ukarah</li> <li>5. Harvesting</li> </ol> <i>Lower Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing</li> <li>2. Weeding</li> <li>3. Harvesting</li> </ol>	Fagun (Feb-March) Baishak (April-May) Jet (May-June) Ashad(June-July) Badau(August-Sep)  Fagun (Feb-March) Baishak (April-May) Srawan (July-August)
<b>3. Buckwheat</b>	Time of Sowing/ Broadcasting  Harvesting	Badau – Asoj (August –Oct) Mongsir–Paush (Nov-Jan)
<b>4. Mustard</b>	<i>Upper Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing/Broadcasting</li> <li>2. Harvesting</li> </ol> <i>Lower Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing/ Broadcasting</li> <li>2. Harvesting</li> </ol>	Asoj (Sep-Oct) Mongsir–Paush (Nov-Jan)  Mongsir (Nov-Dec) Fagun (Feb-March)
<b>5. Pulses</b>	<ol style="list-style-type: none"> <li>1. Time of Sowing/ Broadcasting</li> <li>2. Weeding</li> <li>3. Clearing</li> <li>4. Harvesting</li> </ol>	Srawan (July-August) Asoj (Sep-Oct) Kartik (Oct-Nov) Mongsir (Nov-Dec)
<b>6. Wheat</b>	<ol style="list-style-type: none"> <li>1. Time of Sowing/ Broadcasting</li> <li>2. Irrigation</li> <li>3. Harvesting</li> </ol>	Mongsir (Nov-Dec) Every 15 days Chaiyet (March-April)
<b>7. Millet</b>	<i>Upper Belt Only</i> <ol style="list-style-type: none"> <li>1. Time of Sowing/ Broadcasting</li> <li>2. Harvesting</li> </ol>	Asoj (Sep-Oct) Magh (Jan-Feb)
<b>8. Potato</b>	<i>Upper Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing</li> <li>2. Weeding</li> <li>3. Harvesting</li> </ol> <i>Lower Belt</i> <ol style="list-style-type: none"> <li>1. Time of Sowing</li> <li>2. Weeding</li> <li>3. Harvesting</li> </ol>	Asoj –Kartik 45 days Magh (Jan-Feb)  Mongsir (Nov-Dec) Paush (Dec-Jan) Chaiyet (March-April)

Source: Field Survey, 2015-16.

From the above table, it is clear that Nepali Community have their own agriculture calendar for Land Preparation, Time of Sowing/ Broadcasting, Transplanting, Irrigation, Weeding, Inter culture, Harvesting etc. Crops like Paddy, Maize, Mustard and Potato are grown from lower belt to upper belt according to the calendar.

### Cultivation Calendar of the Lepcha Community

According to Gorer (1938) the Lepcha's agricultural calendar for the Talung valley of Sikkim which may also be taken as representative of the general agricultural practices in Sikkim throughout the year is as given in table 3.7:

**Table 3.7: Agricultural Calendar for Lepcha Community**

Months	Agricultural Activities
CHUNIPU (January) ( <i>Karnet Nyum</i> )	The big sowing of buckwheat
TANGBU (February) ( <i>Kursong Nyum</i> )	Clear the ground and finishing of sowing buckwheat
NIBU (March) ( <i>Thun Nyum</i> )	Finish of clearing ground and sow dry paddy in temporary fields. Sow maize and early millet in the valley. Weed cardamom in flower and strike new plants.
SUMGU (April) ( <i>Sum Nyum</i> )	Harvest barley and wheat. Clear ground for main crop-millet. Weed cardamom again round new- found fruit.
ZIBU (May) ( <i>Glou Nyum</i> )	Harvest buckwheat. Sow main crop-millet. Sow maize in garden burning the wheat straw for fertilizing. This and the three following months are the period of constant rain and heat.
NAPU (June) ( <i>Namchum Nyum</i> )	Plant rice Wheat dry rice. This is the leanest month when people may go hungry.
TIKPU (July) ( <i>Parveem Nyum</i> )	Harvest early millets in valley. Weed main crop-millet.
DENGBU (August) ( <i>Taffa Nyum</i> )	Harvest at earliest variety of wet rice. Make a shade too dry cardamom fruit. Make a small sowing of buckwheat for seed.
GEEBO (September) ( <i>Gloue Nyum</i> )	Harvest dry rice. The women start harvesting the millet, the men look after the cardamom. This and the two following months are relatively dry.
GOOBU (October) ( <i>It Nyum</i> )	Cardamom picking continues. Wet rice is harvested. Barley, wheat and onions are sown in the garden.
CHOOPU (November) ( <i>Ra Nyum</i> )	The seed –buckwheat is harvested cardamom is sold. This and the next two months are the prosperous period.
CHUCHIKPU (December) ( <i>Mar Nyum</i> )	The harvested field is ready for buckwheat. This and the two following months are the period of intense cold.

Source: Gorer (1938: 94).

Gorer, in 1938 explained about the agricultural calendar of Lepchas of Sikkim. He had given the name of months according to the commonly known names which were actually mixed

with Bhutia language. However, the words in *Italic fonts* above are the real Lepcha words for the name of months according to field survey done by the researcher.

### Cultivation Calendar of the Bhutia Community

**Table 3.8: Agricultural Calendar for Bhutia Community**

Four Seasons	Agricultural Activities
Chika (Spring = March-May) 2+3+4	Cultivation time: -Maize, Ginger, Millet etc.
Yarka (Summer = June-August) 5+6+7	Buckwheat, Green Vegetables, Paddy, Pulses, Cardamom etc.
Tonka (Autumn = Sep-Nov)8+9+10	Harvesting time
Gunka (Winter = Dec-Feb)11+12+1	No cultivation and harvesting time

Source: Field Survey, 2015-16.

From the above table, it is seen that Bhutia community of Sikkim pertaining to agriculture aspects follow the season-wise agricultural activities rather than monthly. According to Bhutias, there are four seasons suitable for agricultural activities. Among them, in the season Gunka (Dec-Feb), no agricultural activities like cultivation and harvesting are carried out.

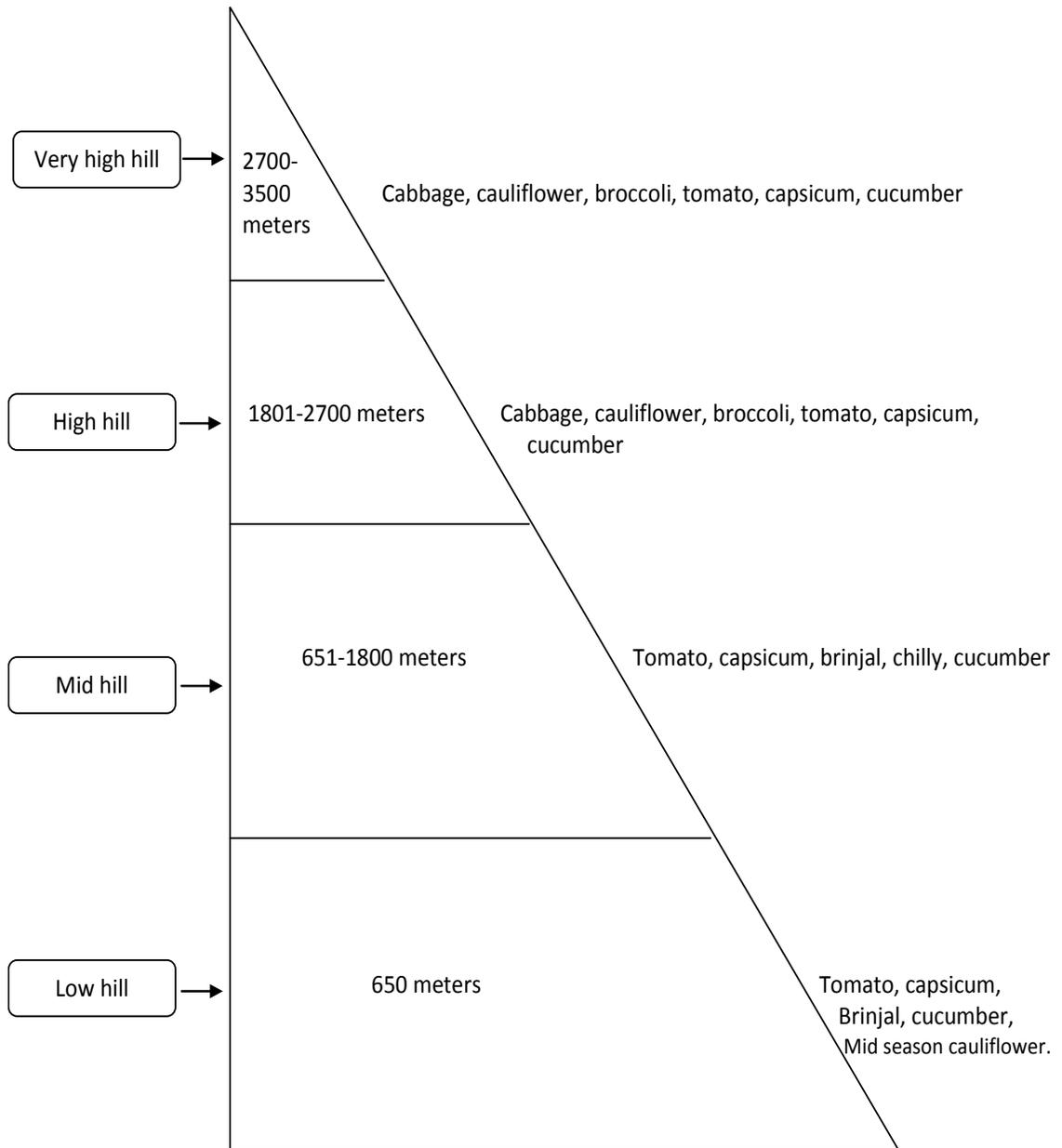
**Table 3.9: Horticulture Schedule of Cropping**

Zone	Sowing	Transplanting	Harvesting
1. <u>Low hill up to 650 m.</u> Tomato, Capsicum, Brinjal, Cucumber, etc Mid season cauliflower	Dec- Feb August	Jan-March September	June-Aug December
2. <u>Mid hills 651-1800 m.</u> Tomato, Capsicum, Brinjal, Chilly, Cucumber etc.	Jan-Feb	Feb-March	July-Aug
3. <u>High hill 1801-2700 m.</u> Cabbage, cauliflower, Broccoli, Tomato, Capsicum, Cucumber	Feb-March April March – April	March- April May April – May	July-Aug Aug Aug-Sept
4. <u>Very high hill 2701-3500 m.</u> Cabbage, Cauliflower, Broccoli Tomato, Capsicum, Cucumber	March – April March	April – May April	July – Aug Aug- Sept

Source: Training Manual of Horticulture crops.

Table 3.9 shows the Horticulture Schedule of Cropping in four different zones in Sikkim such as Low hill up to 650 m, Mid hills 651 m to 1800 m, High hill 1801 m to 2700 m and Very high hill 2701m to 3500 m. According to different zones, crops are sown, transplanted and harvested in different feasible months. From the depiction in the diagram below, it is clear what types of altitude is needed for the vegetables grown.

**Figure 3.3:** Altitudinal Agro-Climatic Zones of Horticulture in Sikkim



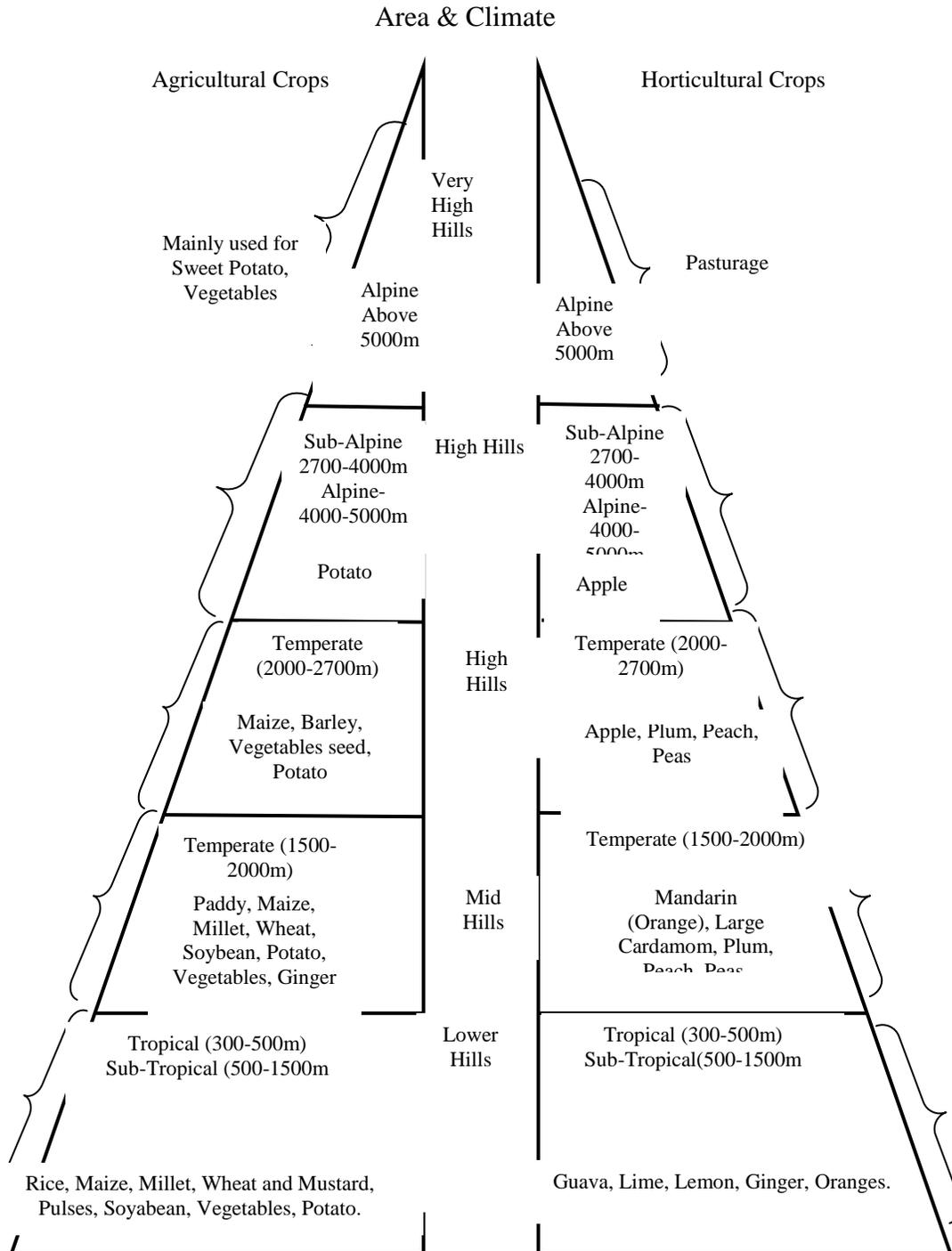
**Table 3.10: Ecological Zones and Ecological Adaptation in Sikkim**

Area	Climate	Altitude (M)	Ecological Adaptation	Crops	
				Agriculture	Horticulture
Lower Hills	Tropical	300-500	Wet & Dry Agriculture, Sedentary Farming, Livestock, Horticulture	Rice, Maize, Millet, Wheat And Mustard, Pulses, Soybean, Vegetables, Potato.	Guava, Lime, Lemon, Ginger, Oranges
	Sub-Tropical	500-1500			
Mid Hills	Temperate	1500-2000	Wet And Dry Agriculture, Slash And Burn Agriculture Or Rotational Dry Collection Of Minor Forest Produce, Horticulture	Paddy, Maize, Millet, Wheat, Soybean, Potatos, Vegetables, Ginger	Mandarin (Orange), Large Cardamom, Plum, Peach, Peas.
High Hills	Temperate	2000-2700	Dry Agriculture, Bhutias Transhumance	Maize, Barley, Vegetables, Sweet Potato	Apple, Plum, Peach, Peas.
High Hills	Sub-Alpine	2700-4000	Yak Herding, Horticulture, Pastoral Economy, Wool, Cheese, Butter, Hides, Apple	Potato	Apple
	Alpine	4000-5000	Potatoes Are Commercial Commodities		
Very High Hills	Alpine	Above 5000	Lachenpa and Lachungpa Transhumance Groups Visit the Area; Lachenpa Grows vegetable And Potato at higher elevation.	Mainly Used For Seed Potato, Vegetables	Pasturage

Source: www.envis.nic.in.

The above table depicts that Area, Climate, Altitude, Ecological Adaptation, Crops-Agriculture and Horticulture are correlated with each other. It also provides information on types of Agriculture and Horticulture crops that are grown and the nature of ecological adaptations that are followed by the people in different areas at different altitude and climatic conditions.

**Figure 3.4: Ecological Zones (Agriculture & Horticulture)**



### **Agro-Economic Activities of Selected Gram Panchayat Units (GPUs) of South District**

The state's economy is largely agrarian, based on the terraced farming of rice and the cultivation of crops such as maize, ginger, buckwheat, finger millet, wheat, barley, oranges, tea and cardamom. Agriculture is the primary activity of the people of Sikkim. About 11.13 percent of the total geographical area of the land is dedicated to agriculture. The subsidiary system of livestock rearing is the most predominant livestock rearing system in most rural areas of Sikkim. It is one of the important parts of the mixed farming system in the mid and lower hills of Sikkim in which agriculture, horticulture and agro-forestry form major pillars in the life of farmers. The role of livestock reared under this system is to support the main components. The livestock help to recycle the crop residues and agricultural products effectively.

South District is the smallest district of Sikkim state with a geographical area of 750 sq km and constitutes only 10.56 percent out of 7096 sq km. The South district also has mixed farming system which supports the economic life of the farmers basically in the rural areas. Around 70 percent of population depends on farming for their livelihood. It has different agro-climatic conditions suitable for cultivation of various crops. South district has 41,790 hectares (2015-16) i.e. 5.89 percent under operated area (agriculture + horticulture) and majority of farmers are marginal and small. The main agricultural and horticultural crops grown in the district (from 300m to 2100 m) are maize, ginger, paddy, barley, buckwheat, mustard, pulses, cardamom, orange and vegetables.

The South district ranks first in terms of production of vegetables. The farmers of South district have made notable improvement in vegetable production. Vegetables during the main seasons are grown in almost all the areas of south district. The horticulture department takes initiatives to encourage farmers to produce vegetables either early or in off-season so that farmers get good market price for their products. Recently, Agriculture and Horticulture Department, Government of Sikkim has adopted few villages or GPUs of South Sikkim in order to improve the agricultural systems and quality of production of farmers. Some of the villages are famous for specific commercial vegetables such as tomato of Sadam, Phongla, Tinzir, bottle-gourd of Pakzor and Samatar, beans of Passi and Rong, cabbage and broccoli of Salleybong and Chisopani, carrot, palak, bhindi, lettuce of Chisopani and Samatar, green peas of Rabang, Ghurpisay, Perbing (in Perbing cabbage and radish are also famous) and Temi, chayote in Bikmat area. Livestock sector is highly livelihood intensive. Agriculture along with livestock is the single largest source of employment in the state. Over 80 percent of the farmers in the state own livestock and earn supplementary incomes from them. In the case of livestock cattle, goat, pig and poultry are main economic support to the villagers.

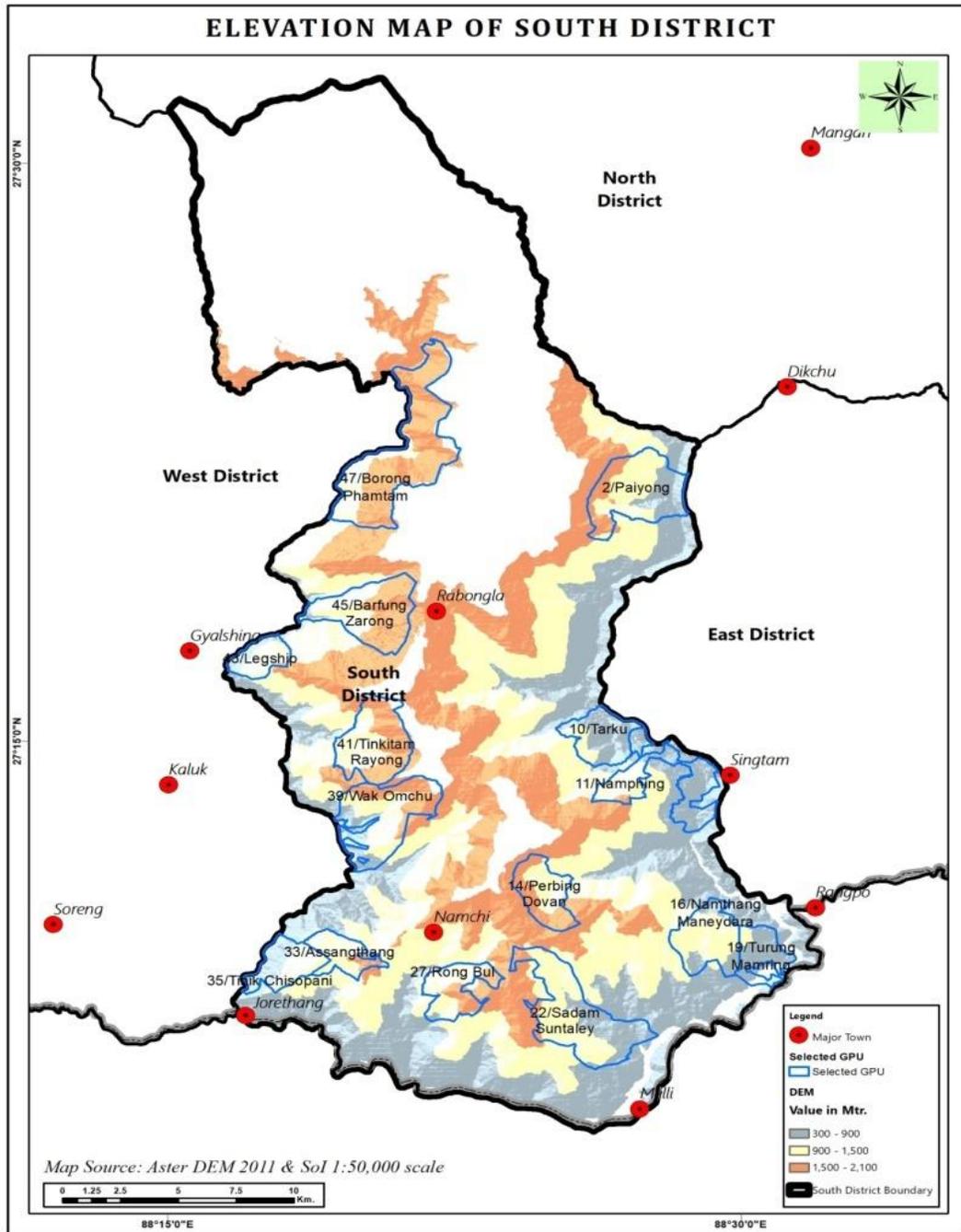
According to agro-climatic zones, the study areas i.e. Gram Panchayat Units (GPU) of South district are categorised into three groups-

The distribution of GPUs according to elevation bands (300m-900m, 900m-1500m, and 1500m-2100m) is as follows:

**Table 3.11: Agro-Climatic Zones**

<b>Sl. No.</b>	<b>Elevation (in metres)</b>	<b>Gram Panchayat Units</b>
1. Set I	300-900 metres	<ul style="list-style-type: none"> <li>i. Namphing GPU (381 m),</li> <li>ii. Legship GPU (596 m),</li> <li>iii. Rong-Bul GPU (644 m),</li> <li>iv. Tarku GPU (769)</li> <li>v. Turung-Mamring GPU (922 m).</li> </ul>
2. Set II	900-1500 metres	<ul style="list-style-type: none"> <li>i. Sadam –Suntaley GPU (1305 m)</li> <li>ii. Tinik- Chisopani GPU (1322 m)</li> <li>iii. Namthang- Maneydara GPU (1400 m)</li> <li>iv. Assangthang GPU (1413 m)</li> <li>v. Wok- Omchu GPU (1471 m).</li> </ul>
3. Set III	1500-2100 metres	<ul style="list-style-type: none"> <li>i. Borong-Phamthang GPU (1846 m).</li> <li>ii. Barfung-Zarung GPU (1853 m)</li> <li>iii. Paiyong GPU (1856 m)</li> <li>iv. Tinkitam-Rayong GPU (1956 m)</li> <li>v. Perbing-Dovan GPU (1976)</li> </ul>

Map No. 9



**Set I: Namphing, Legship, Rong-Bul, Tarku, Turung-Mamring**

**Crops:** In group I, the main crops cultivated include maize, barley, ginger, paddy and chili. The main crops of Namphing GPU are paddy, maize and ginger. Legship GPU has three belts i.e. lower, middle and upper. In the lower belt crops such as maize, barley, ginger, and paddy are grown, in the middle belt ginger and maize and in the upper belt, ginger, maize, orange and cardamom are grown. In Rong-bul GPU crops like buckwheat, ginger, mustard, maize and vegetables are grown. Maize and dalle chillies are grown in all GPUs. In Tarku GPU, in the lower belt crops like paddy are grown whereas in the upper belt maize and paddy are grown. Ginger is grown well in every GPU. In Turung-Mamring GPU maize, pulses and ginger are grown. However the best grown crop is maize. The farming system of Legship GPU is very much traditional. The 99 percent of household's area comes under the traditional farming in Rong-bul GPU. The farming system of Tarku GPU too is largely traditional. Only 5 percent of households are involved in modern way of farming.

However, in case of Turung-Mamring GPU about 65 percent of households are involved in modern way of farming while 35 percent of households are under traditional way of farming as per VDAP report.

**Period of Intensity:** The intensity of agriculture activities in the Namphing GPU is from medium to high. In the months of February, March, July, August and November the intensity of agricultural activities is high but the remaining months fall under medium category. Legship GPU has intense agriculture activities during the months of September, October and November. Medium intensity occurs in the months of January, May, June, and December. The high intensity of agriculture activities is seen during five months: February, March, April, July, and August. In the Rong-bul GPU, agricultural activities start during the months of December, January and February but the intensity of agriculture activities is low during the period. April, May, August, September and March are months of medium intensity, but June, July, October and November have high intensity. The months of July, November and December have low intensity of agricultural activities. The medium intensity occurs in January, March, April, May, September and October, and high intensity of agriculture activities prevails in the months of June, August and February in Tarku GPU. The intensity of agriculture activities in Turung-Mamring GPU is low in the months of January, April, May, October, November and December. In the months of June, July and February the intensity of agriculture activities is medium but it is high in August, September and March.

## **Set II: Sadam-Suntaley, Tinik Chisopani, Namthang-Maneydara-Assangthang-Wok-Omchu**

**Crops:** The main crops of Sadam-Suntaley GPU from lower belt to upper belt are maize, mustard, vegetables (tomato etc.). But the best practices are horticulture and dairy farming. The main crops of Tinik-Chisopani GPU are maize, pulses, ginger and paddy. Similarly, main crops of Namthang-Maneydara GPU in the lower belt are maize, pulses, and paddy and in middle to upper belt ginger and maize. But the best practices in the lower belt are maize and pulses and in the upper belt maize and ginger. The main crops of Assangthang GPU in the lower belt are maize, ginger, tomato, fire ball chilies, in the middle belt maize, buckwheat, ginger, beans and in the upper belt ginger and maize. But the best practices in the lower belt are maize and pulses and in the upper belt are ginger, beans, soybean, fire ball chilies, and buckwheat. The main crops of Wok-Omchu GPU from lower belt to upper belt are ginger, pulses and maize. But the best practice is that of cash crop i.e. ginger. The farming system in Sadam-Suntaley GPU is mostly traditional way of farming. According to VDAP-2011 about 300 households have adopted modern way of farming. According to VDAP-2011 about 27 households in Tinik-Chisopani GPU are involved in modern way of farming and total area under modern farming techniques is only 10 percent. The rest of the households and area are under traditional way of farming. In Namthang-Maneydara only 18 households follow modern farming techniques and the area coverage is only 0.5 percent (VDAP-2011). The rest of the households in the area practices traditional farming, even though villagers focus more on cash crop like ginger. Likewise, the farming system in Assangthang GPU is also traditional. Only 02 households follow modern way of farming and total area under modern farming techniques is only 0.5 acre. The total households involved in cash crop cultivation are 10 percent and the area under modern farming techniques is only 20 percent (VDAP-2011). The rest 90 percent of households and 80 percent of area are under traditional farming in Wok- Omchu GPU.

**Period of Intensity:** In Sadam-Suntaley GPU during the months of January, February and December the intensity of agriculture activities is low but by March, April, May, September, October and November the intensity rises to medium. The highest intensity is recorded in the months of June, July and August. The intensity of agriculture activities in Tinik-Chisopani GPU area in the months of October, November and December is low and it is high in the months of February, March, April, May, June, July and August. In Namthang-Maneydara GPU area during the months of January, May, October, November and December the intensity is low. The medium intensity takes place in the months i.e. February, March, April, July, August and September. There is no high intensity month of agriculture activities. In Assangthang GPU, the intensity of agriculture activities in the months of January, June, August, and September is low. Medium intensity is observed in the months of February, March, April, May, October, November and December. There is only one month i.e. July which has high intensity of agriculture activities. The intensity of agriculture activities in Wok-Omchu GPU area in the months of October, November and December is, while medium

intensity months are January, June and September. The high intensity of agriculture activities occurs during February, March, April and May.

### **Set III: Borong-Phamthang, Barfung-Zarong, Paiyong, Tinkitam-Rayong and Perbing-Dovan**

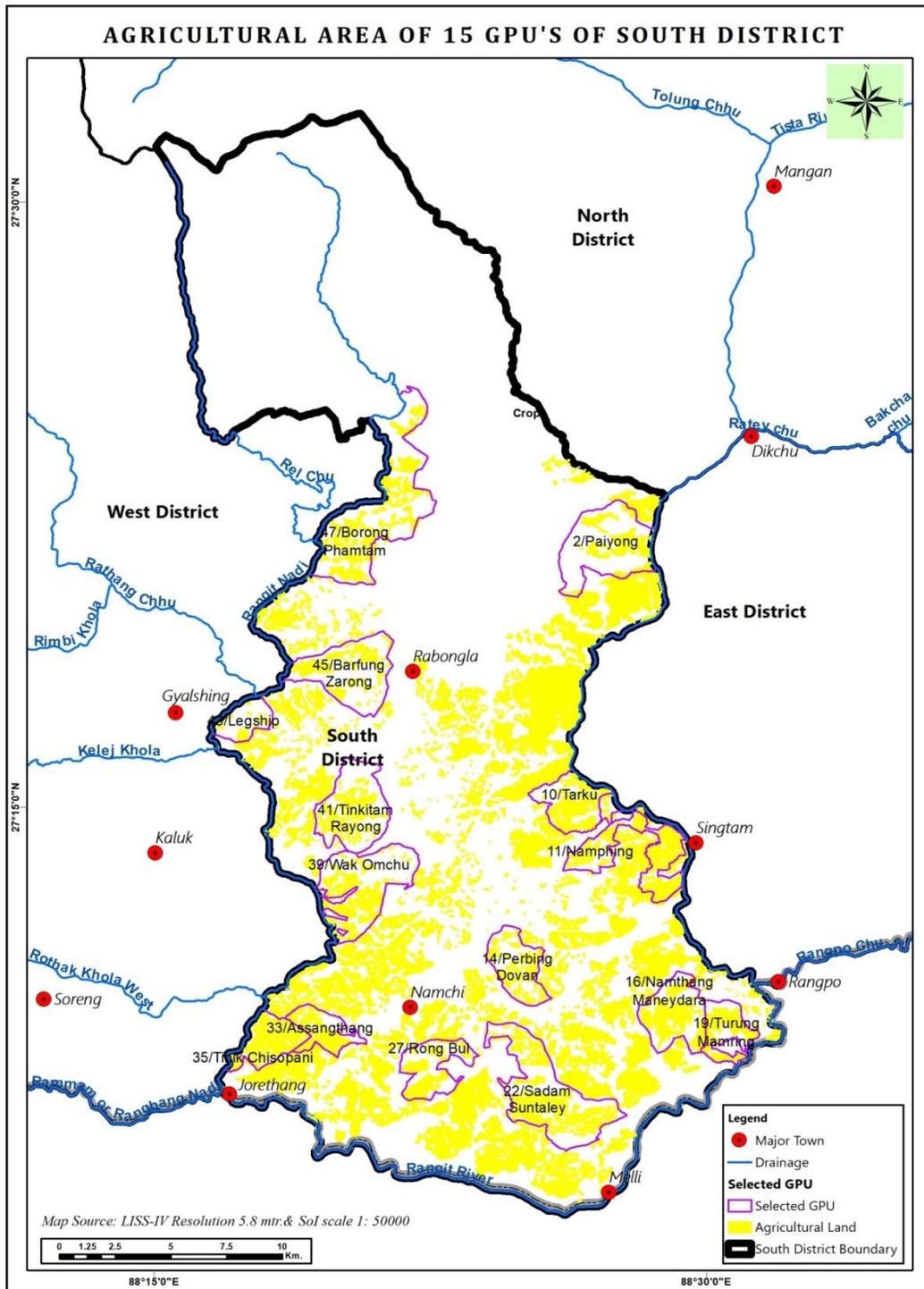
**Crops:** The main crops of Borong-Phamthang GPU in the lower belt are maize, paddy, ginger, orange and cardamom, in the middle belt maize, ginger and cardamom, but in the upper belt ginger, maize, potato and cardamom are grown. But the best practices in this GPU from lower belt to middle belt are ginger, maize and cardamom cultivation, and in the upper belt, cardamom, ginger, maize, vegetables, dairy and goatery. The main crops of Barfung-Zarrong GPU are maize, ginger, cardamom, and paddy. But the best practices from lower belt to upper belt are ginger, dairy farming, vegetables and floriculture. The main crops of Paiyong GPU are paddy, maize, millet, wheat, mustard and ginger. The main crops of Tinikitam-Rayong GPU from lower belt to middle belt are maize and ginger but in the upper belt ginger, maize and potato are common. The best practices of crops in this GPU in the lower belt are ginger, cardamom and orange, in middle belt ginger and cardamom but in the upper belt ginger, potato and cardamom grow best. The main crops of Perbing-Dovan GPU in the lower belt are maize, pulses and ginger, middle belt has maize, potato and cauliflower but in the upper belt potato, maize, radish, cabbage and cauliflower are grown. However, the best practice of crops in this GPU is mixed farming of peas, potato and cabbage. But the potentiality of ginger, broom, potato and cabbage is high.

**Period of Intensity:** The farming system in Borong-Phamthang GPU is traditional way of farming. The total households involved in modern way of farming is only 10 percent and likewise total area under modern farming techniques is only 5 percent (VDAP-2011). The rest i.e. 90 percent of households and 95 percent of area follow traditional way of farming. The farming system in Barfung-Zarung GPU is both modern and traditional way of farming. The total households involved in modern way of farming are only 10 percent and the total area under modern farming techniques is only 4 percent (VDAP-2011). The rest 90 percent of households and 96 percent area are covered by traditional way of farming. The farming system in this GPU is traditional way of farming. The total households involved in modern way of farming are only 25 household (VDAP-2011) and total area under modern farming techniques is only 1 acre. The farming system in Paiyong GPU is traditional way of farming. The total households involved in modern way of farming are only 25 household (VDAP-2011) and total area under modern farming techniques is only 1 acre. The farming system in Tinkitam-Rayong GPU is overwhelmingly traditional. Only 1 percent of households are involved in modern way of farming and likewise total area under modern farming is only 1 percent (VDAP-2011). In the case of Perbing-Dovan GPU both modern and traditional systems are observed. The total households involved modern way of farming are 65 percent of households and total area under

modern farming techniques is 5 percent (VDAP-2011). The rest almost 35 percent of households and 95 percent of area is covered by traditional way of farming.

**Period of Intensity:** In Borong-Phamthang GPU, the intensity of agriculture activities is low in the months of January, October, November and December. The medium intensity occurs in the months of July, August, and September. There are five months of high intensity in agriculture activities i.e. February, March, April, May, and June. Likewise, in Barfung-Zarung the months of January, September, October, November and December have low intensity. The medium intensity is seen in only two months i.e. July and August and high intensity occurs in February, March, April, May and June. In Tinkitam-Rayong GPU the farming system is overwhelmingly traditional. Only 1 percent of households are involved in modern way of farming and likewise total area under modern farming is only 1 percent (VDAP-2011). In Perbing-Dovan three months have low intensity of agriculture activities i.e. January, September and October. The medium intensity occurs in the months of May, June, November and December, There are five months of high intensity in agriculture activities .i.e. February, March, April, July and August.

Map No. 10

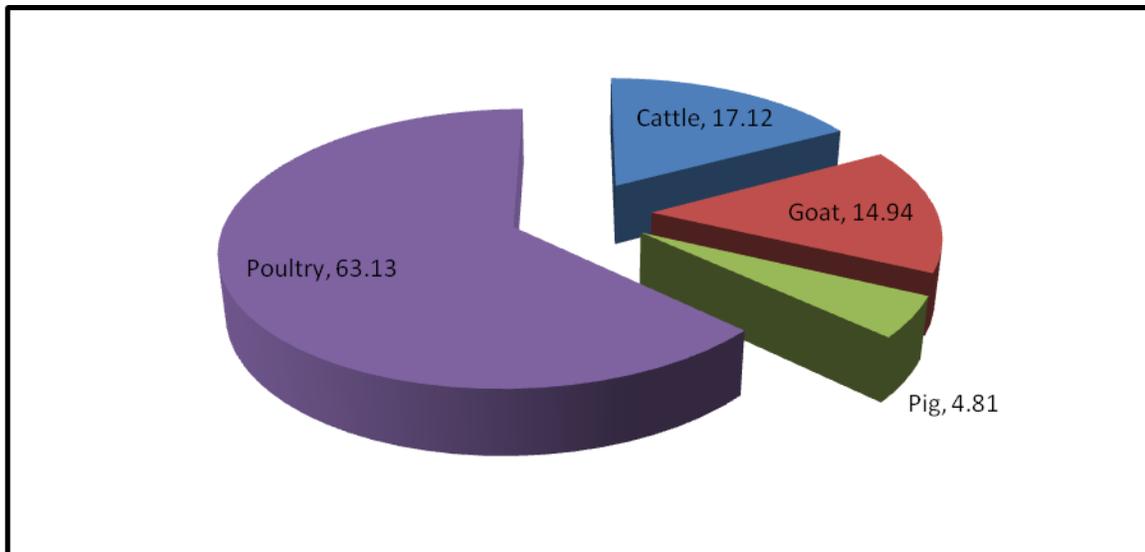


## Availability of Livestock

**Table 3.12: Total Number of Livestock Availability in Five GPUs (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)**

Sl. No.	Livestock	Availability of Livestock Mean $\pm$ S.D.	Standard Error
1.	Cattle	3873 $\pm$ 33.7105	13.7622
2.	Goat	3378 $\pm$ 27.4881	11.2220
3.	Pig	1088 $\pm$ 36.2767	14.8099
4.	Poultry	14279 $\pm$ 35.6146	14.5396
	Total	22618 $\pm$ 3.4641	1.4142

Source: Department of AHLF&VS, 2012.



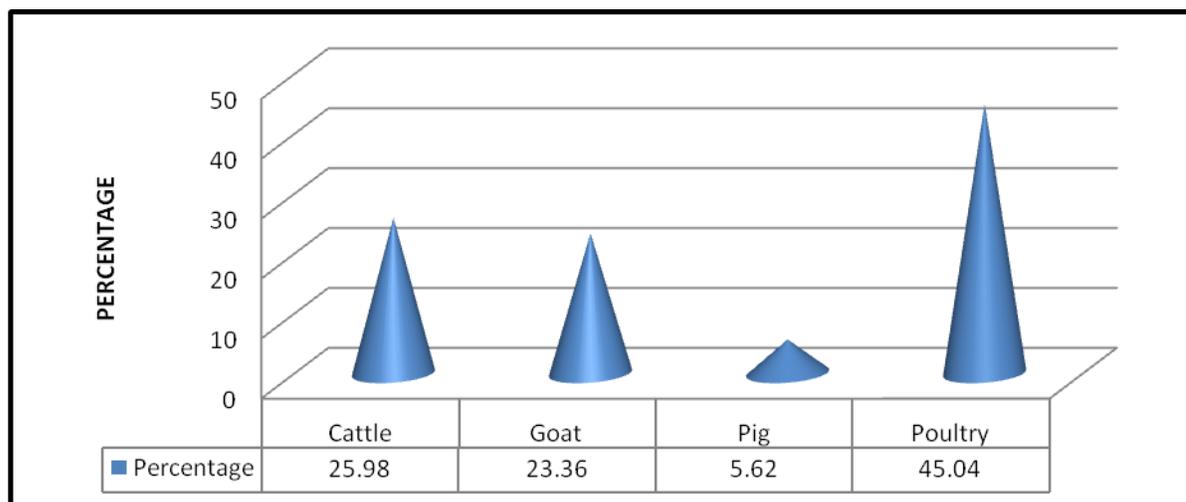
**Figure 3.5: Percentagewise Distribution of Livestock in Five GPUs (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)**

The total number of livestock available in five GPUs - Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring has been compared in the above figure. The highest available livestock is poultry which has the significant mean  $\pm$  S.D. i.e. 3873 $\pm$ 33.7105 and its corresponding standard error is calculated as 13.7622. The second largest available livestock is cattle and the mean  $\pm$ S.D. is 3873 $\pm$ 33.7105 and its corresponding standard error is calculated as 13.7622. Goat comes third with significant mean of 3378 $\pm$ 27.4881 and standard error of 11.2220.

**Table 3.13: Total Number of Livestock Availability in Five GPUs (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)**

Sl. No.	Livestock	Availability of Livestock	Mean $\pm$ S.D.	Standard Error
1.	Cattle	3895 $\pm$ 23.2292		9.4833
2.	Goat	3501 $\pm$ 17.6181		7.1925
3.	Pig	842 $\pm$ 19.6774		8.0332
4.	Poultry	6752 $\pm$ 12.4096		5.0662
	Total	14990 $\pm$ 10.2956		4.2031

Source: Department of AHLF&VS, 2012.



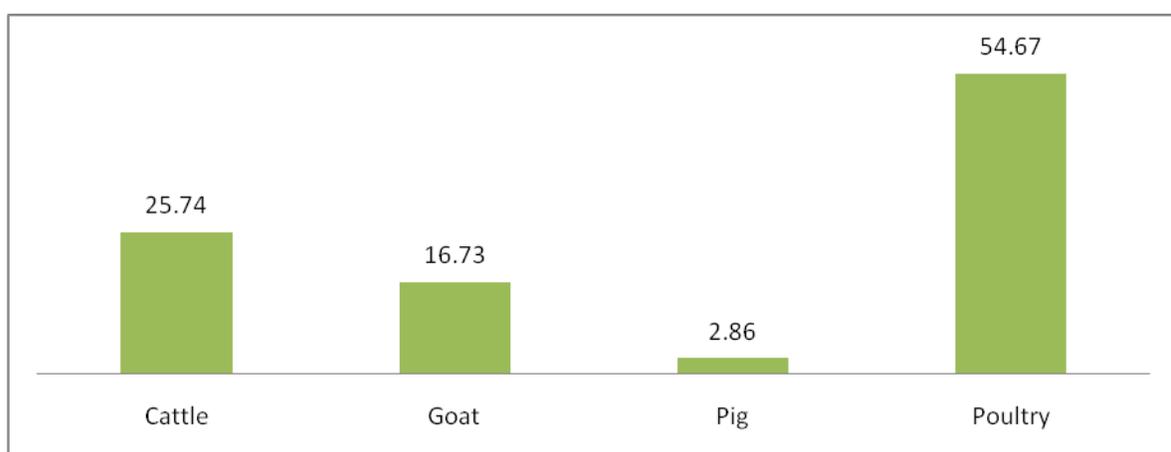
**Figure 3.6:** Percentagewise distribution of Livestock in Five GPU (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)

The total number of livestock available in five GPUs - Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu has been compared in the above figure which makes it clear that the highest availability of livestock is in poultry which has the significant mean  $\pm$  S.D. i.e. 6752 $\pm$ 12.4096 and its corresponding standard error is calculated as 5.0662. The second largest available livestock is cattle and the mean  $\pm$ S.D. is 3895 $\pm$ 23.2292 and its corresponding standard error is calculated as 9.4833, followed by goat (3501 $\pm$ 17.6181) and pig (842 $\pm$ 19.6774).

**Table 3.14: Total Number of Livestock Availability in Five GPU (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)**

Sl. No.	Livestock	Availability of Livestock	Mean $\pm$ S.D.	Standard Error
1.	Cattle	5204 $\pm$ 10.1980		4.1633
2.	Goat	3383 $\pm$ 9.3380		3.8122
3.	Pig	578 $\pm$ 9.1214		3.7238
4.	Poultry	11052 $\pm$ 10.7888		4.4095
	Total	20217 $\pm$ 48.6004		19.8410

Source: Department of AHLF&VS, 2012.

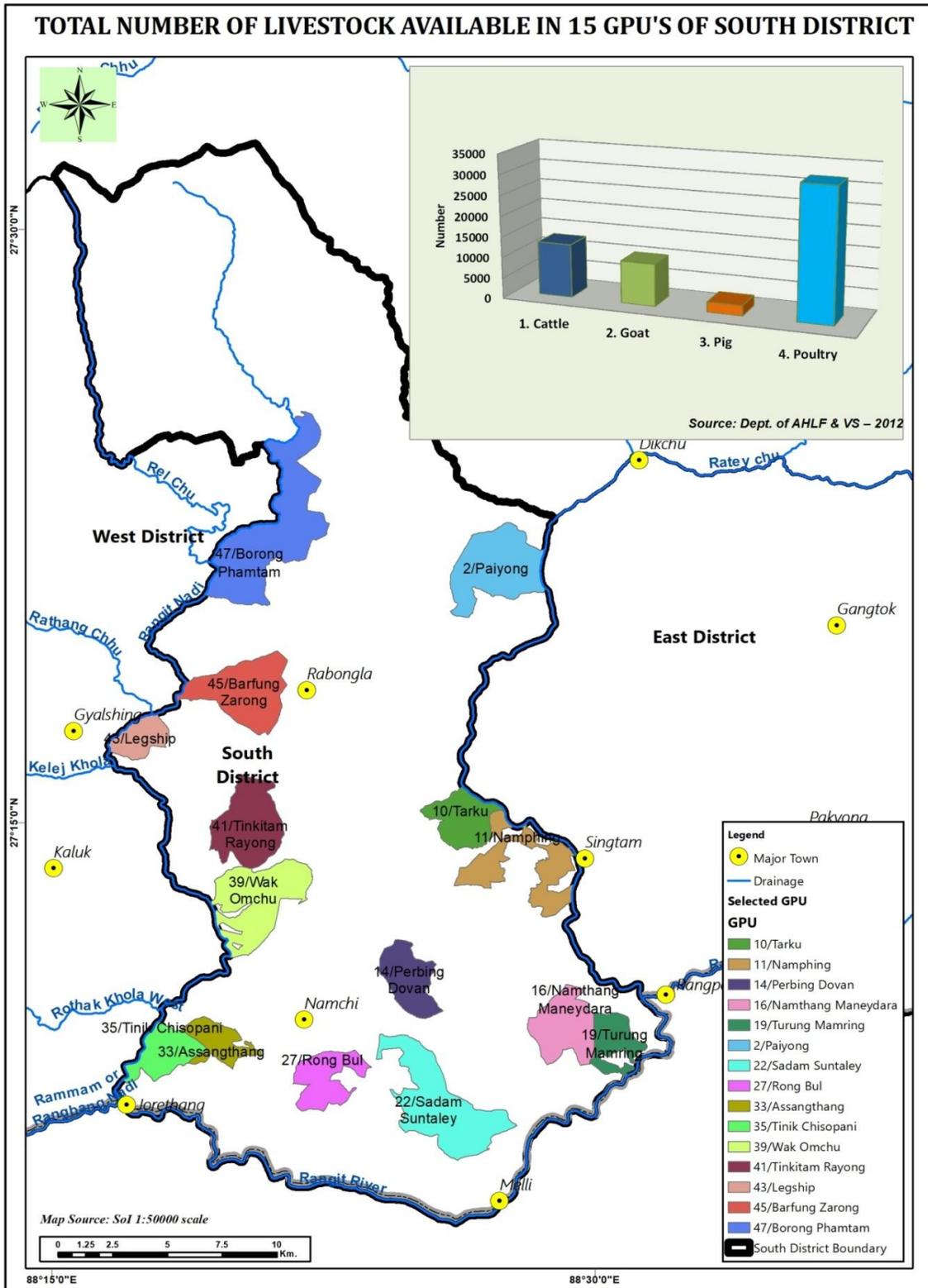


**Figure 3.7: Percentagewise distribution of Livestock in Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)**

The total number of livestock available in five GPUs - Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan has been compared in figure 3.7. The highest availability of livestock is poultry which has the significant mean  $\pm$  S.D. i.e. 11052 $\pm$ 10.7888 and its corresponding standard error is calculated as 4.409. The second largest available livestock is cattle and the mean  $\pm$ S.D. is 5204 $\pm$ 10.1980 and its corresponding standard error is calculated as 4.1633, followed by goat (3383 $\pm$ 9.3380) and pig (578 $\pm$ 9.1214).

It has been observed that in almost all GPUs, the number of poultry is highest. But it should be kept in mind that the poultry are low maintenance livestock compared to cattle, goats and pig. As far as the significance in terms of livelihood is concerned, cattle rank first for obvious reasons.

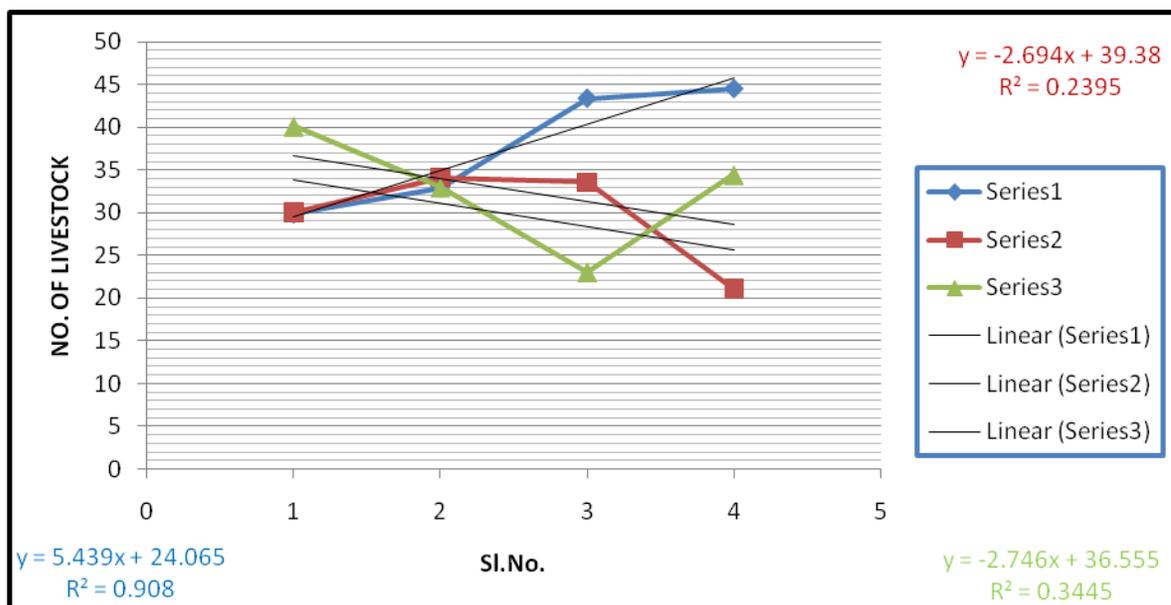
Map No. 11



**Table 3.15: Percentagewise Distribution of Livestock in 15 GPUs**

Sl. No.	Livestock	Five GPU (300-900 metres)	Five GPUs (900-1500 metres)	Five GPUs (1500-2100 metres)	Total (%)
1.	Cattle	29.86	30.02	40.12	100.00
2.	Goat	32.91	34.12	32.97	100.00
3.	Pig	43.38	33.57	23.04	100.00
4.	Poultry	44.50	21.05	34.45	100.00

Source: Department of AHLF&VS, 2012.



**Figure 3.8: Percentagewise Distribution of Livestock in 15 GPUs**

The figure 3.8 indicates the percentagewise distribution of livestock in 15 GPUs based on the secondary data compilation which makes it clear that the series 1, 2 and 3 show the regression lines corresponding to five GPUs between 300m to 900m, between 900m to 1500m and between 1500m to 2100m respectively. The first regression curve shows a highly significant trend as compared to the other two. First curve is increasing in order show that its value is positive in the form of  $y=mx+c$ , that is  $y = 5.439x + 24.065$  and corresponding regression value is  $R^2 = 0.908$ . The series 2 and series 3 curves show a decreasing order and seem less significant as compared to the first and corresponding straight line equations are  $y = -2.694x + 39.38$  and  $= -2.746x + 36.555$  respectively. In the regression methods there are two variables i.e. independent and dependent. In this table livestock is dependent variable and elevation is

independent variable, because livestock always depends on altitude to survive and adjust with natural climate.

**Table 3.16: Income Generated From Livestock Per Annum in Five GPUs, Set I**  
(Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)

Sl. No.	Livestock	Income (Rs.) Mean $\pm$ S.D.	Standard Error
1.	Dairy	941400 $\pm$ 5.0990	2.0816
2.	Goatery	325100 $\pm$ 41.2116	16.8245
3.	Piggery	81800 $\pm$ 64.7888	26.4499
4.	Poultry	286000 $\pm$ 362.4643	1.4797
	Total	1634300 $\pm$ 97.1193	39.6488

Source: Department of AHLF&VS, 2012.

The income generated from livestock per annum in five GPUs such as dairy, goatery, piggery, and poultry of Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring is indicated in table 3.16. The highest income value is generated from dairy which has 57.60 percent among others livestock. This indicates that the inhabitants of five GPUs depend on the dairy farming which is more suitable and reliable source of income due the availability of its required facilities. However, other livestock's also contribute towards generation of income in villages like goatery (19.89%), poultry farming (17.50%), and piggery farming (5.01 %) respectively.

**Table 3.17: Income Generated From Livestock Per Annum in Five GPUs, Set II**  
(Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)

Sl. No.	Livestock	Income (Rs.) Mean $\pm$ S.D.	Standard Error
1.	Dairy	36000 $\pm$ 901.9811	3.6823
2.	Goatery	22500 $\pm$ 90.4013	36.9061
3.	Piggery	28000 $\pm$ 784.6334	3.2032
4.	Poultry	94000 $\pm$ 823.2635	3.3609
	Total	180500 $\pm$ 79.1403	32.3089

Source: Department of AHLF&VS, 2012.

The income as shown above shows the comparison between dairy, goatery, piggery, and poultry of Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu in the form of the significant mean $\pm$  S.D. and standard error. The highest income value is generated from poultry farming that is 94000 $\pm$ 823.2635 and its corresponding error is calculated as 3.3609. This result indicates that the inhabitants of five GPUs depend on the

poultry farming which is more suitable and reliable source of income due to easy availability. In descending order the income from various livestock is: dairy (36000±901.9811), piggery farming (28000±784.6334), and goatery (22500±90.4013). The overall income generated by five GPUs has a significant mean± S.D. i.e. 180500±79.1403 and its standard error calculated as 32.3089.

**Table 3.18: Income Generated From Livestock Per Annum in Five GPUs, Set III**  
(Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)

Sl.No.	Livestock	Income (Rs.)	Mean ±S.D.	Standard Error
1.	Dairy	189300±63.4539		25.9049
2.	Goatery	68800±38.7969		15.8387
3.	Piggery	158800±66.2178		27.0333
4.	Poultry	72700±74.2266		303029
	Total	489600±74.4795		30.4061

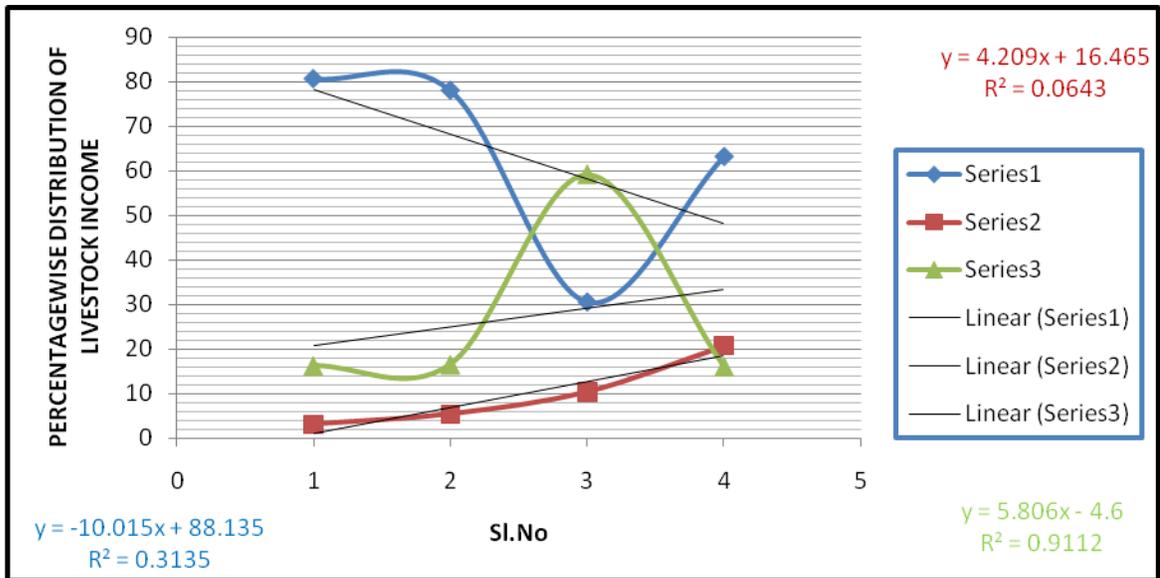
Source: Department of AHLF&VS, 2012.

The income from dairy, goatery, piggery, and poultry of Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan GPUs is shown in table 3.18. The highest income value is generated from dairy that is Rs. 1, 89, 300. This indicates that the inhabitants of these GPUs depend more on dairy farming. Piggery farming is also successful in higher altitude due to availability of space and suitable climatic conditions and contribute second highest income i.e. Rs. 1, 58,800. Similarly, poultry and goatery also support the income generating mechanism but to a lesser extent than dairy and piggery farming.

**Table 3.19: Percentagewise Distribution of Income in 15 GPUs**

Sl. No	Livestock	GPUs between 300 -900 metres	GPUs between 900 -1500 metres	GPUs between 1500 - 2100 metres	Total (%)
1.	Dairy	80.69	3.08	16.23	100.00
2	Goatery	78.07	5.40	16.53	100.00
3.	Piggery	30.45	10.42	59.13	100.00
4.	Poultry	63.18	20.76	16.06	100.00

Source: Department of AHLF&VS, 2012.



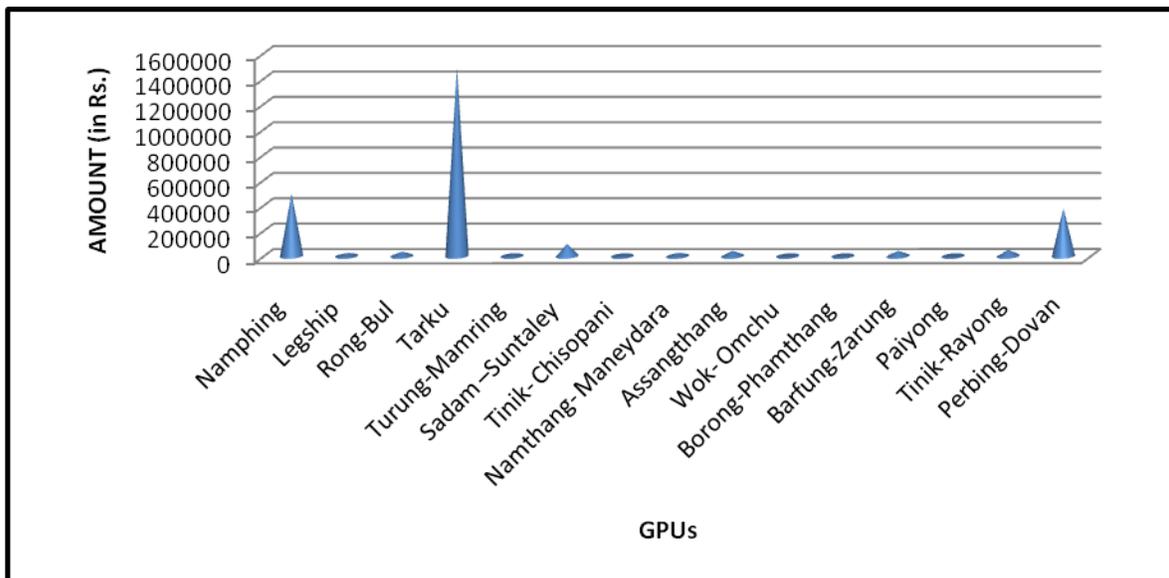
**Figure 3.9:** Percentagewise Distribution of Income in 15 GPUs

The figure 3.9 indicates the Percentagewise distribution of livestock in 15 GPUS based on the secondary data compilation. It is clear that the series 1, 2 and 3 show the regression lines corresponding to Five GPUs falling within 300m to 900 m, 900m to1500m, and 1500m to 2100m respectively and comparison has been made of available livestock, namely, cattle, goat, pig and poultry. First regression curve shows the value of  $y = -10.015x + 88.135$  and corresponding regression value is  $R^2 = 0.3135$ . Similarly, the series 2 and series 3 curves show equations of  $y = 4.209x + 16.465$  and  $y = 5.806x - 4.6$  respectively. The linear series 1 shows the negative; because the income from livestock i.e. dairy is high initially but other livestock income is descending. In the linear series 2 percentage of income of livestock is less even though there is sign of increasing rate of income that's why this line shows moderately positive sign. In the case of linear series 3 there is also indication of increasing income of livestock; the line shows positive.

**Table 3.20: Income Generated in 15 GPUs from Livestock Per Annum**

Sl. No.	Gram Panchayat Units	Amount (in Rs.)	Mean±S.D.	Standard Error
1.	Namphing	494000±34.3336		14.0166
2.	Legship	24000±18.9631		7.7416
3.	Rong-Bul	35600±37.4326		15.2818
4.	Tarku	1490000±48.7007		19.8820
5.	Turung-Mamring	14500±56.4482		23.0448
6.	Sadam –Suntaley	97000±45.2327		18.4661
7.	Tinik- Chisopani	12000±47.9124		19.5601
8.	Namthang- Maneydara	24000±42.6286		17.4030
9.	Assangthang	41500±27.9928		11.4280
10.	Wok- Omchu	6000±42.8158		17.4795
11.	Borong-Phamthang	11000±23.4520		9.5742
12.	Barfung-Zarung	43500±23.2292		9.4833
13.	Paiyong	5100±49.4732		20.1973
14.	Tinik-Rayong	50000±26.7731		10.9300
15.	Perbing-Dovan	380000±23.5202		9.6020
	Total	2728200±64.9730		26.5251

Source: Source: VDAP, 2011.



**Figure 3.10: Income Generated of 15 GPUs from Livestock Per Annum**

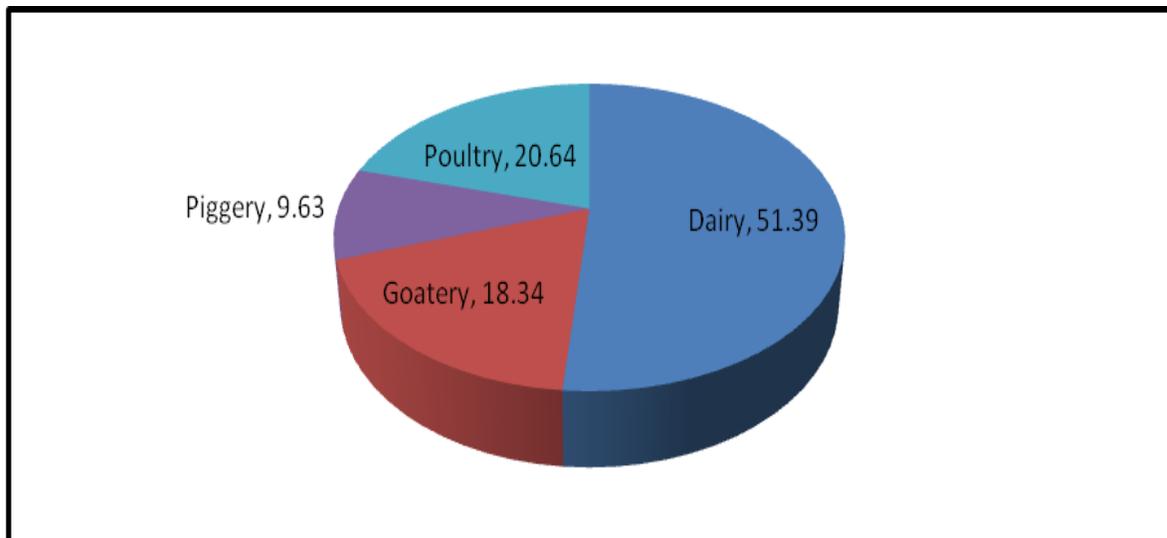
The table 3.20 shows the income generation from livestock of 15 GPUs, the significant mean±S.D. and standard error. The highest income value generated from livestock is in Tarku which is 1490000±48.7007 and its corresponding error is calculated as 19.8820. The second

and third highest income generated from livestock are from two GPUs i.e., Namphing and Perbing-Dovan and their mean± S.D. are 494000±34.3336, 380000±23.5202 and corresponding errors are 14.0166 and 9.6020 respectively. The other GPUs do have average income from livestock. But the lowest income generated from livestock is in the Paiyong GPU that is 5100±49.4732 and its corresponding error is calculated as 20.1973. The landform structure, availability of water, favourable climatic conditions, availability of fodder trees etc. are conducive for rearing of cattle in any particular place. Here, Tarku, Namphing and Perbing-Dovan GPUs have such kinds of favourable components for rearing of cattle.

**Table 3.21: Income Generated from Livestock Per Annum (Average) of 15 GPUs**

Sl. No.	Livestock	Percentage	Mean±S.D.	Standard Error
1.	Dairy	51.39±34.5774		14.1161
2.	Goatery	18.34±10.8949		4.4478
3.	Piggery	9.63±5.2153		2.1291
4.	Poultry	20.64±12.7279		5.1961
	Total	100.0±25.3456		10.3473

*Source:* Compiled by Researcher.



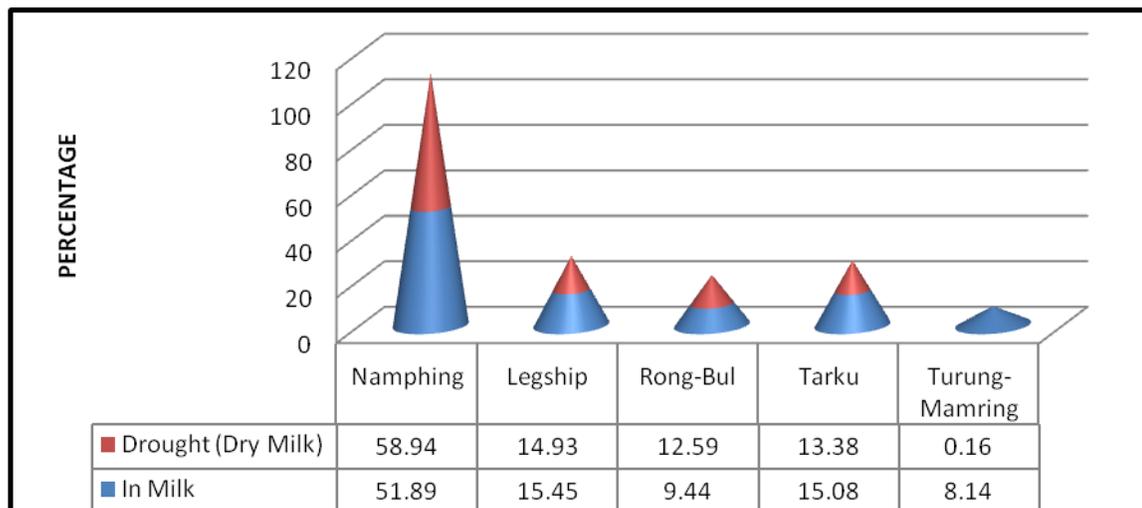
**Figure 3.11: Income Generated from Livestock Per Annum (Average) of 15 GPUs**

Overall, it is found that of all livestock, highest percentage i.e. more than half of income is generated from dairy farming. It is seen that maximum villagers domesticate cattle in almost all GPUs to supplement their income. After dairy farming, 20.64 percent and 18.34 percent income come from Poultry and Goatery respectively. Income is low (9.63 percent) from piggery.

**Table 3.22: Milk and Drought (Dry Milk) Cow of Five GPUs, Set I**

Name of GPU	In Milk Mean $\pm$ S.D.	Standard Error	Drought (Dry Milk) Mean $\pm$ S.D.	Standard Error
Namphing	561 $\pm$ 35.0770	14.3201	379 $\pm$ 41.8760	17.0958
Legship	167 $\pm$ 30.5614	12.4766	96 $\pm$ 48.7975	19.9215
Rong-Bul	102 $\pm$ 35.5640	14.5189	81 $\pm$ 26.3590	10.7610
Tarku	163 $\pm$ 31.1640	12.7226	86 $\pm$ 38.3144	15.6418
Turung-Mamring	88 $\pm$ 53.1337	21.6917	01 $\pm$ .8811	.3597
Total	1081 $\pm$ 43.5201	17.7670	643 $\pm$ 31.0934	12.6938

Source: Department of AHLF&VS, 2012.



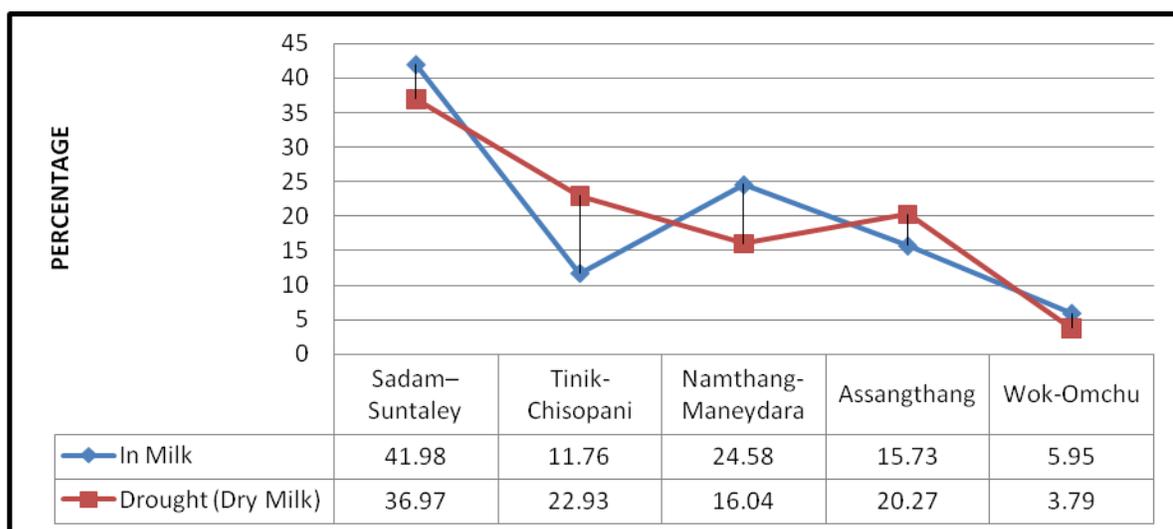
**Figure 3.12: Total Number of Milk and Drought (Dry Milk) Cows of Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring GPUs**

The table 3.22 shows comparison between Milk and Drought (Dry Milk) Cows of Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring GPUs with the significant mean  $\pm$  S.D. and standard error. The mean, S.D. of Milk cow of five GPU is 1081 $\pm$ 43.5201 and its corresponding error is 17.7670. This result indicates that the inhabitants of five GPUs depend on the Dairy farming and the Milk cow numbers are more compared to Drought cow. The mean  $\pm$ S.D value of Drought cow is 643 $\pm$ 31.0934 and Standard error is 12.6938. The lowest numbers of Milking and Dry Milk cows are found in Turung-Mamring GPUs due to scarcity of water, lack of fodder tress and people are found engaged in part-time job in factories.

**Table 3.23: Milk and Drought (Dry Milk) Cow of Five GPUs, Set II**

Name of GPU	In Milk Mean $\pm$ S.D.	Standard Error	Drought (Dry Milk) Mean $\pm$ S.D.	Standard Error
Sadam–Suntaley	275 $\pm$ 35.0257	14.2991	166 $\pm$ 27.5245	11.2368
Tinik-Chisopani	77 $\pm$ 20.5912	8.4063	103 $\pm$ 25.1077	10.2502
Namthang-Maneydara	161 $\pm$ 35.0941	14.3271	72 $\pm$ 25.6826	10.4849
Assangthang	103 $\pm$ 43.6669	17.8269	91 $\pm$ 30.6267	12.5033
Wok-Omchu	39 $\pm$ 17.8997	7.3075	17 $\pm$ 7.6681	3.1305
Total	655 $\pm$ 30.2588	12.3531	449 $\pm$ 26.3286	10.7486

Source: Department of AHLF&VS, 2012.



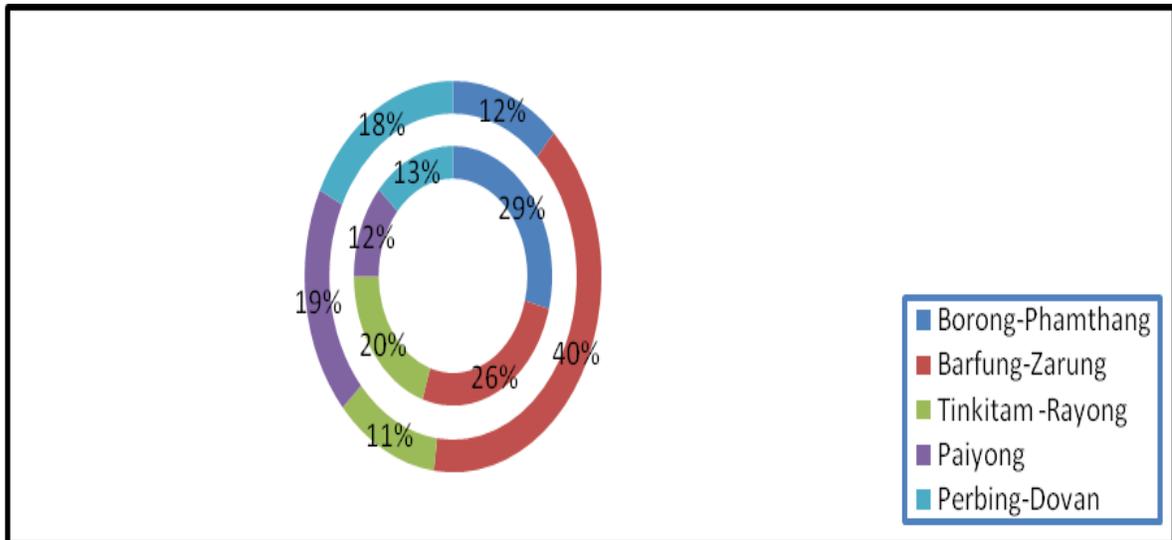
**Figure 3.13: Total Number of Milk and Drought (Dry Milk) Cow of Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang & Wok-Omchu)**

The table 3.23 shows the Milk and Drought (Dry Milk) Cows of Five GPUs of Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu. The highest number of Milk and Drought (Dry Milk) Cows has been found in Sadam-Suntaley GPU and the lowest has been found in Wok-Omchu GPU. The number of population has a correlation with the number of cattle reared in a village. The total population of Sadam-Suntaley GPU is 4,021 while Wok-Omchu GPU has only 1,856 persons as per 2011 census. Consequently Sadam-Suntaley GPU has much higher number of Milk and Drought (Dry Milk) Cows than Wok-Omchu and other areas.

**Table 3.24: Milk and Drought (Dry Milk) Cow of Five GPUs, Set III**

Name of GPU	In Milk Mean $\pm$ S.D.	Standard Error	Drought (Dry Milk) Mean $\pm$ S.D.	Standard Error
Borong-Phamthang	379 $\pm$ 35.1169	14.3364	98 $\pm$ 56.1106	22.9070
Barfung-Zarung	338 $\pm$ 18.7616	7.6594	331 $\pm$ 48.6621	19.8662
Tinkitam -Rayong	259 $\pm$ 30.6398	12.5086	93 $\pm$ 54.1664	22.1133
Paiyong	151 $\pm$ 34.7044	14.1680	156 $\pm$ 38.3614	15.6609
Perbing-Dovan	176 $\pm$ 27.9857	11.4251	146 $\pm$ 33.8467	13.8178
Total	1303 $\pm$ 68.7808	28.0796	824 $\pm$ 15.3103	6.2503

Source: Department of AHLF&VS, 2012.



**Figure 3.14:** Total Number of Milk and Drought (Dry Milk) Cow of Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)

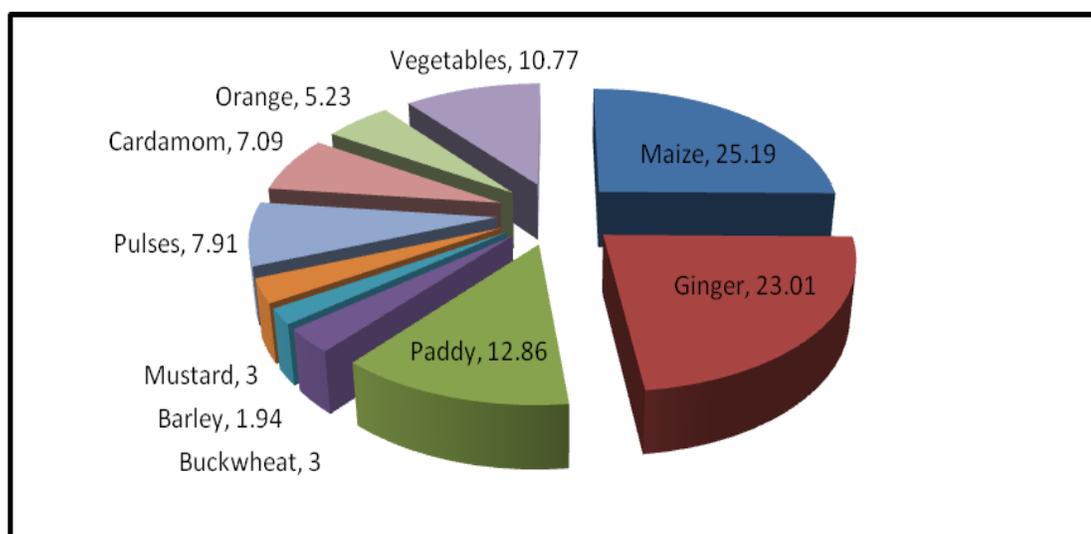
The figure 3.14 shows Milk and Drought (Dry Milk) Cows of Five GPUs viz. Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan. The crust represents Drought (Dry Milk) Cows and mantle shows the Milk cows. As per above figure in both crust and mantle, Barfung-Zarung GPU secures the highest percentage in both Milk and Drought (Dry Milk) Cows i.e. 40 and 26 percent respectively. Some of the reasons such as favourable climatic conditions, ample space, consumption of meat and highest total population i.e. 5,835 as per 2011 census among other the GPUs are behind the highest number of Milk and Drought (Dry Milk) Cows in Barfung-Zarung GPU.

## Availability of Crops and Ways of Farming in the Study Area

**Table 3.25: Percentagewise Availability of Crops in Study Areas**

Sl. No	Main Crops	Availability of crops Mean $\pm$ S.D.	Standard Error
1.	Maize	25.19 $\pm$ 16.1121	6.5777
2.	Ginger	23.01 $\pm$ 13.0384	5.3229
3.	Paddy	12.86 $\pm$ 8.9218	3.6423
4.	Buckwheat	3.00 $\pm$ 1.5811	.6455
5.	Barley	1.94 $\pm$ 1.1715	.4782
6.	Mustard	3.00 $\pm$ 1.5811	.6455
7.	Pulses	7.91 $\pm$ 5.1282	2.0936
8.	Cardamom	7.09 $\pm$ 5.6921	2.3237
9.	Orange	5.23 $\pm$ 3.4741	1.4183
10.	Vegetables	10.77 $\pm$ 5.9563	2.4316
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.



**Figure 3.15: Percentagewise Availability of Crops in Selected Areas**

The table (3.25) and figure 3.15 present the percentagewise availability of crops and a comparison between maize, ginger, paddy, buckwheat, barley, mustard, pulses, cardamom, orange and vegetables. The table shows the significant mean  $\pm$ S.D. and standard error. The highest available crop is maize that is 25.19 $\pm$ 16.1121 and its corresponding error is calculated

as 6.5777. The second highest available crop is ginger and it has significant mean  $\pm$ S.D. is 23.01 $\pm$ 13.0384 and its corresponding error is calculated as 5.3229. After maize and ginger come paddy, (12.86 $\pm$ 8.9218), vegetables (10.77 $\pm$ 5.9563), pulses (7.91 $\pm$ 5.1282) and cardamom (7.09 $\pm$ 5.6921) respectively. But the lowest crop available is barley having the mean  $\pm$ S.D. of 1.94 $\pm$ 1.1715 and its corresponding error is calculated as .4782. The above table shows that maize is the dominant crop in the study area. The second available crop is ginger, an important spice and grown in almost all parts of South district, but mostly confined in mid and low altitude areas. The climate and soil of South district are particularly favourable for ginger. For many farmers in the district, ginger cultivation is the primary source of income.

**Table 3.26: Traditional Way of Farming**

Sl. No.	Gram Panchayat Units (GPUs)	Traditional (%)	Mean $\pm$ S.D.	Standard Error
1.	Namphing	99.00 $\pm$ 41.6076		16.9862
2.	Legship	100.00 $\pm$ 25.7449		10.5103
3.	Rong-Bul	99.00 $\pm$ 41.6076		16.9862
4.	Tarku	95.00 $\pm$ 21.7715		8.8881
5.	Turung-Mamring	35.00 $\pm$ 13.6088		5.5557
6.	Sadam –Suntaley	66 $\pm$ 36.1220		14.7467
7.	Tinik- Chisopani	94.00 $\pm$ 29.1547		11.9023
8.	Namthang- Maneydara	96.00 $\pm$ 33.2806		13.5867
9.	Assangthang	99.00 $\pm$ 41.6076		16.9862
10.	Wok- Omchu	90.00 $\pm$ 27.5100		11.2309
11.	Borong-Phamthang	90.00 $\pm$ 27.5100		11.2309
12.	Barfung-Zarung	90.00 $\pm$ 27.5100		11.2309
13.	Paiyong	92.00 $\pm$ 29.3121		11.9666
14.	Tinik-Rayong	99.00 $\pm$ 41.6076		16.9862
15.	Perbing-Dovan	35.00 $\pm$ 13.6088		5.5557

Source: VDAP, 2011.

The above table illustrates that most of the GPUs of the district still follow the traditional way of farming which ranges between 90-100 percent. Among 15 GPUs, only two GPUs i.e., (Turung-Mamring and Perbing-Dovan) are adopting less traditional way of farming and the significant mean  $\pm$ S.D. for the two are (35.0 $\pm$ 13.6088), (35.0 $\pm$ 13.6088) and corresponding

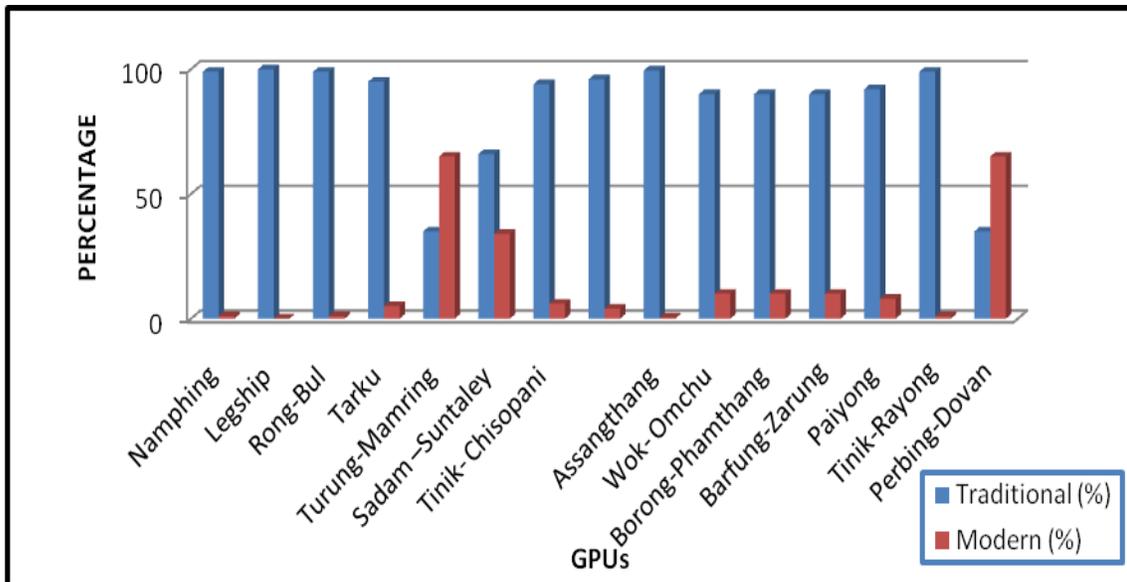
errors are (5.5557) and (5.5557) respectively. Sadam-Suntaley is the GPU where traditional way of farming is less adopted; it has significant mean± S.D. of 66±36.1220 and corresponding error is calculated as 14.7467. Farmers of Sikkim follow the traditional way of farming due to the physiographic features and conservative market, but it is high time to adopt modern ways of farming.

**Table 3.27: Modern Way of Farming**

Sl. No.	Gram Panchayat Units (GPUs)	Modern (%) Mean ±S.D.	Standard Error
1.	Namphing	1.00±.6841	.2792
2.	Legship	0.00±.0000	.0000
3.	Rong-Bul	1.00±.6841	.2792
4.	Tarku	5.00±2.8816	1.1764
5.	Turung-Mamring	65.00±13.2815	5.4221
6.	Sadam -Suntaley	34.00±8.8994	3.6331
7.	Tinik- -Chisopani	6.00±3.7416	1.5275
8.	Namthang- -Maneydara	4.00±2.0976	.8563
9.	Assangthang	0.500±.2607	.1064
10.	Wok- -Omchu	10.00±5.6213	2.2949
11.	Borong-Phamthang	10.00±5.6213	2.2949
12.	Barfung-Zarung	10.00±5.6213	2.2949
13.	Paiyong	8.00±4.6043	1.8797
14.	Tinik-Rayong	1.00±.6841	.2792
15.	Perbing-Dovan	65.00±13.2815	5.4221

Source: VDAP, 2011.

The table 3.27 shows that most GPUs of South Sikkim do not follow the modern way of farming and those GPUs which follow modern way farming ranges between 0-10 percent only. Among 15 GPUs, only three GPUs i.e., (Turung-Mamring, Perbing-Dovan and Sadam-Suntaley) have adopted modern way of farming in larger scale as per the above data.



**Figure 3.16:** Comparison between Traditional and Modern Ways of Farming

The agriculture system in the State of Sikkim was purely traditional with agrarian economy over centuries due to remoteness, inaccessibility, fragility and marginality (Gazetteer, 2013). The above figure reveals that maximum Gram Panchayat Units follow the traditional way of farming. Farmers of some GPUs like Turung-Mamring, Perbing-Dovan and Sadam-Suntaley, practise modern way of farming to a comparatively larger extent. Some GPUs like Namphing, Legship, Rong-Bul, Assangthang, Tinik-Rayong have very small percentage of modern farming practices. The rest of the GPUs are slowly adopting modern ways of farming. The 2015-16 agriculture progress report shows that productivity in both rabi and kharif season is good in two GPUs i.e. Turung-Mamring and Sadam-Suntaley, but due to high altitude some of the rabi and kharif crops are not being grown in Perbing-Dovan GPU, even though this GPU practices modern way of farming. During fieldwork it has been observed that farmers of Turung-Mamring, Perbing-Dovan and Sadam-Suntaley GPUs also follow traditional farming predominantly.

Some of the things which come under modern farming include drip irrigation, mulching, line showing methods, maintenance of distance between crops, use of shade nets and green house etc. These are the major components of horticulture. In the high altitude areas like Perbing, Damthang, and Namchi, low cost green houses are well adopted by farmers. Cultivation of flowers, off-season vegetables and high value crops in the green house are proving to be highly profitable ventures. The farming system of South district may be categorized as mixed farming. Farmers depend on agriculture, horticulture and animal husbandry for their livelihood.

**Table 3.28: Households Main Economic Activities and Sources**

Sl. No.	Activities	Households involved in Economic Activities
1.	Agriculture+Animal Husbandry	1135
2.	Services	235
3.	Others	130
4.	Total	1500

*Source:* Field Survey, 2015-16.

The economic profile of Sikkim is presented under three broad heads, namely, (i) Agriculture and allied activities, (ii) Industries, and (iii) Services. The economic profile of the state shows an overwhelming dependence on agriculture and allied activities (Choudhury, 2006). The households main economic activity in the selected area include agriculture with animal husbandry and others activities which play a vital role in supporting and sustaining their livelihood. As per the above table, the highest number of households, i.e. 1,135 are involved in main economic activities viz. agriculture with animal husbandry. Actually, agriculture with animal husbandry covers over 76 percent in rural areas. The second highest number of households are involved is services and it has a total of 235 households. People in villages are involved in other activities too.

**Table 3.29: Agriculture Activities for Livelihood**

Sl. No.	Agriculture Activities	No. of Households Involved
1.	Mainly Subsistence	1,444
2.	Mainly Commercial	51
3.	No Agricultural Activity	5
	Total	1,500

*Source:* Field Survey, 2015-16.

Sikkim's agriculture thus remained highly subsistence oriented (Economic Survey, 2006-07). The agricultural activities for livelihood in study areas are mainly categorized into three groups - mainly subsistence, mainly commercial and no agricultural activity. The highest livelihood of Sikkim's farmers depends on mainly subsistence which covers around 96 percent and some households are marching towards commercial basis i.e. 3.4 percent in order to earn money for their family. Some of the households i.e. 0.33 percent in villages are not involved in agricultural activity due to less population, water scarcity, old age, but are involved in other forms of activities.

## References

- Bhatt S.C. and Gopal K. Bhargava. 2005. *Land and People of Indian States and Union Territories: Sikkim*. Vol. 34, Delhi: Kalpaz Publications.
- Choudhury, Maitreyee. 2004. "State of Agriculture in Sikkim" In *The Himalayan Miscellany*, Vol.15. CHS, University of West Bengal: 25-34
- Debnath, J.C. 2009. *Economic History and Development of Sikkim*. Delhi: Abhijeet Publications: 46-47.
- GoS (Government of Sikkim). 2001. *Sikkim Human Development Report*. Mahendra P. Lama (ed.). Delhi: Social Science Press, GoS.
- 2005. *Trainer's Manual*. Gangtok Sikkim: Department of Agriculture and Horticulture, GoS.
- 2006. *Training Manual Horticultural Crops 2005-06*. Gangtok Sikkim: Department of Horticulture and Cash Crops Development, GoS.
- 2007. *Economic Survey 2006-2007*.Gangtok Sikkim: Department of Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS: 13.
- 2011. *Village Development Action Plan; A Plan For Realizing of A Poverty Free Sikkim*. Gangtok Sikkim: Department of Rural Management and Development, GoS.
- 2011. *Annual Progress Report 2010-2011*. Krishi Bhawan , Tadong, Gangtok: Development of Food Security and Agriculture, GoS:1
- 2012. *Report on 19<sup>th</sup> Livestock Census*. Krishi Bhawan, Gangtok: Department of Animal Husbandry Livestock, Fisheries and Veterinary Services, GoS.
- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS.
- Gorer, Geoffrey. 2005. *Himalayan Village: An account of the Lepchas of Sikkim*. (Second Edition), Varanasi, India: Pilgrims Publishing: 22.
- Khawas, V.2012. "Agriculture in the Sikkim Himalaya: A Geographical Note" In *Politics, Society and Development* edited by M.Yasin and D.P. Chhetri. Delhi: Kalpaz Publications: 193.
- Sikkim A to Z (2009-10) 2010. Tadong, Gangtok: Ghising Torrent International Pvt.Ltd:11.

Subba, J.R. 1984. *Agriculture in the Hills of Sikkim*. Gangtok, Sikkim: Sikkim Science Society:15

----- 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 102-103.

**Web Link**

<http://www.envis.nic.in/soer/soer-sikkim/resources> (Accessed on November 26,2010)

# Chapter 4

## Land Use and Land Reforms

### Introduction

There are spatial variations in terms of the general land use pattern of the different areas because of the diversities in landform and rainfall in various regions. It is essential to shift from general to particular areas where agriculture plays a vital role as a means of livelihood for majority of the people in.

Land use is an important subject particularly relevant to agricultural geography. According to J.L. Buck, land utilization is the satisfaction which the farm population derives from the type of agriculture; develop the provision for future production and contribution to national needs (Zuater 1951). Land use is also related to conservation of land from one major use to another general use (Nanvati, 1951). Land use is a geographical concept since it involves specific areas. The study of land use forms a significant part of geography and has assumed a place of pride in the field of applied geography. According to Symons (1978) the land use study forms the spearhead for the advance of geography into the applied sciences as maps of land use have been recognized as essential tools of regional planning and development (shodhganga.inflibnet.ac.in).

### Classification of Land Use/Land Utilization Pattern in Sikkim

Realizing the need of land utilization statistics for the state, the stock-wise survey was initiated in 1990-91 and the land utilization statistics of Sikkim of 1995-96 was published by the Department of Agriculture, Government of Sikkim. The land utilization statistics constitutes the basis of planning and development in agriculture and allied sectors. Crucial linkages do exist between the land utilization statistics and the economic growth of the state. Based on these data the potential land use plans could be drawn for more efficient and proper utilization to realize increased production of food, fodder, fuel, etc. in future. Obviously, the land is the most important natural resource, and requires a focused agenda encompassing the critical aspects of preservation, conservation and utilization for ever-growing needs and economic benefits of man (Bhutia, 2006).

According to the survey report of 1995-1996, published by the Department of Agriculture, Government of Sikkim, the nine fold classification of land utilization was adopted to generate data on area distribution under various classification of land use viz., forest, land put to non-

agricultural uses, barren and uncultivable land, permanent pastures and other growing lands, miscellaneous tree crops and groves not included in the net area sown, cultivable waste land, fallow lands other than current fallows, current fallows, and net area sown.

**Table 4.1: Old and New Classification of Land**

Sl. No.	Old Five Fold Classification	Sl. No.	New Nine Fold Classification
1.	Forest	1.	Forest
2.	Area not available for cultivation	2.	Land put to non-agricultural use
3.	Other Cultivated land excluding current fallow lands	3.	Barren and Uncultivable land
4.	Fallow Lands	4.	Permanent Pastures and other Grazing Lands
5.	Net Area Sown	5.	Miscellaneous tree crops and groves not included in the Net Area Sown
		6.	Cultivable waste
		7.	Fallow land other than current fallows
		8.	Current Fallows
		9.	Net Area Sown

*Source:* Subba, 2008

From the above table (4.1), it is seen that in the old classification land was classified into five categories only, viz. forest area not available for cultivation, other cultivated land excluding current fallows, fallow lands, and net area sown. However, in the new classification of land, it has been increased to nine fold i.e. forest, land put to non-agricultural use, barren and uncultivated land, permanent pastures and other grazing lands, miscellaneous tree crops and groves not included in the net area sown, cultivable waste, fallow land other than current fallows, current fallows and net area sown.

Sikkim being located in the Eastern Himalayas has a major chunk of its area under the snowy peaks and mountains ranges, including dense forests, the National Park and the restricted area for defense purpose. Hence, out of the total geographical area of 709,600 hectares, nearly 75 percent of the state's area (around 46 percent under the snowy peaks and ranges and about 29 percent under the dense forests) has not been taken into account in this survey of land utilization. Reporting area for land utilization statistics amounts to 24.58 percent of the total geographical area of Sikkim. The survey shows the distribution of reported area under various classifications of land use block-wise. The total arable land (the net area sown plus the current fallow and other lands) is estimated to be 95,136 hectares, i.e. 56.03 percent of the total reporting area. Around 50,708 hectares of land is under forests, constituting 29.74 percent of the reporting area. Land put to non-agricultural uses adds up to 2,607 hectares or 1.53 percent; barren and unculturable land 9,886 hectares, or 5.81 percent; permanent pastures and other

growing lands 4,371 hectares or 2.56 percent; land under miscellaneous tree crops and groves 5,436 hectare, or 3.19 percent; and culturable land 2,389 hectare, or 1.41 percent of the total reporting area (Bhutia, 2006). It is the first attempt to come up with this extensive survey about land utilization pattern in Sikkim.

Agriculture is the backbone of Sikkimese economy. More than 70 percent of the population depends upon agriculture and related activities to maintain their livelihood. Prior to 1975, the uncertainties of land tenure rights, negligible public investment and over dependence on traditional technologies had made cultivation in Sikkim very expensive. The economy was further obstructed by low productivity, negligible marketable surplus and other institutional backwardness. This was further affected by shifting cultivation in some important geographical pockets and unsuccessful structure of agricultural administration. However, after merger with Indian Union, with limited area of cultivated land, smaller land holdings, difficult hilly terrain, varied agro-climate condition prevailing at short distances, low farm income and lack of adequate supportive infrastructures for agriculture expansion, the state has slowly yet indigenously, achieved sustenance to its food obligations.

The Fifth Plan (1976-77 to 1980-81) document of Sikkim mentioned, "agricultural stagnation is the main impediment on the rate of growth of the economy" which restricted the peoples' purchasing power and in addition such stagnation also limited the scope for industrialization (Economic Survey, 2006-07:13).

In spite of limited cultivated land in Sikkim, agricultural development could make considerable progress in the last three decades. Introduction of new crops such as wheat, rajma (beans), rape and mustard (oil seeds), extension of more areas under high yielding and improved varieties, increased use of fertilizers and pesticides, and expansion of area under double or multiple cropping have played crucial role in converting agriculture into a viable venture from a mere subsistence farming ( DESME, 2006-07:13-14).

No definite systematized land utilization classification is being followed in Sikkim. The old system of land utilization is still being followed in the state. In this system, cultivable land has been classified into three broad groups:

- 1.) Wet field - comprises all paddy fields,
- 2.) Dry field - comprises all un-irrigated field
- 3.) Banjo - waste land, and
- 4.) Cardamom field - all fields under cardamom crop.

The paddy field and dry field is again divided into three circles as per the notification issued in 1974, depending upon the fertility of the land. The fertile field comes under 'A' circle, moderately fertile in 'B' circle and less fertile in 'C' circle. Cardamom field is again divided into 'A' 'B' and 'C' circle depending upon the fertility of the land, irrespective of slope and

elevation, and land compensation are paid accordingly. The notification issued by the state is given below:

**Notification No.156-Dated 5.7.1974**

It is notified for the information to the general public and all concerned that in view of all round increase of the market value of the land and agricultural crops, the rate of the land compensation for acquisition has been revised as under with effect from 1.4.1974.

**Table 4.2: Notification pertaining to agricultural land compensation**

Kind of Land	Circle 'A' Per Acre of Land			Circle 'B' Per Acre of Land			Circle 'C' Per Acre of Land		
	I	I	III	II	III	II	III	II	III
Paddy Field	Rs.5000	Rs.3800	Rs.2500	Rs.4000	Rs.3000	Rs.2000	Rs.3200	Rs.2200	Rs.1600
Paddy Field	Rs.1800	Rs.1400	Rs.900	Rs.1600	Rs.1200	Rs.800	Rs.1200	Rs.900	Rs.600
Paddy Banjo	-	-	Rs.700	-	-	Rs.600	-	-	Rs.500

Source: Subba, 1984.

Cardamom: - I - Rs.6000/- II - Rs.4000/- III - Rs.2500/- IV - Rs.1500/-

The above table shows that the agricultural land has different values and price according to the productiveness, slope and elevation of land. Even the paddy field has been divided into three different categories A, B and C according to market value/compensation. If the land is acquired by the government, then value/compensation is given to the villagers according to categories of land revised in 1974.

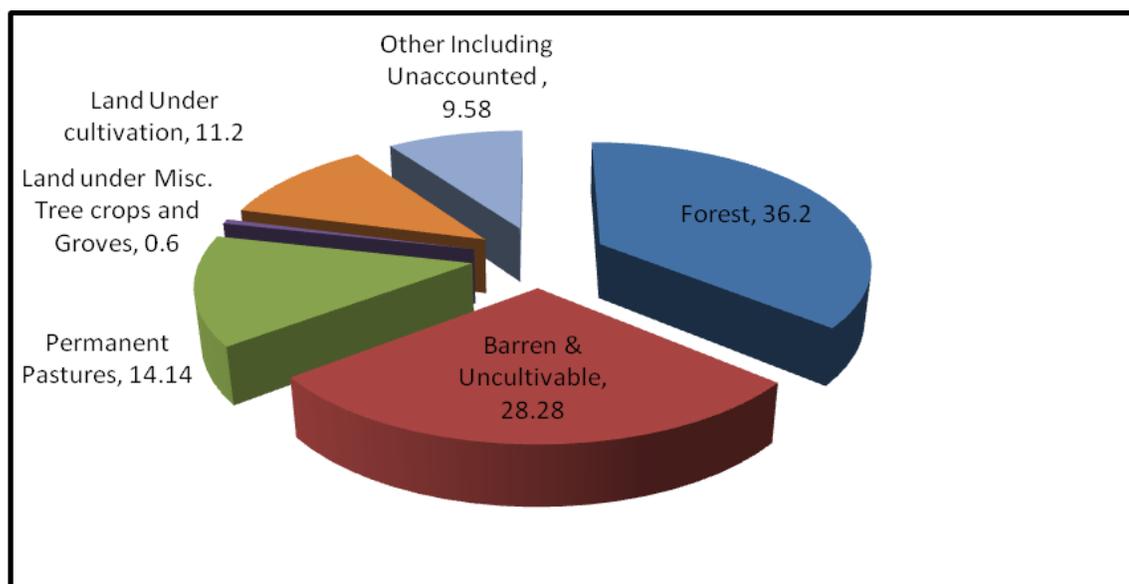
The first scientific survey of land in Sikkim was carried out in 1950-58, using the British measurement system of acres and miles. The second, 1976-83 survey is till date the last land survey carried out after Sikkim became a constituent state of India. The metric system of hectares and kilometers was used, and the survey covered all the areas of Sikkim. This was a critical survey, because previous land records had undergone several changes due to partition, mutation, registration and acquisition by the government, private parties and others (Lama, 2001).

The last cadastral survey in Sikkim was done during the 1950-58: according to that survey the following table has been prepared. The particular survey is being updated now and some of the portions, which could not be covered earlier time, are being covered now. Sikkim however, has no permanent field agency to find out the data and up-date these data from year to year.

**Table 4.3: Area under Different Land Use in Sikkim ('000 Ha)**

Land Type	Area as per 1958-60 Survey Operation	
	Mean $\pm$ S.D.	Standard Error
Forest	262.14 $\pm$ 40.0499	16.3503
Barren & Uncultivable	204.80 $\pm$ 52.8469	21.5746
Permanent Pastures	102.40 $\pm$ 33.3946	13.6332
Land under Misc. Tree crops and Groves	4.00 $\pm$ 2.0976	.8563
Land Under cultivation	81.23 $\pm$ 23.4861	9.5881
Other Including Unaccounted	69.39 $\pm$ 14.2688	5.8252
Total	723.96 $\pm$ 54.4683	22.2366

Source: Subba, 1984.



**Figure 4.1** Area under Different Land Use in Sikkim ('000 ha) as per 1958-60 Survey

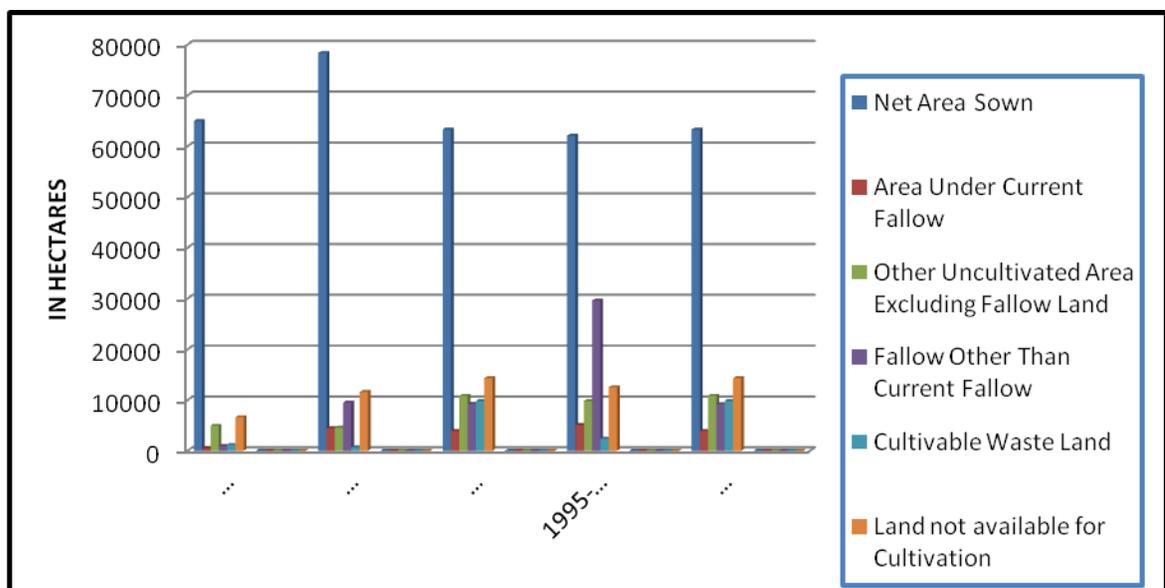
The table 4.3 and figure 4.1 show area under different land use in Sikkim in ha as well as in percentage, their significant mean  $\pm$ S.D. and standard error. The highest available land type is under Forest, the mean  $\pm$ S.D. 262.14 $\pm$ 40.0499, percentage mean  $\pm$ S.D. 36.20 $\pm$ 21.7990 and its corresponding error is calculated as 16.3503 and 8.8994. The second highest available land type is barren & uncultivable and it has significant mean  $\pm$ S.D 204.80 $\pm$ 52.8469, percentage mean  $\pm$ S.D 28.28 $\pm$ 17.2394 and its corresponding error is calculated as 21.5746 and 7.0379.

After forest and barren & uncultivable come permanent pastures with mean  $\pm$ S.D 102.40 $\pm$ 33.3946, percentage mean 14.14 $\pm$ 13.4461 and its corresponding error 13.6332 & 5.4893. Land under cultivation (81.23 $\pm$ 23.4861 & 11.20 $\pm$ 8.1240 and 9.5881 & 3.3166) comes in fourth position which clearly indicates shortage of available land under cultivation.

**Table 4.4: Land use Pattern under Operational and Non-Operational Holdings in Sikkim (1976-77 to 2000-01)**

Sl. No.	Land Type	1976-1977		1980-1981		1990-91		1995-1996		2000-2001	
		Ha	%	Ha	%	Ha	%		%	Ha	%
1.	Net area sown	64,927	9.15	78,321	11.04	63,254	8.91	62,043	8.74	63,250	8.91
2.	Area under current fallow	501	0.07	4,428	0.62	3,906	0.55	5,078	0.71	3,910	0.55
3.	Other uncultivated area excluding fallow land	4,925	0.69	4,560	0.64	10,820	1.53	9,807	1.38	10,830	1.53
4.	Fallow other than current fallow	944	0.13	9,474	1.34	9,204	1.30	29,573	4.16	9,200	1.30
5.	Cultivable waste land	1,153	0.16	681	0.10	9,807	1.38	2,389	0.33	9,810	1.38
6.	Land not available for cultivation	6,613	0.93	11,604	1.64	14,300	2.02	1,2494	1.76	14,300	2.01
Total		79,062	11.14	109068	15.37	111301	15.96	121384	17.08	111300	15.68

Source: Pradhan, 1998, DESME, 2002& Gazetteer of Sikkim, 2013.



**Figure 4.2:** Land use Pattern and Land under Operational and Non-Operational holdings

The table and figure given above indicate that the net area sown initially gained some area in 1980-81 (11.04), but thereafter it remained almost stagnant in 1990-91(8.91), 2000-01(8.91) and 1995-96 (8.74). The fallow other than current fallow land increased sharply during the year 1995-96. The land not available for cultivation remained more or less same since 1980-81.

There has been a marginal decrease in net sown area since 1990-91 but almost threefold increase in fallow land other than current fallow. Due to lack of irrigational facilities, manpower etc. many farmers kept their land unutilized for more than one year. Between 1995-96 and 2000-2001 some progress has been seen in the utilization of fallow land other than current fallow because state government took initiatives and motivated farmers to convert such land for agricultural use.

**Table 4.5: Land Use Pattern: East and West District of Sikkim 2005-06 (in Ha)**

SL. No.	Particulars	East District Mean $\pm$ S.D.	Standard Error	West District Mean $\pm$ S.D.	Standard Error
1.	Irrigated Land	2532.14 $\pm$ 15.2315	6.2182	2119.5 $\pm$ 18.7082	7.6376
2.	Un-Irrigated Land	9475.46 $\pm$ 22.6008	9.2267	10433.45 $\pm$ 20.6203	8.4182
3.	Non-Agricultural Use	3277.15 $\pm$ 20.8518	8.5127	1832.06 $\pm$ 14.6013	5.9609
4.	Forest/Jungle/Bushes	9112.07 $\pm$ 7.6941	3.1411	2433.31 $\pm$ 18.9208	7.7244
5.	Grass Land	3795.76 $\pm$ 25.0120	10.2111	4525.00 $\pm$ 16.3340	6.6683
6.	Barren Land	1652.96 $\pm$ 25.2982	103279	1219.74 $\pm$ 22.3875	9.1396
7.	Uncultivated Fallow Land	8178.6 $\pm$ 28.3125	11.5585	2529.11 $\pm$ 20.1891	8.2421
8.	Cardamom Field	787.21 $\pm$ 29.4006	12.0027	840.16 $\pm$ 26.1839	10.6895
	Total	38811.35 $\pm$ 19.9599	8.1486	25932.33 $\pm$ 19.5448	7.9791

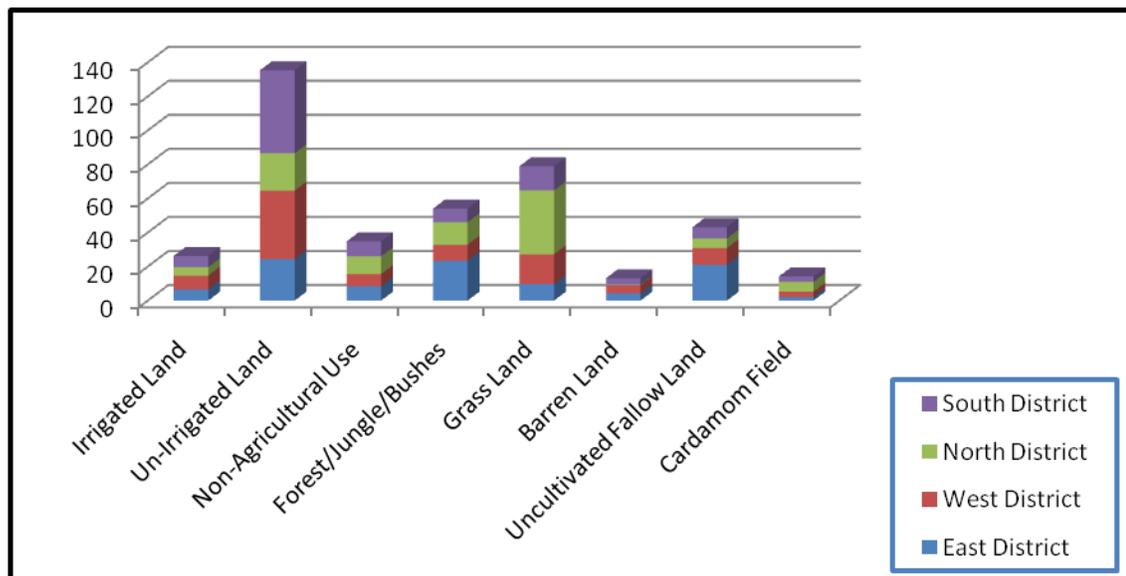
Source: DESME, 2006-07.

**Table 4.6: Land Use Pattern: North and South District of Sikkim 2005-06, (in Ha)**

SL. No.	Particulars	North District Mean $\pm$ S.D.	Standard Error	South District Mean $\pm$ S.D.	Standard Error
1.	Irrigated Land	886.97 $\pm$ 29.1890	11.9163	2104.62 $\pm$ 23.8914	9.7536
2.	Un-Irrigated Land	3959.84 $\pm$ 22.9172	9.3559	15435.74 $\pm$ 18.3738	7.5011
3.	Non-Agricultural Use	1903.13 $\pm$ 25.9306	10.5861	2754.33 $\pm$ 24.5519	10.0233
4.	Forest/Jungle/Bushes	2383.77 $\pm$ 28.2772	11.5441	2519.7 $\pm$ 23.1948	9.4692
5.	Grass Land	6752.15 $\pm$ 20.8710	8.5205	4515.00 $\pm$ 26.0537	10.6364
6.	Barren Land	63.29 $\pm$ 19.2249	7.8485	1209.11 $\pm$ 29.0860	11.8743
7.	Uncultivated Fallow Land	1023.01 $\pm$ 20.5621	8.3944	2086.54 $\pm$ 29.1273	11.8911
8.	Cardamom Field	1030.21 $\pm$ 20.3666	8.6146	1003.67 $\pm$ 21.2602	8.6794
	Total	18002.37 $\pm$ 2.0816	9.0148	31628.71 $\pm$ 20.9666	8.5596

Source: DESME, 2006-07.

The above tables (4.5 & 4.6) illustrate the significant mean S.D and standard errors in the land use pattern in different districts of Sikkim. The significant mean clearly indicates that most of the cultivated land in all the districts of Sikkim is un-irrigated. The South district has highest un-irrigated land compared to other districts of Sikkim. Actually South district is drought prone area. The irrigated land, non-agricultural use, barren land, cardamom field are in the same level in South district. But the West and North districts have fluctuating land use pattern. The North district has maximum area under grass land, while the East district has the highest share of uncultivated fallow land. The existing pattern of land use of Sikkim has been shown in figure 4.3.



**Figure 4.3:** District-wise Distribution of Land Use Pattern, Sikkim 2005-06, (in Percent)

Of the total geographical area of 7096 sq. km, 82.31 percent is under the administrative control of the Forest, Environment and Wildlife Management Department. The land available for cultivation was 12.3 percent in 1990-91 including current and fallow land. In 2010, the net cultivated area was around 79,000 ha (11.13 percent) including the large cardamom plantations. The state is yet to develop a comprehensive land use policy. Since 2000 the net cultivated area decreased significantly due to conversion of agricultural land into non-agricultural use for development activities, such as establishing pharmaceutical industries and hydropower project infrastructures (Gazetteer of Sikkim, 2013).

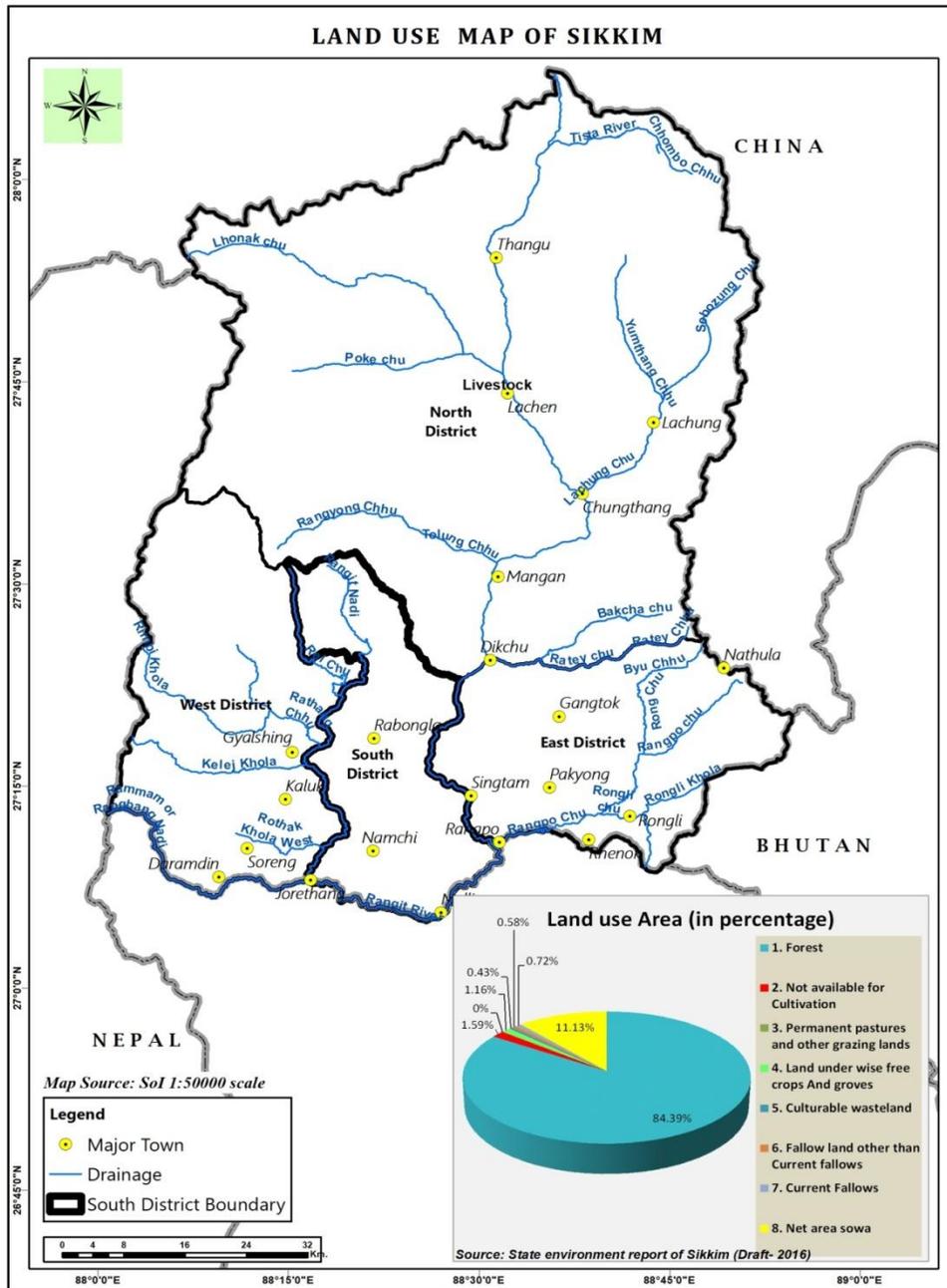
**Table 4.7: Land Use in Sikkim, 2016**

Sl. No.	Land Use	Area in (ha
1.	Forests	5,84000
2.	Not available for cultivation	11,000
3.	Permanent pastures and other grazing lands	0
4.	Land under Misc. Tree crops and groves	8,000

5.	Culturable wasteland	3,000
6.	Fallow land other than current fallows	4,000
7.	Current fallows	5,000
8.	Net area sown	77,000
	Total	6,92,000

Source: State of Environment Report Sikkim (Draft) -2016.

Map No. 12



The State of Environment Report Sikkim 2016 has mentioned eight types of land use pattern in Sikkim viz. forests, not available for cultivation, permanent pastures and other grazing lands, land under misc. tree crops and groves, culturable wasteland, fallow land other than current fallows, current fallows and net area sown. The highest land use has been seen in forests because of 'green mission as well as ten minutes to earth' which encourage the people for the plantation of different trees in every physical surrounding in Sikkim, that's why Forests covers 84.39 percent of land. Among the other land use pattern net area sown has occupied 11.13 percent of land in Sikkim. But the permanent pastures and other grazing lands seem to be zero due to ban of grazing of animals in Sikkim.

Since the area under study is in the South district of Sikkim, the exclusive land use pattern in the district in various years (2001-02, 2005-06 and 2014-15) is given below:

**Table 4.8: Land Use Pattern of South District (2001-02 & 2005-06)**

SL. No.	Particulars	2001-02	Standard Error	2005-06	Standard Error
		Hectares Mean $\pm$ S.D.		Hectares Mean $\pm$ S.D.	
1.	Irrigated Land	21667 $\pm$ 24.4540	9.9833	2105 $\pm$ 22.8648	9.3345
2.	Un-Irrigated Land	16350 $\pm$ 22.9869	9.3843	15436 $\pm$ 25.5812	10.4435
3.	Non-Agricultural Use	1614 $\pm$ 17.6522	7.2064	2754 $\pm$ 27.0776	11.0544
4.	Forest/Jungle/Bushes	1457 $\pm$ 25.9461	10.5924	2520 $\pm$ 26.6833	10.8934
5.	Grass Land	1284 $\pm$ 25.4244	10.3794	1209 $\pm$ 18.4173	7.5188
6.	Barren Land	2386 $\pm$ 26.0998	10.6552	2087 $\pm$ 25.3535	10.3505
7.	Uncultivated Fallow Land	642 $\pm$ 19.2769	7.8697	1004 $\pm$ 21.0902	8.6100
8.	Cardamom Field	4400 $\pm$ 25.2586	10.3318	4515 $\pm$ 20.8134	8.4970
	Total	49800 $\pm$ 21.9545	8.9628	31630 $\pm$ 34.5079	14.0878

Source: DESME, 2004-05, 2006-07.

The table 4.8 shows the land use pattern of South district during 2001-02 & 2005-06, in terms of irrigated land, un-irrigated land, non-agricultural use, forest/jungle/bushes, grass land, barren land, uncultivated fallow land and cardamom field and their significant mean  $\pm$ S.D. and standard error. According to the figure and table, in the year 2001-02, irrigated land was

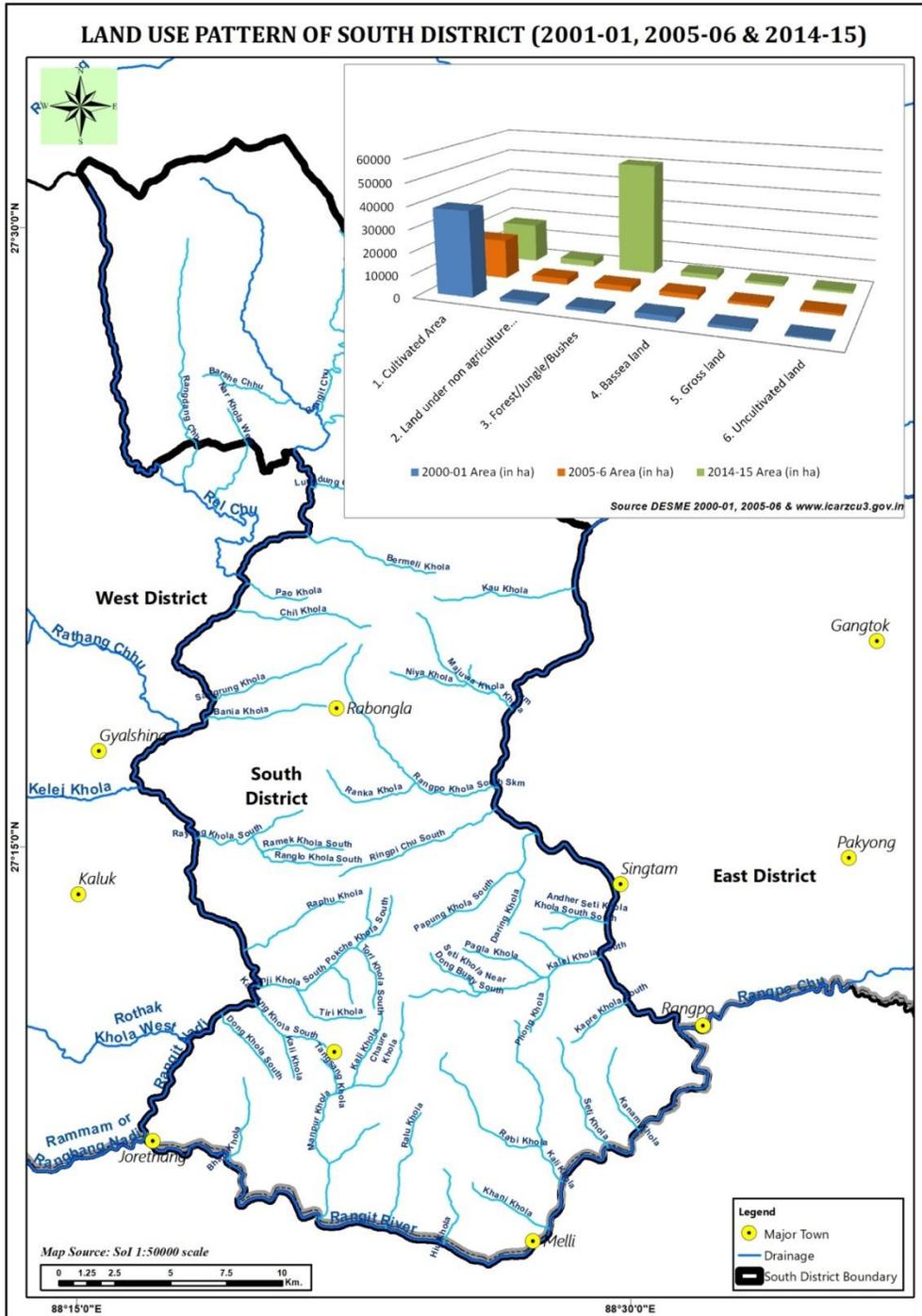
highest (91.14%), having the mean  $\pm$  S.D. 21667 $\pm$ 24.4540 and its corresponding error 9.9833. But, in 2005-06, the irrigated land was found to be only (8.86%) and the mean  $\pm$  S.D. 2105 $\pm$ 22.8648 and its corresponding error calculated were 9.3345. It seems the total land under cultivation might have increased, but those were mostly un-irrigated. Besides, in some areas, water sources were drying up, thereby causing decrease in irrigated land. The un-irrigated land in 2001-02 was 51.44% having the mean  $\pm$  S.D. 16350 $\pm$ 22.9869 and its corresponding error 9.3843. But in 2005-06, the un-irrigated land is found to have decreased (48.56%), the mean  $\pm$  S.D. 15436 $\pm$ 25.5812 and corresponding error calculated as 10.4435. The cardamom field in 2001-02 was 49.36% and the mean  $\pm$  S.D. 4400 $\pm$ 25.2586 and corresponding error calculated as 10.3318. But in 2005-06, the cardamom field increased to 50.64% and the mean  $\pm$  S.D. 4515 $\pm$ 20.8134 and corresponding error have been 8.4970. The other categories are barren land (2001-02: 2386 $\pm$ 26.0998, 2005-06: 2087 $\pm$ 25.3535), land under non-agricultural use (2001-02: 1614 $\pm$ 17.6522, 2005-06: 2754 $\pm$ 27.0776), forest/jungle/bushes (2001-02: 1457 $\pm$ 25.9461, 2005-06: 2520 $\pm$ 26.683) and lowest available of land use is uncultivated fallow land (2001-02: 642 $\pm$ 19.2769, 2005-06: 1004 $\pm$ 21.0902).

**Table 4.9: Land Use Pattern of South District (2014-15)**

SL. No.	Classification of land	Area (Ha)		Percentage (%)	
		Mean $\pm$ S.D.	Standard Error	Mean $\pm$ S.D.	Standard Error
1.	Cultivated Area	17540.36 $\pm$ 13.2060	5.3913	23.39 $\pm$ 14.9933	6.1210
2.	Land under non-agriculture use	2754.33 $\pm$ 24.8676	10.1521	3.67 $\pm$ 2.1061	.8598
3.	Forest/Jungle/Bushes	50405.99 $\pm$ 28.1069	11.4746	67.21 $\pm$ 25.0439	10.2241
4.	Barren Land	2086.54 $\pm$ 32.6925	13.3466	2.78 $\pm$ 1.5439	.6303
5.	Grass Land	1209.11 $\pm$ 21.8723	8.9293	1.61 $\pm$ .9879	.4033
6.	Uncultivated Land	1003.67 $\pm$ 32.8268	13.4014	1.34 $\pm$ .8671	.3540
	Total	75000.0 $\pm$ 52.1536	21.2916	100.00 $\pm$ 25.3456	10.3473

Source: www.icarzc3.gov.in.

Map No. 13



The economics of South district is mostly connected with agriculture that gives the source of livelihood and economic security of sizable local population. It is estimated that more than 70 percent of rural population depends on agriculture and allied sectors for economic, food and nutritional security. The table 4.8 and figure 4.6 show the land use pattern of South district.

The highest available land use is forest/jungle/bushes having (67.21%). The second highest available of land use is cultivated area (i.e. 23.39 %). After forest/jungle/bushes and cultivated area comes land under non-agriculture use (3.67%). Other land uses such as barren, grass and uncultivated lands are negligible.

### Land Use Pattern in the Study Area (Gram Panchayat Units)

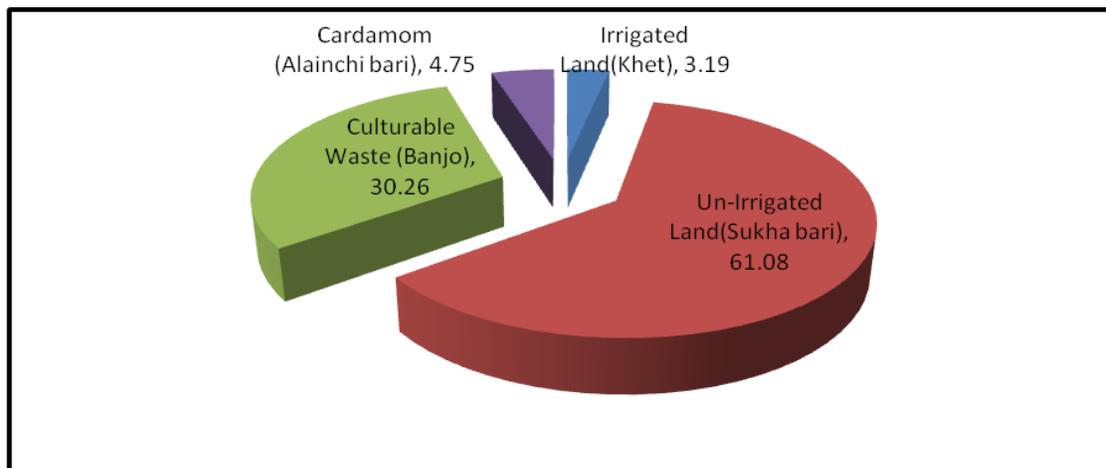
For an intensive study of prevailing land use pattern in South district, fifteen Gram Panchayat units (GPUs) have been randomly selected. These GPUs have been grouped in three sets according to elevation. The Set I consists of the GPUs of Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring. The Set II has the GPUs of Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu, while Set III consists of Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan.

The table 4.10 shows the overall land use pattern in the GPUs of Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring (Set I).

**Table 4.10: Land Use Pattern in GPUs Set I (Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring)**

SL. No.	Particulars	Hectare
1.	Irrigated Land( <i>Khet</i> )	265.70
2.	Un-Irrigated Land( <i>Sukha bari</i> )	1639.00
3.	Culturable Waste ( <i>Banjo</i> )	897.70
4.	Cardamom ( <i>Alainchi bari</i> )	107.33
	Total	2909.73

Source: VDAP, 2011.



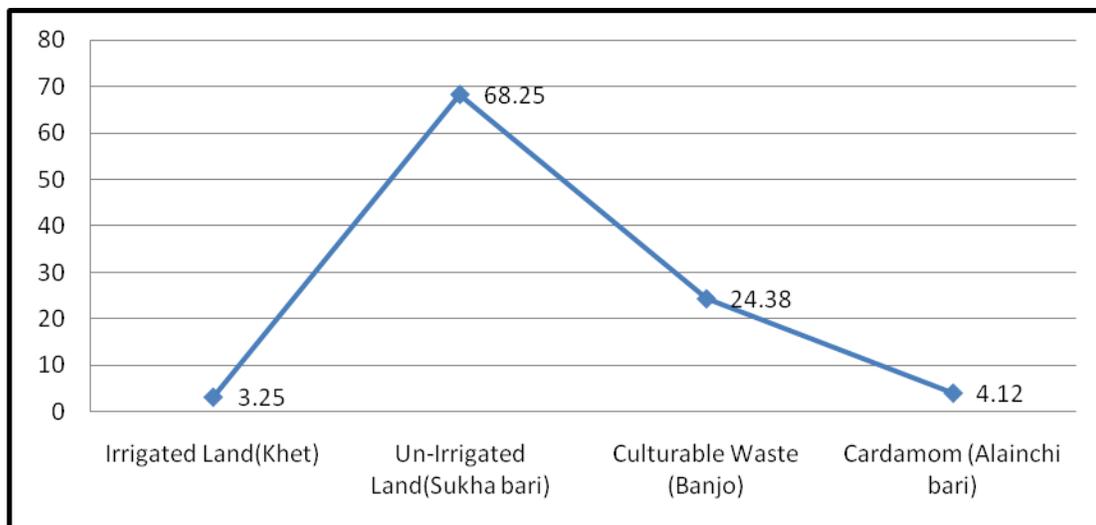
**Figure 4.4: Land Use Pattern of GPUs Set I (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)**

The figure illustrates the land use pattern of five GPUs, namely Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring of South district. The land use has been classified as irrigated land (*khet*), un-irrigated land (*sukha bari*), culturable waste (*banjo*) and cardamom (*alainchi bari*). The highest available of land use is found as un-irrigated land (*sukha bari*) having (56.33%) due to scarcity of water even in rainy season. The second highest available land use pattern is culturable waste (*banjo*) having 30.85 % of land. This high percentage of waste land may be attributed to acute scarcity of water and lack of man power. The irrigated land (*khet*) and cardamom fields (*alainchi bari*) account for only 9.13% and 3.69% respectively. The findings of the primary data collected in the current study corroborate with the secondary data in terms of un-irrigated land (*sukha bari*) as the dominant land use pattern in the study area.

**Table 4.11: Land Use Pattern of GPUs Set II** (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)

SL. No.	Particulars	Hectares
1.	Irrigated Land ( <i>Khet</i> )	156.70
2.	Un-Irrigated Land ( <i>Sukha bari</i> )	2448.00
3.	Culturable Waste ( <i>Banjo</i> )	1212.80
4.	Cardamom ( <i>Alainchi bari</i> )	190.20
	Total	4007.70

Source: VDAP, 2011.



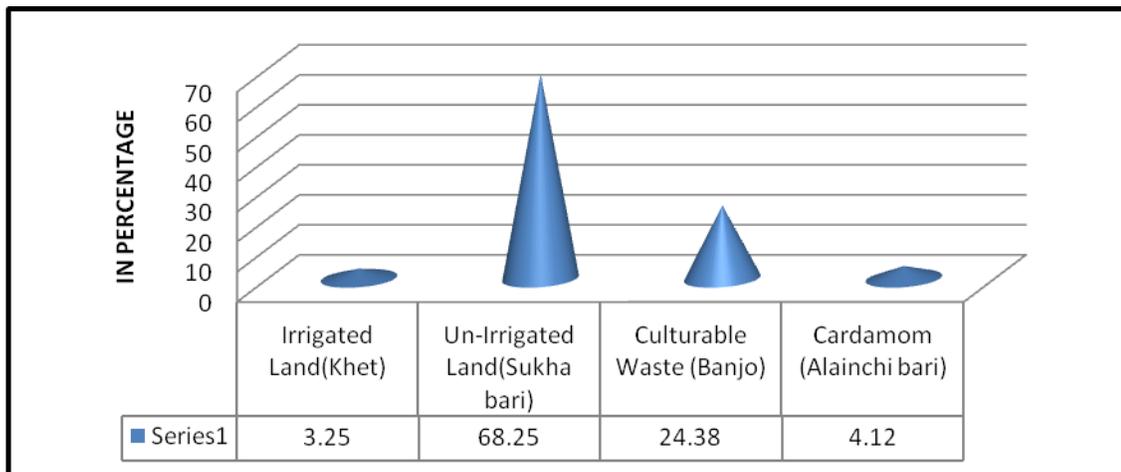
**Figure 4.5: Land Use Pattern of GPUs Set II** (Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu)

The figure 4.5 shows the land use pattern of five GPUs Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu of South district. The highest available land use is un-irrigated land (*sukha bari*) accounting for 61.08%. The second highest available land use is culturable waste (*Banjo*) having 30.26%. After un-irrigated land (*sukha bari*) and culturable waste (*banjo*) come cardamom (*alainchi bari*) having 4.75%. The irrigated land (*khet*) is 3.91% only. The findings of the primary data collected in the current study corroborate with the secondary data in terms of un-irrigated land (*sukha bari*) as the dominant land use pattern in the study area.

**Table 4.12: Land Use Pattern of GPUs Set III (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan)**

SL. No.	Particulars	Hectares
1.	Irrigated Land( <i>Khet</i> )	156.30
2.	Un-Irrigated Land( <i>Sukha bari</i> )	3284.00
3.	Culturable Waste ( <i>Banjo</i> )	1173.00
4.	Cardamom ( <i>Alainchi bari</i> )	198.42
	Total	4811.72

Source: VDAP, 2011.



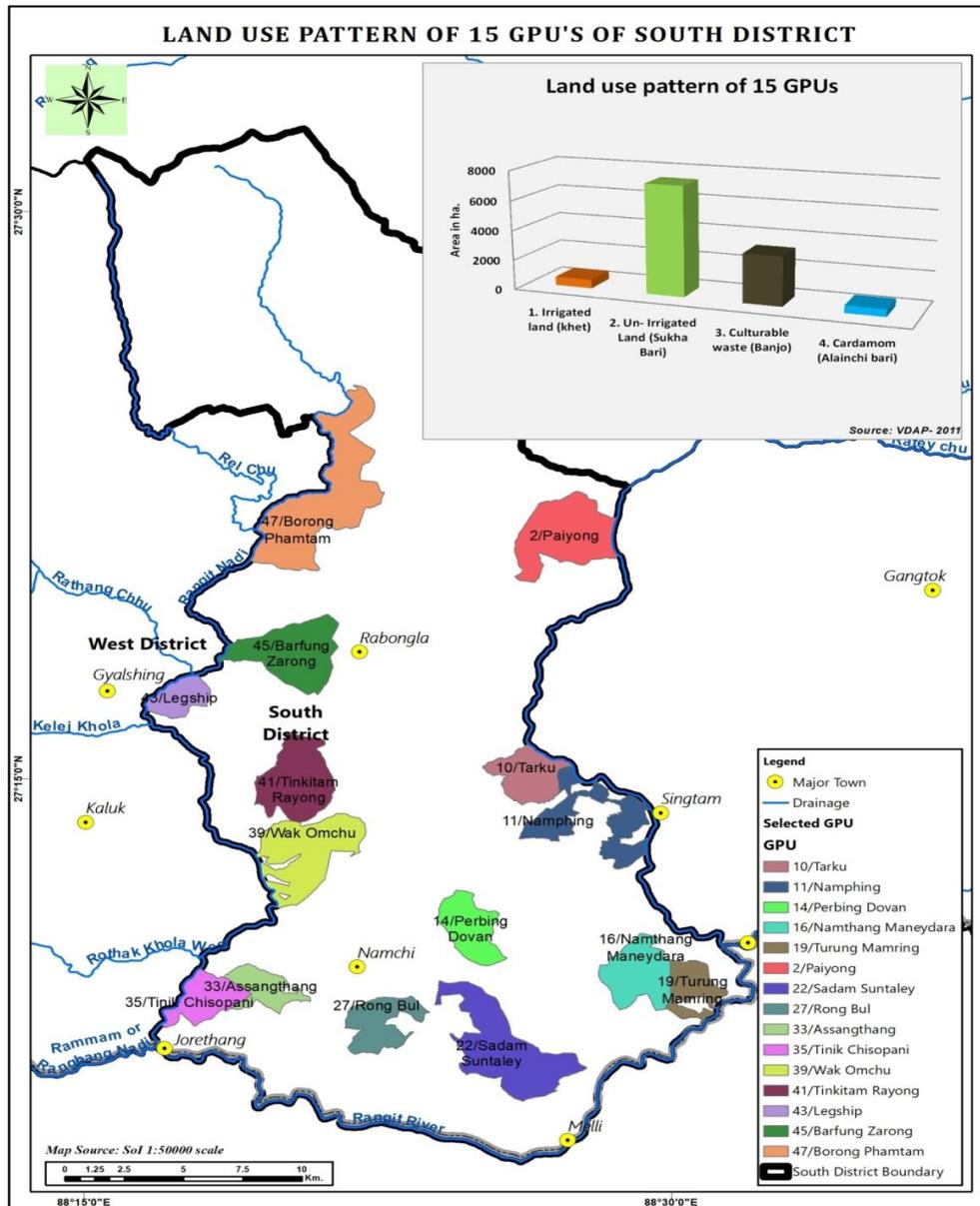
**Figure 4.6: Land Use Pattern of GPUs Set III (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan)**

The above table 4.12 depicts the land use pattern of five GPUs Borong-Phamthang, Barfung-Zarung, Paiyong, Tinik-Rayong and Perbing-Dovan of South district,. The highest available land use pattern is of un-irrigated land (*sukha bari*) with 68.25%. This could be due to scarcity

of water and landforms features. The second highest available land use pattern is of culturable waste (*banjo*) with 24.38 %. After un-irrigated land (*sukha bari*) and culturable waste (*banjo*) comes cardamom (*alainchi bari*) with 4.12% and irrigated land (*khet*) with 3.25% respectively. The findings of the primary data collected in the current study corroborates with the secondary data in terms of un-irrigated land (*sukha bari*) as the dominant land use pattern in the study area.

In all three sets of GPUs, un-irrigated land (*sukha bari*) is the dominant land use component and the results of primary survey confirm the secondary data.

**Map No. 14**



## **Land Reform in Sikkim**

Changes in the land ownership is basic concept in land reform system, particularly when it embraces giving land to the people who actually get acquainted with it and taking it away from the people who occupy large areas for their benefit.

Changes in the agrarian structure may broadly be of two types: first, changes in agrarian relation which may occur in an indirect manner in response to spontaneous operation of socio-economic process: second, changes brought about as a result of direct investment may assume the form of land legislation and its implementation through governmental action. All these kinds of attempts to alter the agrarian structure may be characterized as land reforms (Joshi; 1976).

Different approaches were taken for land reform during Chogyal's regime in Sikkim. But only the feudal group was enjoying the different benefits within a region. The poor people were frustrated with landlordism, and then the educated elite group came up with a mission to overcome social oppression, economic exploitation and political dictatorship as well as to improve the status of peasants, and some associations were formed. Some of the important ones were the Praja Sudharak Samaj led by Tashi Tshering, Praja Sammelan led by Gobardhan Pradhan and Dhan Bahadur Tewari, and the Praja Mondal led by Kazi Lendup Dorji. Tashi Tshering was the leading exponent of the peasant rights and primarily under his inspiring leadership, on December 7, 1947, these three associations formed the Sikkim State Congress which submitted to the Maharaja a charter of demands comprising of three points: abolition of landlordism, introduction of responsible government and Sikkim's accession to India. The Chogyal considered only the first and second proposals and he advised the state congress to drop the third proposal. Meanwhile, he took pains to politicize the demands with the help of orthodox traditional forces consisting of the Kazis and the hereditary landlords of Sikkim. These forces organized the Sikkim National Party in 1948. The land reforms committee has made a significant breakthrough by bringing into the public eye major aspects of land reforms in Sikkim. The suggestions were humble, but their implementation was fraught with problems. It goes without saying that if the recommendations were given effect they were likely to bring about far-reaching changes in the traditional society of Sikkim (Dhamala & Bhowmick, 1985). If the recommendations were accepted by the Chogyal, then the scenario would have been different in Sikkim.

A brief outline of the recommendations of the committee may be discussed in three important aspects:

- 1) Abolition of private estates and monastery estates,
- 2) Tenancy reforms and
- 3) Ceiling on holdings.

Since 1975, the Government of Sikkim has enacted legislations such as the Sikkim Cultivators Protection Act 1975, the Sikkim Agricultural Land Ceiling and Reforms Act 1978, and the Sikkim Land (Requisition and Acquisition) Act 1978. An analysis would reveal that these acts are intended to fulfill three purposes:

- a. Elimination of intermediaries in the land management system,
- b. Enforcement of ceiling law in respect of land holdings and distribution of surplus land, and
- c. Protection of tenancy rights (Dhamala & Bhowmick, 1985).

Sikkim being agriculture-based state, land has its own meaning which acts as a source of livelihood greatly from its quantity, type and altitudes which are usually different from one another. In an agricultural society like Sikkim the farmland has been determined by a primary key like wealth, stability and governance. A good number of people mostly live in rural areas of Sikkim and most of them sustain their life through agriculture if they are to make a living at all.

While patterns vary greatly from place to place, it is generally true that where a few individuals (as it was in Sikkim) own a large share of land, the same individuals dominate local politics and through their roles as lenders, landlords and employers also control the economic lives of their neighbours (Gupta (1992).

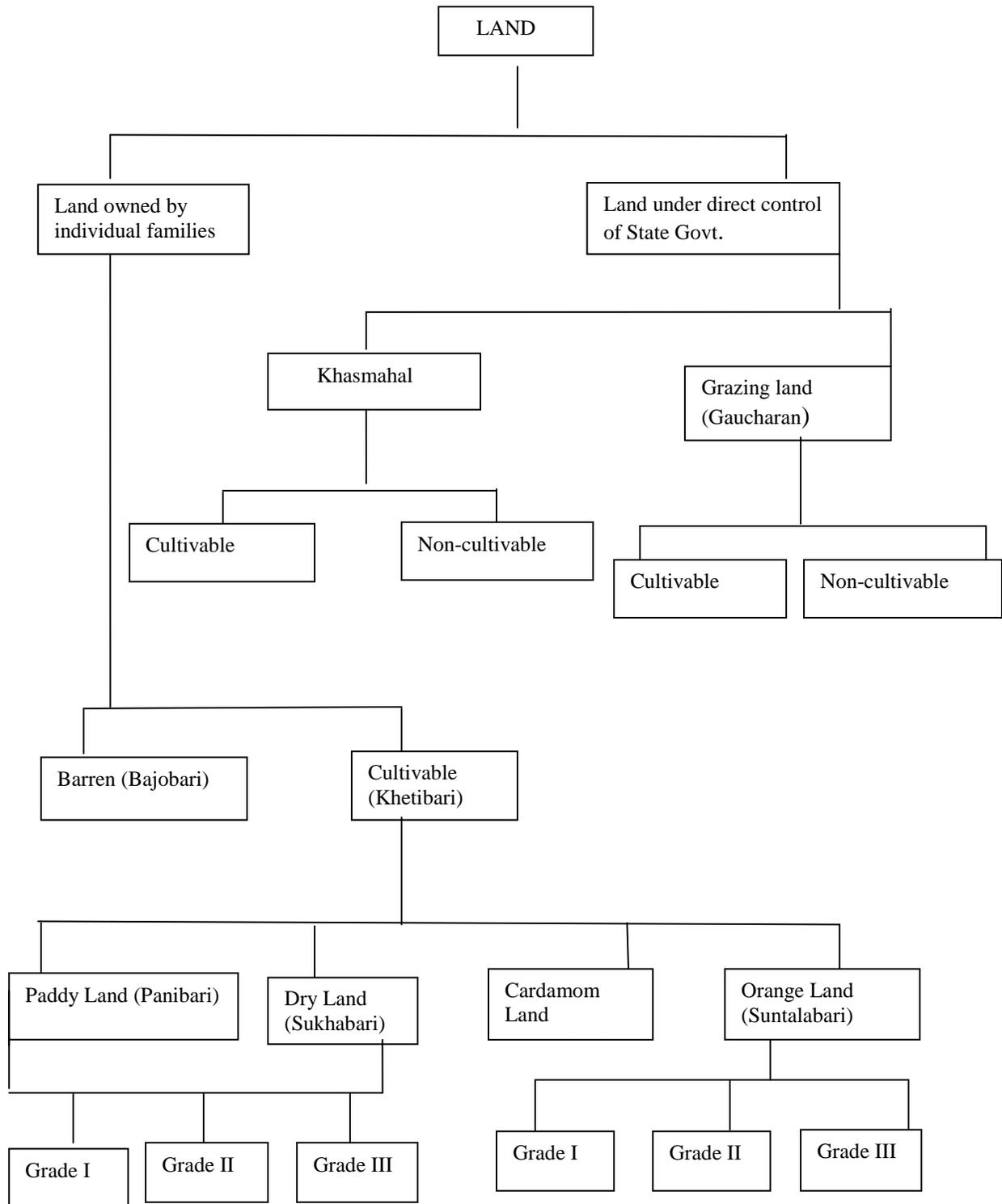
Until the merger of the state with the Indian Union it remained as a feudal state under the regime of temporal and theocratic Bhutia rulers known as Chogyals. At that time, the following land ownership/management pattern was prevalent. Traditionally all lands belonged to the Chogyal which were divided as *illakas* and entrusted under the management of landlords, the Kazis and other aristocrats (the members of the ruling families). Besides, almost half of the land was vested with Chogyals and his family as private estate which mainly consisted of cardamom growing areas and rich forests (Das, B.S.; 1938; 9). The advent of British into Sikkim and their introduction of modified lease system developed lessee landlordism in the region. As a result there emerged a three-tier land ownership pattern: Private Estate, Land owned by the five big Monasteries; and Public Estate, i.e. land distributed to the lessee landlords. After the abolition of lessee system in 1950 the private estates and monasteries estates continued as usual while public estates came directly under the control of Land Revenue Department (Datta, 1992).

After 1951, land settlement programme was introduced and 108 estates were demarcated and designated which were divided into following three categories:

- 1) Government estates (90), which included the old leased land areas as well as the private estates of the Kazi and Thikadar families; 2) Monastic estates (5), and 3) Royal family estates (13).

Thus, approximately 85 percent of the land would be under government estate, 11 percent under royal family estate, and 4 percent under monastic estate. However, after the merger of Sikkim with India the land settlement pattern has changed. The classification of land which has been shown in the flow chart is an attempt to delineate the type, quality and pattern of land settlement in today's Sikkim (Datta, 1992).

**Figure 4.7:** Schematic presentation of Classification of Land



*(Note: The words within the parentheses denote Nepali colloquial terms)*

Source: Datta, 1992

According to the survey and settlement report of 1958, out of a total 27,694 holdings in Sikkim 3658 were within the private estate constituting 13 percent of the total number of holdings.

### **Ceiling on Land Holding**

The ceiling on land holdings seeks to take away unequal distribution of landed property and it hinders the social and economic development of the state. Concentration of property in the hand of a few is bound to badly affect agricultural production and social structure as well. As per the settlement report of 1958, out of 2, 23,314 acres of agricultural land, 66,727 acres were possessed by 8 percent of the families. It is clearly seen, this small section being financially strong and socially influential were likely to exercise the power in the decision making process of the government. In order to bring in land re-distribution, the need for imposing a ceiling on land can hardly be over-emphasized. The committee however recommended that in the early stages of land reforms the ceiling may be kept at such a level that those landowners who have been enjoying limitless area of land in contravention of government orders may be allowed to retain such an amount that they are in a position to lead a decent living from the income of the land within the ceiling. In other words, the committee did not acknowledge any drastic change. With the predominance of political power enjoyed by the landowning class of Sikkim, any drastic change is likely to frustrate the objective of land reform itself (Dhamala & Bhowmick, 1985).

After changes in land regulations were introduced in 1949, the State of Sikkim issued a Notification, No.3082/L.R. in 1954, which has some progressive elements of land reforms and provides for the maintenance of economic holdings.

The lower ceiling of land holdings is ensured by the provision of the ‘sale of land in execution’. It states:

*“No Court will sell or transfer a holding or any part of a holding of a primary holder in execution of a decree, whether revenue or civil, if by such sale or transfer the said holding will become less than five in acres in area... provided that sale of land to meet government dues will be excluded from the purview of this notification”* (Lama, 2001, 45).

This notification also fixed an upper ceiling through ‘restrictions on purchase’, according to which ‘No person who already has a holding or holdings exceeding 20 acres in area may purchase land sold in execution of a revenue or civil decree.’

In a mountainous state like Sikkim, the all India land ceiling of 12 acres, which is a blanket ceiling irrespective of topographical variations, is difficult to implement. It might be more appropriate to fix land ceiling, on a case to case basis using methods suitable to the terrain.

After the merger of Sikkim in 1975, the government intervened mainly to provide legislative measures against the termination of cultivation rights and for the continuity of cultivation by existing cultivators. This was done in view of the problems faced by the tillers of the soil, who cultivated land owned by others under precarious terms and conditions (Lama, 2001:45).

### **Ceiling on Agricultural Land**

The State Government may from time to time by notification declare that with effect from the date mentioned in the notification (hereinafter in this Act referred to as the notified date) no person shall be entitled to hold any agricultural land in excess of the ceiling limit in the State of Sikkim and all lands in excess of ceiling limit shall vest in the State in accordance with and under the provisions of this Act and the rules and notifications made there under. The date mentioned in every such notification shall be the commencement of the agricultural year. Every such notification shall also be published in such manner as may be prescribed.

1. The ceiling limit shall be determined according to the following principles, namely:
  - i) In the case of an adult unmarried person or a person who has no family or a person who is the sole surviving member of any family, six and half standard acres,
  - ii) In the case of a person having family members, twelve and half standard acres.
  - iii) In the case of a person having a family consisting of more than five members, twelve and half standard acres and further two standard acres for each member in excess of five, so, however, that the aggregate of the ceiling limit for such person shall not, in any case, exceed twenty and half standard acres.

2. For the purpose of determining the ceiling limit under clause (i), lands held individually by the person concerned and the other members of such family, shall be deemed to be held by one person having a family.

3. For the purpose of determining the ceiling limit of any person holding agricultural lands, who is a member of a joint family, the share of such a person in the joint family shall be deemed to be the extent of land which would be allotted to such person had such lands been divided or partitioned, as the case may be, on the notified date.

4. i) In the case of monastery or other religious institution mentioned in Group A: Sixty standard acres;

ii) In the case of monastery or other religious institutions mentioned in Group 'B' of the Schedule: Twenty-five standard acres; provided that the STATE Government may, by notification, include any other monastery or religious institution in the Schedule.

5. In the case of tea garden, orchard, livestock and poultry farm, dairy, mill, factory, workshop, any local authority, any corporation, any educational institution or any other

institution established exclusively for a charitable purpose, any co-operative society, any company registered under any law for the time being in force, so much of land as in the opinion of the State Government is required for such tea garden or orchard or livestock and poultry farm or dairy or mill or factory or workshop or local authority or corporation or institution or co-operative society or company.

6. The State Government may, in such manner as may be prescribed by notification, classify all agricultural lands in Sikkim into different Circles according to elevation and altitude and may also classify agricultural lands within each such Circle into different classes to quality, produce, productivity and the like and shall specify in such notification what quantity of land in each such class shall be treated as equivalent to one standard acre for the purpose of determining the ceiling limit under this section.’

7. Transfer of land: No person holding agricultural land in excess of the ceiling limit immediately before the notified date shall transfer any such land or part thereof by way of sale, mortgage, gift, lease or otherwise until he has furnished a statement under Section 8 and a notification regarding the excesss land held by him has been published under sub-section (1) of Section II; and any such transfer in contravention of this provision shall be demand to be null and void (Law and Legislative Department, 1978).

### **Detection of Excess Land**

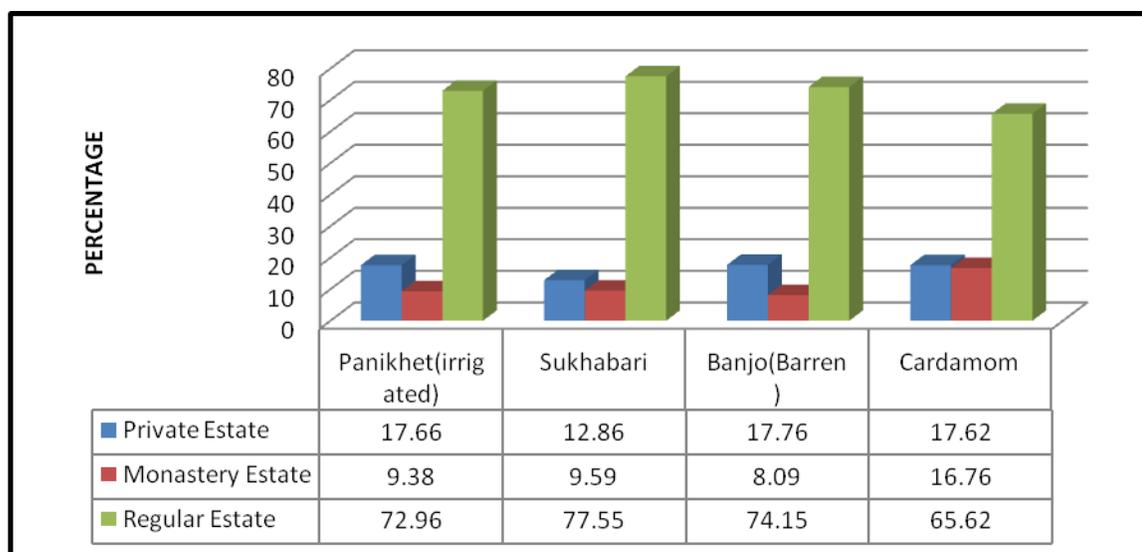
It is possible to detect excess land on the basis of ceiling on land holdings. No doubt, it is very difficult task for the administrative machinery in any underdeveloped country, not to speak of the administration in Sikkim with its given level of efficiency. According to the settlement Report of 1958, the total cultivated area was 2, 23,314 acres. The pattern of distribution of cultivated land is shown below: (Dhamala & Bhowmick, 1985).

**Table 4.13: Pattern of Distribution of Cultivated Land (Three Estates)**

Sl. No.	Kind of Land	Private Estate	Monastery Estate	Regular Estate	Total Percentage
1.	Panikhet (irrigated)	5,075.80	2,696.78	20,974.56	28,747.14(13%)
2.	*Sukhabari (Unirrigated)	20,378.56	15,213.80	122,886.70	158,479.06(70%)
3.	Banjo (Barren)	4,020.45	1830.35	16,787.19	22,637.99(10%)
4.	Cardamom	2,369.61	2,254.18	8,826.85	13,450.64(7%)
	Total	31,844.42	21,995.11	169,475.30	22, 3314.83(100%)

Source: Dhamala & Bhowmick, 1985.

\*Sukhabari (unirrigated) included orange groves, which had 221.20 acres in holding in the private estates, 106.23 acres in monastery estates and 1,483.14 acres in regular estates)



**Figure 4.8:** Percentage wise Distribution of Cultivated Land among three Estates

**Table 4.14: Pattern of Distribution of Cultivated Land**

Sl. No.	Kind of Land	Total Land S.D.	Mean ± S.D.	Standard Error
1.	Panikhet (irrigated)	28,747.14±23.5287		9.6055
2.	Sukhabari (Unirrigated)	158,479.06±33.1481		13.5326
3.	Banjo(Barren)	22,637.99±23.1516		9.4516
4.	Cardamom	13,450.64±19.4010		7.9204
	Total	22, 3314.83±21.1471		8.6332

Source: Dhamala & Bhowmick, 1985.

The table 4.14 shows the pattern of distribution of total cultivated land during 1958 in Sikkim and the mean± S.D. and standard error are also indicated. The highest is available sukhabari (unirrigated) land with significant mean ± S.D. of 158,479.06±33.1481 and its corresponding error calculated as 9.6055. The second highest available land is the panikhet (irrigated) land with mean ±S.D. of 28,747.14±23.5287 whereas the corresponding error calculated is 9.6055. After sukhabari (unirrigated) and panikhet (irrigated) comes banjo (barren) land with a significant mean ± S.D. is 22,637.99±23.1516 and the corresponding error calculated as

9.4516. The lowest available is that of cardamom land in Sikkim which has the mean  $\pm$ S.D. 13,450.64 $\pm$ 19.4010.

In the past, the government of Sikkim has been engaged in detection of excess land which may be distributed among the landless people. There had been no settlement reform after 1958. Hence, the Land Revenue Department has faced difficulties in carrying out the task of detecting excess land above the ceiling. Nevertheless, the land revenue department has given a tentative estimate of the excess land likely to be acquired for distribution among landless peasants (Dhamala & Bhowmick, 1985).

Regarding the size of holdings in Sikkim, the Government of Sikkim would have to depend on the settlement Report of 1958. The average area of holding is 8.06 acres. The holdings are still larger in comparison with those in India which are less than 2 acres. (Dhamala & Bhowmick, 1985).

### Land Holding Pattern

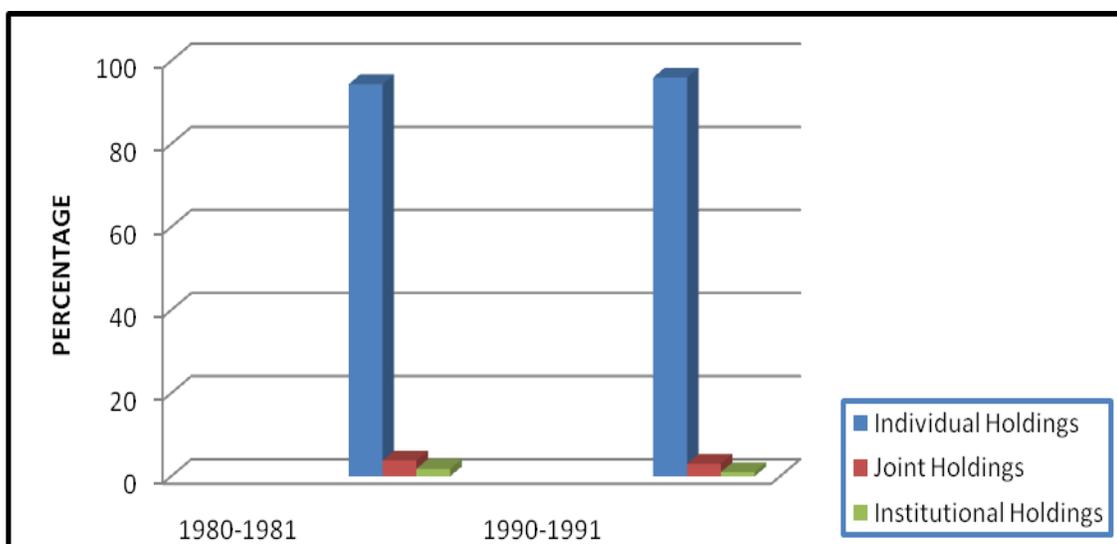
Agricultural holdings are disseminated in altitude between 300 to 3000 meters. The largest parts of the cultivable lands are terraced and farmers have inhabited on these holdings while practicing regular cropping system. Both marginal and small holdings put together comprise about 50% of all operational holdings and 41% of the total cultivated area.

**Table 4.15: Area in Operation Holding and Under Tenure and Tenancy Status in Sikkim**

Sl. No.	Operational Holdings of Land (Ha)	1980-1981		1990-1991	
		Mean $\pm$ S.D.	Standard Error	Mean $\pm$ S.D.	Standard Error
1.	Individual Holdings	102975 $\pm$ 42.6808	17.1794	106996 $\pm$ 36.9323	15.0775
2.	Joint Holdings	4120 $\pm$ 44.4162	18.1328	3027 $\pm$ 19.5550	7.9833
3.	Institutional Holdings	1973 $\pm$ 40.0050	16.3319	1297 $\pm$ 41.6653	17.0098
	Total	109068 $\pm$ 28.0499	11.4513	111302 $\pm$ 47.4046	19.3528

Source: H.R Pradhan, 1998.

The table 4.15 shows that there is significant increase in total land in ha under individual operational holdings in the year 1990-1991 (significant Mean  $\pm$  S.D 106996 $\pm$ 36.9323) compared to 1980-1981 (significant Mean  $\pm$  S.D.102975 $\pm$ 42.6808), but the area under joint and institutional holdings decreased substantially.



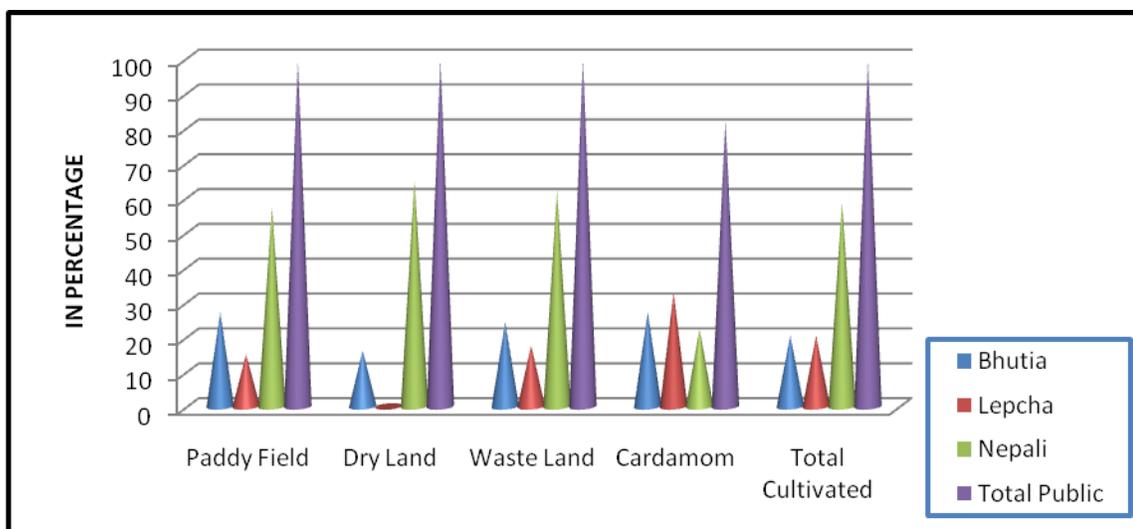
**Figure 4.9:** Area in Operation Holding and Under Tenure and Tendency Status (in Percentage)

The figure 4.9 illustrates areas under operation holding and tenancy status of Sikkim during 1980-81 & 1990-91. It is seen that in both 1980-81 & 1990-91, individual holdings far ahead of joint and institutional holdings in terms of area. The individual holdings contributed 2400 times than joint holdings and 5200 times than institutional holdings in 1980-81 while in 1990-91 individual holdings contributed 3400 times of joint holdings and around 8000 times of institutional holdings. Individual holdings pay substantial amount of land revenue to the government every year.

**Table 4.16: Community-wise Distribution of Land in Sikkim, 1976-83 (in Percent)**

Community	Total Paddy Field	Total Dry Land	Waste Land	Cardamom	Total cultivated Land
Bhutia	27.12	16.13	24.18	27.05	20.32
Lepcha	14.97	00.00	17.53	32.72	20.38
Nepali	57.19	64.95	62.00	22.37	58.66
Total Public	99.28	99.56	99.60	82.15	99.36
GrandTotal (ha)	11,727.10	6,47,39.80	11,734.40	2,1761.70	1,09,963.00

Source: Lama, 2001.



**Figure 4.10:** Community-wise Distribution of Land in Sikkim (1976-83) (ha)

The table 4.16 and the figure 4.10 depict the community-wise distribution of paddy field, dry land, waste land, cardamom and total cultivated land during 1976-83 in Sikkim amongst Bhutia, Lepcha, Nepali and all communities put together. The Nepali community came first in all sectors of land except cardamom. Nepali people are settled mostly in lower belt where cardamom is not well-suited due to scarcity of water. The Bhutia community comes second with moderate share in paddy and cardamom lands. The Lepchas have comparatively larger share of cardamom land but they do not have much dry land holdings due to their settlements in higher and moist areas.

It is worthwhile to take stock of the community-wise distribution of households possessing dry land in Sikkim. The table 4.17 makes an assessment of household that do have or do not have dry land. The mean S.D. values and standard errors are shown in the table.

**Table 4.17: Community-wise Distribution of Households Possessing Dry Land**

Community	HHs having dry land Mean $\pm$ S.D.	Standard Error	HHs not having dry land Mean $\pm$ S.D.	Standard Error
Bhutia	8163 $\pm$ 28.1638	11.4978	6606 $\pm$ 31.3942	12.8166
Lepcha	6213 $\pm$ 16.8641	6.8847	1828 $\pm$ 18.1659	7.4162
Tamang	3697 $\pm$ 29.3052	11.9638	4021 $\pm$ 13.6088	5.5557
Limboo	7701 $\pm$ 27.0924	11.0604	2971 $\pm$ 25.6046	10.4530
Bahun	5031 $\pm$ 37.6669	15.3774	2649 $\pm$ 30.6463	12.5113
Chettri	7885 $\pm$ 33.6689	13.7453	5624 $\pm$ 15.8113	6.4549

Pradhan	2149±28.0642	11.4571	2292±43.2111	17.6408
Rai	10547±30.4499	12.4311	4883±29.7523	12.1463
Manger	1796±28.5587	11.6590	1219±26.0537	10.6364
Gurung	4226±25.7992	10.5324	2263±31.8310	14.2197
Sunuwar/Mukhia	271±42.6286	17.4030	324±16.9587	6.9231
Thami	30±19.0473	7.7760	62±29.6445	12.1023
Jogi	76±25.0918	10.2437	18±10.7144	4.3741
Dewan	6±3.7416	1.5275	38±24.2074	9.8826
Bhujel	367±26.6308	10.8719	334±28.0356	11.1455
Kami	2244±37.9420	15.4897	2471±34.1467	13.9403
Damai	800±36.3483	14.8391	1545±30.2787	12.3612
Sarki	116±28.4464	11.6132	100±25.3456	10.3473
Majhi	25±17.2046	7.0237	75±29.6513	12.1051
Sanyasi/Giri	155±28.3619	11.5787	108±23.5966	9.6332
Others	180±30.2588	12.3531	10721±22.7947	9.3059
Total	61678±38.4915	15.7141	50152±28.3760	11.5844

Source: Socio-economic 2006.

Among different communities, the Rai community has highest number of households possessing dry land in Sikkim and it has significant mean  $\pm$  S.D. is 10547 $\pm$ 30.4499 and corresponding error is calculated as 12.4311. The community which does not have dry land has a significant mean  $\pm$  S.D. of 10721 $\pm$ 22.7947 and its corresponding error is calculated as 9.3059. The second highest position is occupied by the Bhutia community in both having dry land and not having dry land, the significant mean  $\pm$  S.D. is 8163 $\pm$ 28.1638 & 6606  $\pm$ 31.3942 and it has corresponding error calculated as 11.4978 & 12.8166. The Chettri community comes third in possessing both dry land and not having dry land and their significant mean  $\pm$  S.D. are 7885 $\pm$ 33.6689 & 5624 $\pm$ 15.8113 and corresponding error of 13.7453 & 6.4549. The lowest number of households which have dry land and do not have dry land belongs to Dewan and Jogi communities and their significant mean  $\pm$  S.D. are 6 $\pm$ 3.7416 & 18 $\pm$ 10.7144 and corresponding errors are calculated 1.5275 & 4.3741.

**Table 4.18: Distribution of Households Possessing Dry Land in South District**

Sl. No.	Households	Possessing of Dry Land
1.	HHs having dry land	18,236
2.	HHs who do not have dry land	8,455
	Total	2,6691

Source: Socio-economic 2006.

The table 4.18 depicts the distribution of households possessing dry land and do not have dry land in South district as per socio-economic survey of 2006. It is found that 68.32 percent

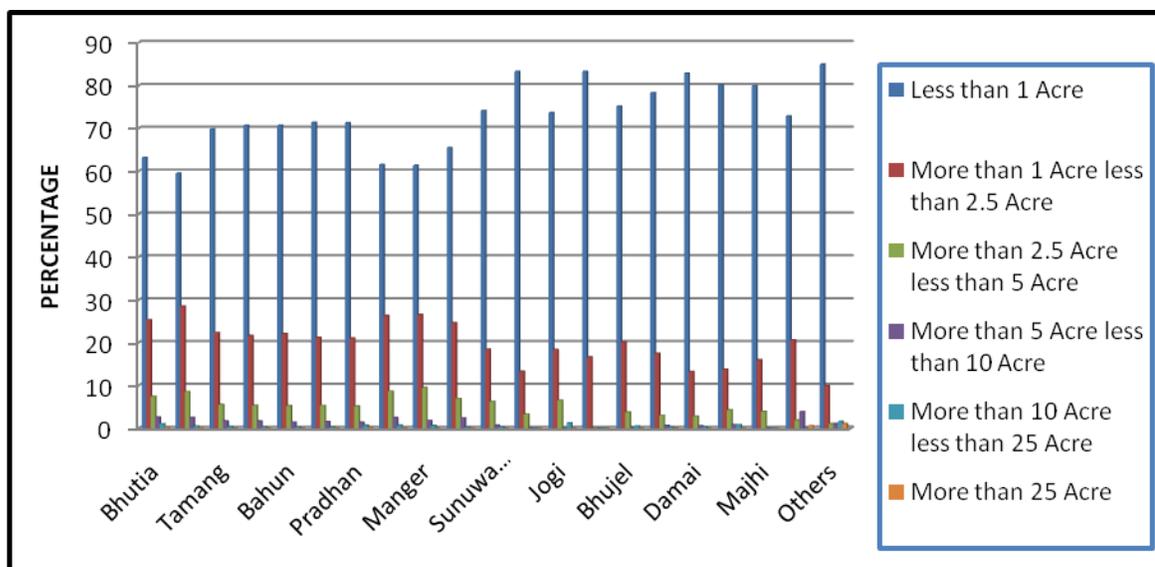
households have dry land due to the fact that the South district is in lee ward side and most drought prone area of Sikkim.

**Table 4.19: Community-wise Distribution of Households Possessing Dry Land by Size (in percent)**

Communities	>1 acre	1 acre - 2.5 acre	2.5 acre - 5 acre	5 acre - 10 acre	10 acre - 25 acre	<25 acre	Grand Total
Bhutia	63.25	25.35	7.46	2.60	1.09	0.26	100.00
Lepcha	59.58	28.50	8.61	2.53	0.58	0.19	100.00
Tamang	69.84	22.37	5.57	1.70	0.46	0.05	100.00
Limboo	70.73	21.67	5.39	1.70	0.43	0.08	100.00
Bahun	70.74	22.10	5.29	1.47	0.34	0.06	100.00
Chettri	71.38	21.24	5.34	1.56	0.37	0.11	100.00
Pradhan	71.34	21.08	5.21	1.40	0.74	0.23	100.00
Rai	61.55	26.34	8.69	2.54	0.76	0.11	100.00
Manger	61.41	26.56	9.52	1.84	0.67	0.00	100.00
Gurung	65.55	24.63	6.96	2.44	0.31	0.12	100.00
Sunuwar/Mukhia	74.17	18.45	6.27	0.74	0.37	0.00	100.00
Thami	83.33	13.33	3.33	0.00	0.00	0.00	100.00
Jogi	73.68	18.42	6.58	0.00	1.32	0.00	100.00
Dewan	83.33	16.67	0.00	0.00	0.00	0.00	100.00
Bhujel	75.20	20.16	3.81	0.27	0.54	0.00	100.00
Kami	78.34	17.51	3.03	0.71	0.31	0.09	100.00
Damai	82.88	13.25	2.88	0.63	0.38	0.00	100.00
Sarki	80.17	13.79	4.31	0.86	0.86	0.00	100.00
Majhi	80.00	16.00	4.00	0.00	0.00	0.00	100.00
Sanyasi/Giri	72.90	20.65	1.94	3.87	0.00	0.65	100.00
Others	85.00	10.00	1.11	1.11	1.67	1.11	100.00
Total (%)	67.03	23.65	6.62	1.99	0.58	0.13	100.00

Source: Socio-economic 2006.

The table 4.19 shows the percentagewise distribution of households possessing dry land within communities by land size such as less than 1 acre, more than 1 acre to less than 2.5 acres, more than 2.5 acres to less than 5 acres, more than 5 acres to less than 10 acre, more than 10 acre to less than 25 acre, and more than 25 acre in Sikkim.



**Figure 4.11:** Community-wise Distribution of Dry Land by Size (in) Percentage

The figure no. 4.11 indicates that the Lepchas have least amount of dry land in possession followed by Rais, Pradhans and Bhutias, where as the Thami and Dewan communities own substantial dry lands.

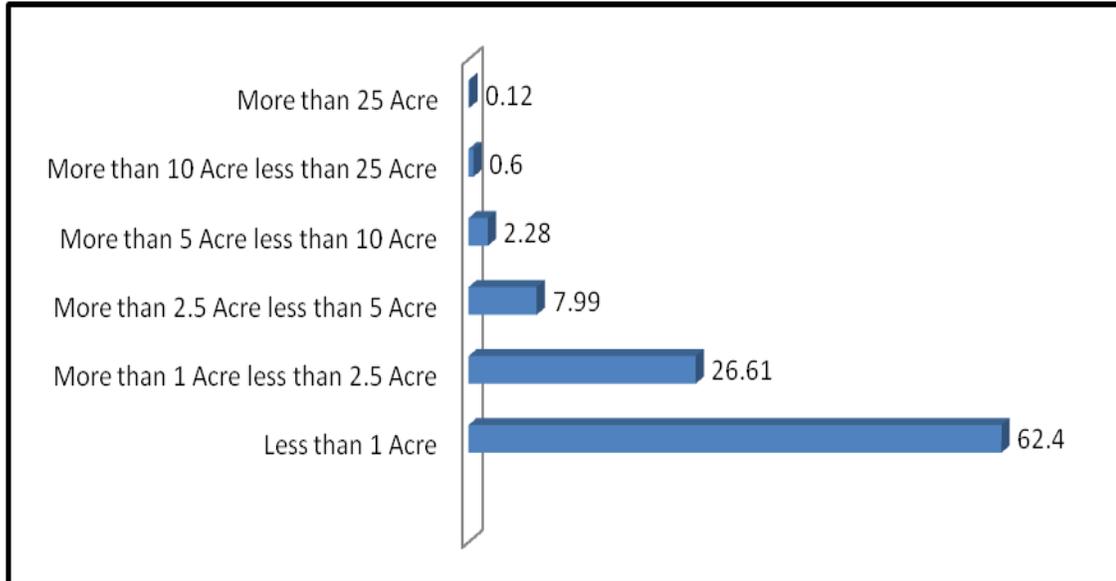
**Table 4.20: Distribution of Households Possessing Dry Land by Size, South District**

Sl. No.	Land Size	Households Possessing Dry Land Mean $\pm$ S.D.	Standard Error
1.	Less than 1 Acre	11379 $\pm$ 32.9423	13.4486
2.	More than 1 Acre less than 2.5 Acre	4853 $\pm$ 28.2913	11.5498
3.	More than 2.5 Acre less than 5 Acre	1457 $\pm$ 29.4278	12.0138
4.	More than 5 Acre less than 10 Acre	415 $\pm$ 26.7955	10.9392
5.	More than 10 Acre less than 25 Acre	110 $\pm$ 23.8746	9.7467
6.	More than 25 Acre	22.00 $\pm$ 15.3231	6.2556
	Total	18236 $\pm$ 43.9499	17.9425

Source: Socio-economic 2006.

The data in table 4.20 shows distribution of households possessing dry land by size in South District and a comparison is made among different categories of land size - less than 1 acre, more than 1 acre, less than 2.5 acre, more than 2.5 acre, less than 5 acre, more than 5 acre, less than 10 acre, more than 10 acre less than 25 acre and more than 25 acre. It is found that the highest number of households possesses dry land of less than 1 acre, the significant mean  $\pm$ S.D. is 11379 $\pm$ 32.9423 and standard error is calculated as 13.4486. Second position is occupied by the category of more than 1 acre and less than 2.5 acre of land which has the significant mean  $\pm$ S.D. is 4853 $\pm$ 28.2913 and standard error is calculated as 11.5498. The third

position is held by the category of more than 2.5 acre and less than 5 acre, the significant mean  $\pm$ S.D.  $1457 \pm 29.4278$  and standard error is calculated  $12.0138$ . The lowest position is taken by lands more than 25 acre and the significant mean  $\pm$ S.D. is  $22.00 \pm 15.3231$  and standard error is calculated as  $6.2556$ .



**Figure 4.12:** Households Possessing Dry Land (in Percentage)

**Table 4.21: Distribution of Households Possessing Orchards by Size, South District**

Sl. No.	Land Size	Households Possessing Orchards Land Mean $\pm$ S.D.
1.	Less than 1 Acre	206 (87.29%)
2.	More than 1 Acre less than 2.5 Acre	20 (8.47%)
3.	More than 2.5 Acre less than 5 Acre	2 (0.85%)
4.	More than 5 Acre less than 10 Acre	5 (2.12%)
5.	More than 10 Acre less than 25 Acre	3 (1.27%)
6.	More than 25 Acre	0 (00%)
	Total	236 (100.00%)

Source: Socio-economic 2006.

The table 4.21 shows distribution of households possessing orchards land by size in South district. It is found that households having less than 1 acre (marginal) have highest percentage i.e. 87.29 and those with more than 1 acre but less than 2.5 acre (small) comes in second

position which secures 8.47 percent. None of the households has large orchards exceeding 25 acres.

**Table 4.22: Distribution of Land Holdings (South District, 1991)**

Category	Holding (ha)			
	No. (%) Mean ± S.D.	Standard Error	Area (%) Mean ± S.D.	Standard Error
Marginal	44.00±23.7655	9.7022	9.70±7.4027	3.0221
Small	25.00±17.2046	7.0237	18.30±13.3865	5.4650
Semi-Medium	18.00±11.5758	4.7258	24.00±17.5727	7.1740
Medium	10.00±5.6213	2.2949	26.00±16.2450	6.6332
Large	3.00±1.6272	.6643	22.00±15.3231	6.2556
Total	100.00±25.3456	10.3473	100.00±25.3456	10.3473

Source: Chakrabarti, 2012.

The table 4.22 shows the distribution of marginal, small, semi medium, medium and large landholdings in the South district. The marginal farmers (44 percent) are predominant in the district, the majority of people having less than 1 acre of land in 1991.

The per capita land availability in Sikkim in different years from 1971 to 2001 has been divided into five categories such as Net Cultivable Land, Operated Area for Agricultural Use, Land for Non-Agricultural use, Pasture & Cultivable Waste Land and Forest. In the following tables (no. 4.23 and 4.24) the per capita availability of land in Sikkim in the years 1971, 1981, 1991 and 2001 have been presented to highlight the decreasing trend in all categories of land except forest.

**Table 4.23: Per Capita Land Availability in Sikkim, 1971 & 1981 (in Ha)**

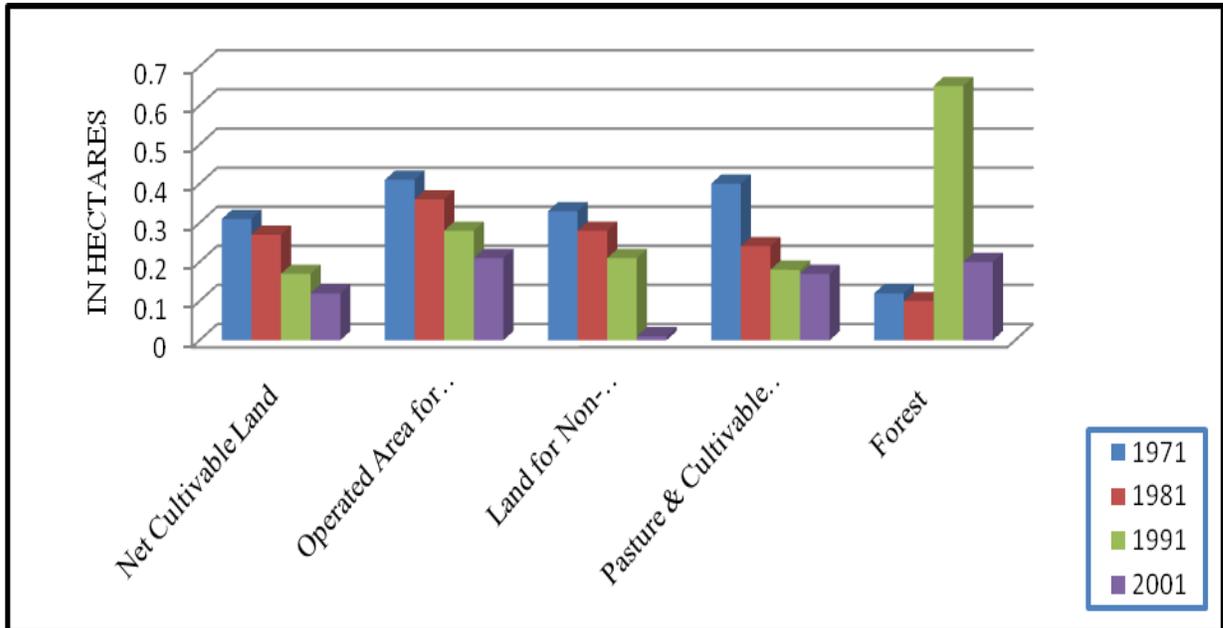
Sl. No.	Type of Land	1971 Hectares Mean ± S.D.	Standard Error	1981 Hectares Mean ± S.D.	Standard Error
1.	Net Cultivable Land	0.31±.1357	0.5544	0.27±.1346	.0549
2.	Operated Area for Agricultural Use	0.41±.1740	.0710	0.36±.1513	.0618
3.	Land for Non- Agricultural use	0.33±.1296	.0529	0.28±.0946	.0886
4.	Pasture & Cultivable Waste Land	0.40±.1662	.0678	0.24±.0907	.0370
5.	Forest	0.12±.0641	.0252	0.10±.6681	.0278

Source: H.R Pradhan, 1998 and Gazetteer of Sikkim, 2013.

**Table 4.24: Per Capita Land Availability in Sikkim, 1991 & 2001 (in Ha)**

Sl. No.	Type of Land	1991 Hectares Mean $\pm$ S.D.	Standard Error	2001 Hectares Mean $\pm$ S.D.	Standard Error
1.	Net Cultivable Land	0.17 $\pm$ .0864	.0353	0.12 $\pm$ .0641	.0252
2.	Operated Area for Agricultural Use	0.28 $\pm$ .0946	.0386	0.21 $\pm$ .1019	.1019
3.	Land for Non-Agricultural use	0.21 $\pm$ .1019	.1019	0.01 $\pm$ .0028	.6011
4.	Pasture & Cultivable Waste Land	0.18 $\pm$ .1056	.0431	0.17 $\pm$ .0864	.0353
5.	Forest	0.65 $\pm$ .2490	.1016	0.20 $\pm$ .1056	.0431

Source: Pradhan, 1998 and Gazetteer of Sikkim, 2013.



**Figure 4.13: Per Capita Land Availability in Sikkim in Different Years (in Ha)**

In the case of land availability in Net Cultivable Land, a decreasing tendency is seen from 1971 to 2001. Land availability in the case of Operated Area for Agricultural Use has been decreasing from 1971 to 2001. Land for Non-Agriculture became almost nil in 2001. Pasture & Cultivable Waste Land also started decreasing between the years 1971 to 1981, and from 1991 to 2001 it is almost in the same position. In 1991, it is seen that the per capita land

availability of Forest has suddenly increased. Per capita availability of all types of land except forest land in Sikkim had decreased from 1971 to 2001.

## References

Chakrabarti, A. 2012. "Food Security in Sikkim: A Critical Review" In *Politics, Society and Development* edited by M.Yasin and D.P. Chhetri. Delhi: Kalpaz Publications: 214.

Das, B.S. 1996. *The Sikkim Saga*. New Delhi: Vikas Publishing House Pvt. Ltd: 9.

Datta, A.1992. "Land and Ethnicity in Sikkim," In *Man in India*, June: 165.

Dhamala, R. Ranju and Bhowmick, D.J. 1985. "Land Reforms in Sikkim," In *The Himalayas: Profiles of Modernization and Adaptation*, edited by S.K. Chaube. New Delhi: Sterling Publishers Pvt. Ltd: 115-122.

GoS (Government of Sikkim). 1996. *Land Utilisation Statistics of Sikkim*. Bhutia, Kunga Gyatso. Tadong, Sikkim: Department of Agriculture, Gos.

----- 2001. *Sikkim Human Development Report*. Mahendra P. Lama (ed.). Delhi: Social Science Press, GoS: 39-45.

----- 2002. *Sikkim: A Statistical Profile 2002*. Gangtok Sikkim: Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

----- 2007. *Economic Survey 2006-2007*.Gangtok Sikkim: Department of Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS: 13-14.

----- 2011. *Village Development Action Plan; A Plan For Realizing of A Poverty Free Sikkim*. Gangtok Sikkim: Department of Rural Management and Development, GoS.

----- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS: 234.

Gupta, Manas Das. 1992. *Sikkim: Problems and Prospects of Development*. New Delhi: Indus Publishing Company:37.

Joshi, P.C. 1976. *Land Reforms in India*. Delhi: Allied Publishers Ltd: 87.

Pradhan, H.R.1998. 'Economic Structure of Sikkim,' In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.

Subba, J.R. 1984. *Agriculture in the Hills of Sikkim*. Gangtok, Sikkim: Sikkim Science Society: 40-41.

----- 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 79-80.

**Web Link**

[Shodhganga.inflibnet.ac.in](http://Shodhganga.inflibnet.ac.in) (Accessed on August 08, 2015).

[www.icarzc3.gov.in](http://www.icarzc3.gov.in) (Accessed on June25, 2016).

# Chapter 5

## Cropping Pattern

### Introduction

Even though Sikkim is a tiny state of India, occupying very little area under cultivation, it embodies a variety of cropping patterns largely due to dissimilarity in topography as well as altitude. The cropping pattern varies according to altitude and prevailing climate. The major cropping patterns in Sikkim are presented in this chapter by taking only major crops into consideration. The crop with substantial percentage in total sown area in a particular region is taken as the base crop and all other possible substitute crops which are sown in the region either as alternatives as support crop in the same period or as crops that are suitable as rotation in the successive season, are considered in the pattern.

Though cropping activity goes on all the year round in Sikkim, there are two main seasons in the state. They are:

1. *Kharif Season* (May to October) - the crops grown during this season are known as kharif crops e.g. maize, rice, millet etc. and
2. *Rabi Season* (October to March) - the crops grown during this season are known as rabi crops e.g. wheat, barley, mustard etc.

### *Cropping Pattern in Kharif Season*

- Pre-kharif: Maize (February- August); in dry field, maize+soybean
- Maize+beans+vegetables
- Kharif: Paddy (May to October-November)
- Kharif: Paddy+soybean/rajma
- Kharif: Rajma+vegetables/potato
- Kharif: Urd (Pehali dal)
- Kharif: Millet (pure crop).

### *Cropping Pattern in Rabi Season*

- Rabi: In dry field, maize is followed by mustard and buckwheat (September – February).
- Rice is followed by wheat in irrigated field as well as in dry field, to cover fallow land (September – March).
- Large area expansion has been done under buckwheat crop to fill the gap created by low production of wheat during dry season.

- Barley as pure crop in limited area (nfsm.gov.in).

The prevalent cropping systems of Sikkim are the cumulative results of past and present decisions by individual farmers, farming communities of the state, governments and their agencies. These decisions are usually based on experience, tradition, food habit, market facility, expected profit, personal preferences and resources, social and political pressures and so on (Subba, 1984).

The cropping pattern of a region is determined by a variety of factors, most notably, elevation, topography, precipitation and so on. All kinds of seasonal, off-season and perennial crops can be grown in Sikkim due to climatic variations caused by altitudes. The mixed farming system of agriculture, horticulture and livestock rearing practices are common in Sikkim. The climate of Sikkim is conducive for growing a large number of high value cash crops such as cardamom, potatoes, ginger, variety of fruits, off-season vegetables and numerous other horticultural crops along with agricultural crops and livestock. In general, maize-ginger inter-cropping or maize-urd are common practices in low and mid elevation dry-fields; paddy-maize/wheat/tori/potato crop rotation at lower elevation; orange-legumes/ginger at mid elevation, cardamom at mid and higher elevation, seed-potato-maize or maize-soybean or seed potato-pea/soybean/temperate fruits at high elevation are common crop rotations. The cropping patterns of the state have undergone metamorphic changes since the merger with India in 1975. These changes are significant indicators of the ongoing process of agricultural transformation from cereal dominated subsistence agriculture to high value cash crop dominated commercial agriculture (Subba, 2008). After 1975, cereal dominated subsistence agriculture slowly started being altered into high value cash crop-based commercial agriculture with increased production of pulses, oilseeds, fruits and vegetables and cultivation of cash crops such as ginger and mandarin orange in more areas.

**Table 5.1: Agriculture Crops and Cropping Seasons at Different Agro-Climatic Conditions**

Seasons	Crops/Vegetables	Crops sown	Crops harvested
Winter	Wheat, Buckwheat, Mustard, Radish, Cabbage, Cauliflower, Potatoes, Peas, Tomatoes etc.	December-February	April-May
Summer (Pre-kharif)	Maize	March-April	June-July in lower and August-September in higher altitudes
	Yams, Colocasia, Tapioca	March-April	December-March
	Chayote (Eskush), other climber crops (cucumber, pumpkin, gourds, etc)	March-April	June through March
	Ginger, Turmeric	March-May	Anytime during November through March
Monsoon	Rice, Pulses , Beans	June-July	October-December

(Kharif)			
	Finger-millet, soybean	August	November-December
Year round	Cabbage, Radish, Carrot, Cauliflower, Brocoli, Beans, Tomatoes etc.	Grown mostly in all the seasons at different altitudes	

Source: Gazetteer of Sikkim, 2013.

### **Cropping Pattern is also determined by Rainfall and Temperature**

The increase in precipitation with altitude may be no less important for agriculture than the decrease in temperature. Since the capacity of air to hold moisture varies directly with its temperature, and as this decreases adiabatically in ascending air, highlands have heavy precipitation. Consequently, up to a specific height agriculture gets hampered by heavy rainfall and soil erosion. At places the combination of high altitude and sufficient moisture results in snowfall which makes agricultural activity very difficult. Beyond certain heights the rainfall declines in mountainous areas where its effectiveness lessens, but low temperatures and low evapotranspiratory demand may be supplemented to a large measure. At different altitudes, the rainfall effectiveness also differs on different slopes. It generally is more effective over the windward side. Similarly the effectiveness will be relatively less over the sunny slopes because of more evapotranspiration (Singh & Dhillon, 2008). So the precipitation and moisture holding capacity variations from place to place have crucial role in determining the cropping pattern in hilly region.

To indicate the significance of rainfall and temperature variations on cropping pattern, the rainfall and temperature data of two different places from two districts, namely East and South districts are given below:

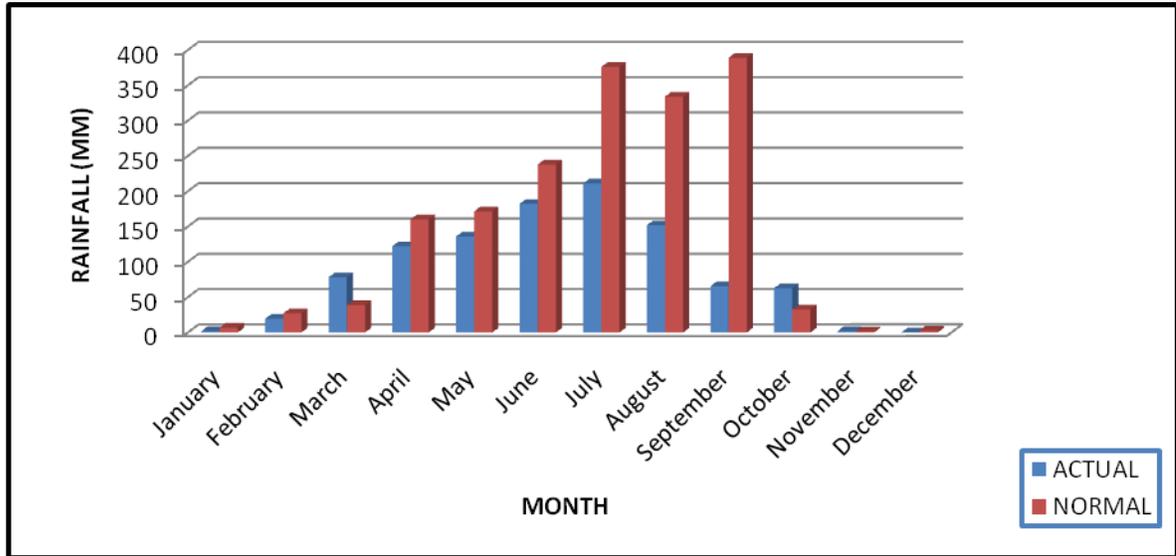
**Table 5.2: Actual and Normal Rainfall (mm) of Namthang (South District)**

Month/Year (2013-14)	Actual	Normal	Situation
January	2.00	7.00	Scanty
February	19.40	27.10	Deficient
March	78.30	38.90	Excess
April	122.20	160.20	Deficient
May	135.80	171.50	Deficient
June	182.20	237.90	Deficient
July	211.20	376.20	Deficient
August	151.90	334.00	Deficient
September	065.60	389.10	Scanty
October	062.80	32.70	Excess
November	002.20	1.70	Excess
December	0.00	2.90	Scanty

Source: Hand Book on Agriculture Sikkim, 2013-14.

As per the table given above, the actual and normal rainfall of Namthang, South district seems to be scanty and deficient. During the time of cultivation, insufficient rainfall leads to non

affluent condition for the agriculture. During 2013-14, rainfall was excessive in three months i.e. March, October and November.

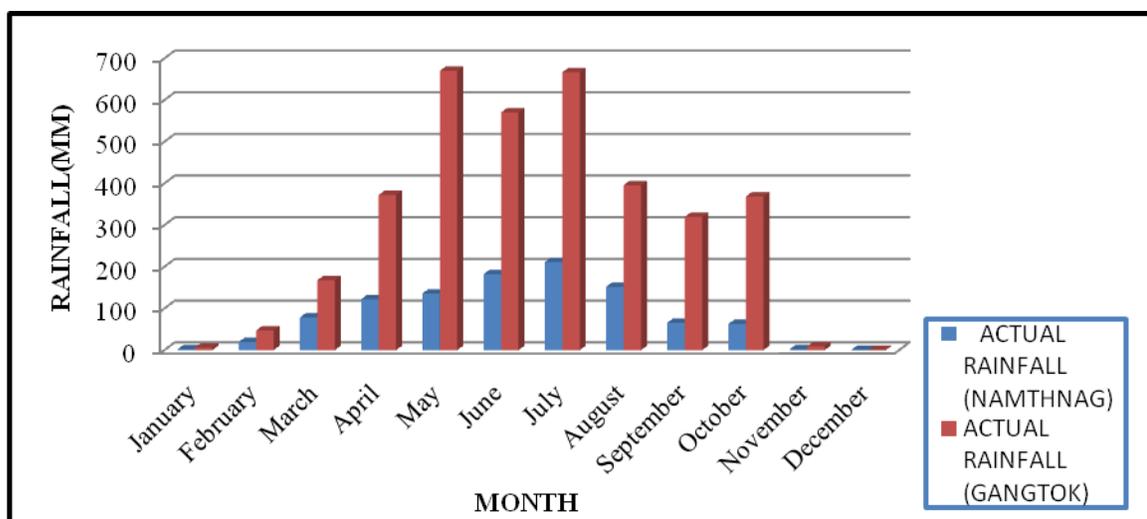


**Figure 5.1:** Rainfall (mm) of Namthang (South District) 2013-14

**Table 5.3: Actual Rainfall of Gangtok (East District) and Namthang (South District).**

(Source: Hand Book on Agriculture Sikkim, 2013-14)

Month/Year (2013-14)	Actual Rainfall (Namthnag)	Actual Rainfall (Gangtok)
January	2.00	6.00
February	19.40	47.30
March	78.30	167.90
April	122.20	372.30
May	135.80	670.20
June	182.20	570.40
July	211.20	666.80
August	151.90	395.70
September	065.60	319.80
October	062.80	368.90
November	002.20	8.80
December	0.00	8.40



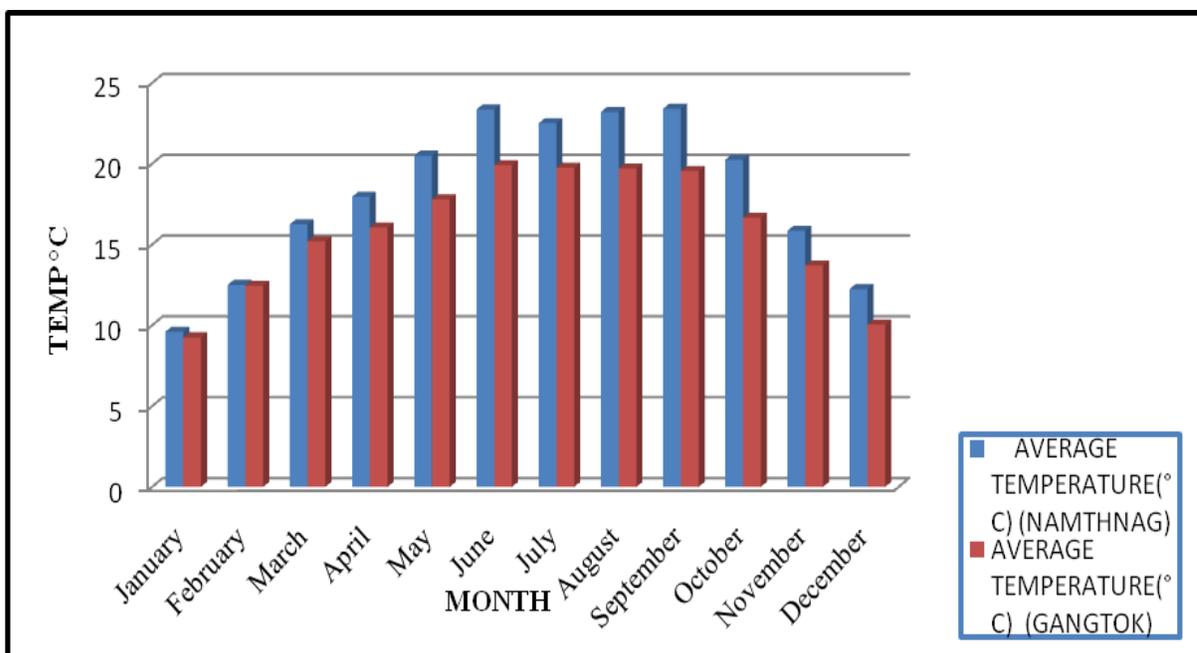
**Figure 5.2:** Actual Rainfall (mm) of Gangtok and Namthang (2013-14)

From the above figure, it is revealed that the actual rainfall in Gangtok, i.e. the East district and that of Namthang, i.e. South district varies greatly due to topographical aspects of the regions. In almost all the months from January to December, rainfall occurs routinely in East district, but the South district remains dry in winter months. In other months too, rainfall in South district is far too little in comparison with the East district. The South district is considered as drought prone area of Sikkim.

**Table 5.4: Average Temperature of Gangtok (E. District) and Namthang (S. District)**

Month/Year (2013-14)	Average Temperature(°C) (Namthang)	Average Temperature(°C) (Gangtok)
January	9.60	9.25
February	12.50	12.45
March	16.25	15.20
April	17.95	16.05
May	20.50	17.80
June	23.35	19.90
July	22.50	19.75
August	23.20	19.70
September	23.40	19.55
October	20.25	16.65
November	15.85	13.70
December	12.25	10.05

Source: Hand Book on Agriculture Sikkim, 2013-14.



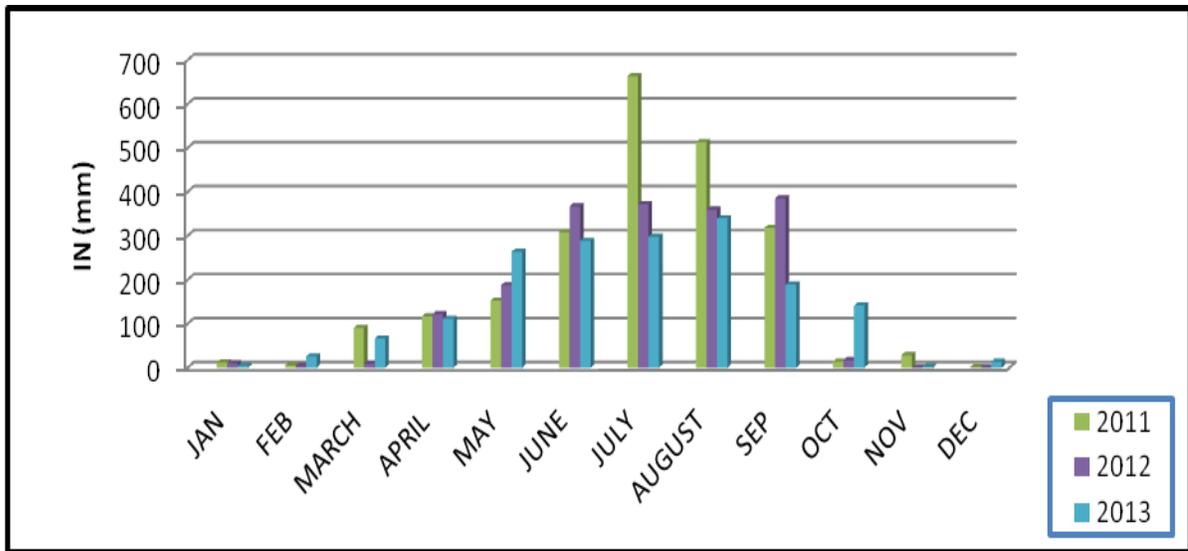
**Figure 5.3:** Average Temperature (°C) of Namthang and Gangtok (2013-14)

It is evident from the above figure that the average temperature (°C) of Namthang in South district is always higher in comparison with Gangtok in East district. The average monthly temperature in Gangtok normally remains below 20 degree, which indicates a salubrious climate, favourable for a variety of crops.

**Table 5.5: South District Rainfall (mm) for Three Consecutive Years (2011-2013)**

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2011	11.5	5.4	90.4	117	152.7	308.5	663.3	513.4	318.2	13.9	28.6	1.0
2012	10.1	3.6	9.1	122	187.5	367.2	372.1	359.7	385.1	16.9	0.0	0.0
2013	4.0	25.7	66.2	111	263.8	288.4	297.8	339.6	189.2	141.5	2.2	13.5

Source: sikervis.nic.in.



**Figure 5.4:** South District Rainfall (mm) for Last Three Years (2011-2013)

From the aforesaid figure which shows the rainfall of South district for three consecutive years i.e. 2011-2013, it is found that the highest rainfall occurs in the month of July. Of the three years from 2011-2013, the highest rainfall recorded was in 2011. In 2012, rainfall has been almost even in the months from June to September. In 2013, rainfall in the month of May was more than the previous years.

Sikkim's diverse ecological condition that arrays from tropical to alpine support the cultivation of a variety of fruits, vegetables, in and out of season, and are also excellent for commercial crops like cardamom, ginger, orange, etc. The present trend towards rapid expansion of horticultural crops will have positive implications for improving food and economic security of the farmers of Sikkim. However, scrutiny of yield data and other parameters like net income per hectare, market demand, peak season of arrivals and price trend in major markets should be kept in mind to regulate the production –marketing chain. Ginger, vegetable farming, seed potato farming in horticulture and also livestock rearing especially dairying has particularly helped small and marginal farmers of Sikkim to come out of poverty trap (Subba, 2008).

Horticulture plays an important role in Sikkim's agriculture and commerce. The vegetable farming extends from the foothills to altitude up to 2000m above sea level. The major vegetables of the state are:

- a.) *Kharif Vegetables:* Brinjal, chili, capsicum, pumpkin, French beans, cowpea, bhindi (okra), cucumber, bottle gourd, sponge gourd, balsam apple, chayote etc.

- b.) *Rabi Vegetables*: Cabbage, cauliflower, broccoli, garden pea, French beans, radish, carrot, turnip, palak (spinach), amaranthus, methi (fenugreek), leafy mustard, lettuce, coriander, leafy onion, garlic, seed potato, colocasia etc.
- c.) *Off Season Vegetables*: Cabbage, cauliflower, broccoli, Brussels sprouts, radish, carrot, tomato, green pea, French beans, palak (spinach), leafy mustard, chayote, cucumber, amaranthus, leafy onion, summer potato, capsicum, asparagus, bamboo shoots, fern shoots, stinging nettles, mushroom etc.

### **Cropping and Intercropping System**

Population pressure on the cultivated land is constantly increasing. The per capita availability of net cultivable land in the state during 1981 was 0.31 ha, which decreased to 0.24 ha in 1991, which further decreased to 0.24 ha in 2001.

Most of the land available in state is sloping. Field trials were conducted at ICAR complex to evaluate the role of mono, sequential and intercropping systems on partially terraced and partially contour bounded micro-watershed (Awasthi and Prasad, 1987). The overall results showed the feasibility of increasing total crop yields, carbohydrate, calorie and protein production through crop intensification and diversification. The sloping lands are three to four times less efficient in meeting the food needs of calorie and protein because it can hardly sustain three to four persons per ha per annum against the sustainability of nine to ten persons in a plain land. Continuous available cropping system on steep land even with moderate level of fertilizer beyond two to three years may not be of desirable proportion because of heavy soil erosion. In hill areas like Sikkim terraced farming has been under practice in order to prevent soil erosion. It is therefore a kind of compulsion to adopt agri-horti-silvi pastoral system as an alternative for such steep sloping land. Sikkim is already deficit in food and vegetables. About half of its population is being fed from outside sources. Hence, it is imperative to augment vegetable production by intensifying vegetable cultivation and increasing the cropping index by multiple cropping programmes. Combining vegetables with several multiple and relay cropping systems in irrigated areas and intercropping systems in rainfed farming systems are relatively new concepts to be explored to benefit the farmers and to increase vegetable production. Multiple cropping and intercropping provides maximum production with available resources per unit area and provides maximum benefit to the farmers from the available land resources. Most of the vegetable crops produced in the state are the products of mixed cropping, relay cropping and intercropping systems. Potato and garden pea are common intercrops at higher hills in Sikkim. French beans, garden pea, tomato, ginger are very common intercrops in the state (Sikkim Study Series, 2004).

### **Cultivation of Seasonal Vegetables**

Cost of production of vegetables in the hilly areas per unit is higher than that of the plains due to low production, wild plant problem, manual means of operation and other climatic factors

which play a very important role to determine the fostering of vegetables. As a result, the hill farmers cannot compete with the farmers of the plains in the vegetable market. Therefore, the reason of Kharif and Rabi seasonal vegetable production is the only way to meet both family demand and the local market. The vegetable growers of the state cannot compete with the outside market in seasonal Kharif and Rabi vegetables. The basic aim of seasonal Kharif and Rabi vegetable production should be to meet the deficit supply of vegetables in the state. About half of the vegetable requirement of the state is being met from the sources based outside the state. As per the speculative data published in the Sikkim Bihari Jagran Manch post of 7<sup>th</sup> April, 2018 Sikkim has an eating population of approximately 10.0 Lakhs including tourist and labourers. Sikkim is hypothetically producing 24,710.0 tons of vegetable and consuming 1,09,500.0 tons of vegetables, thus there is a shortfall of 84,790.0 tons.

### **Cultivation of Off-Season Vegetables**

Most of the vegetables produced in the state are off-season vegetables. Production of vegetables at times other than the normal season is known as off-season vegetables. A wide range of agro-climatic condition of Sikkim with elevation ranges from 270m to 4000m, temperature range of 0°C to 10°C (December to January) to 15°C to 30°C (June to September), well distributed annual rainfall (May to September) 82mm to 3493mm, relative humidity of 70% and above most of the time and sunshine hours of 0.05 to 3.87 hours/day (summer) to 4 to 7 hours/ day (October), provide ample scope for cultivation of various types of local and exotic vegetables all round the year both for inside and outside markets (Subba, 1998). The most commonly and commercially cultivated off-season vegetables in the state are as follows:

- a. Solanaceous: Summer potato, Summer tomato, capsicum, Akbarey chili (Dale Khursani), tree tomato, green Chili,
- b. Cole Crops: Off-Season cabbage, cauliflower, broccoli, Brussels sprouts,
- c. Roots and Bulbs: Radish, carrot, turnip, beetroot,
- d. Legume Crops: Garden pea, French beans
- e. Cucurbits: Chayote, cucumber, green pumpkin, and
- f. Others: Amaranthus, palak, leafy mustard, leafy onion, leek , bamboo shoots, fern shoots, stinging nettles, mushrooms, buckwheat leaf, etc (Subba, 1998).

Farming of off-season vegetables has its own capacity in the market places as it can compete in both internal and external markets. Himachal Pradesh is a good example in the field of

seasonal vegetable production like tomato, capsicum, cabbage and cauliflower. At present, there has been growing production of off-season vegetables in Sikkim. Therefore, it may be a viable means to capture the market.

### **Fruit Crops**

In Sikkim, a large range of fruit crops are grown in diverse climatic conditions. Climate has a significant role in the selection of the right kind of fruit crops that could be effectively grown in the area. Due to monsoonal rainfall from April to September and humidity higher than 70 percent almost throughout the year, the state has enormous possibilities of cultivating fruit crops. Sometimes, high rainfall and humidity, hailstorms create problems of high intensities. The important fruits grown in the state are mandarin orange, banana, guava, papaya, mango, peach, plum, pears, apple, avocado etc. The state is also rich in native range of minor or wild fruits. Presently mandarin orange is a significant commercial fruit crop of Sikkim. But the productivity of fruit crops is very low. Fruits are grown in different elevations in Sikkim.

**Table 5.6: Altitude wise Distribution of Cultivated Fruits Crops**

<b>Altitude in meter</b>	<b>Crops</b>
250-1000	Banana, Mango, Papaya, Guava, Litchi, Sapota, Jackfruit, Limes and Lemons, Mosambi
1000-1500	Mandarin Orange, Pomegranate, Avocado, Guava, Banana, Low Chilling Peach, Plum and Pear, Passion Fruits, Strawberries etc.
1500-2000	Peach, Plum, Pear, Low Chilling Apple, Kiwi Fruits, Passion Fruits, Walnut etc.
2000-4000	Apple, Apricot, Plum, Peanut, Walnut, Almond etc.

*Source:* Upadhyaya, 1998.

The above table depicts distribution of cultivated fruit crops according to altitude ranging between 250 to 4000 m. In the bottom up to 1000 m, tropical fruits like banana, mango, papaya, guava, litchi, sapota, jackfruit, limes and mosambi are cultivated. Between 1000 - 1500 m of altitude, varieties of sub-tropical fruits such as, mandarin orange, pomegranate, avocado, guava, banana, low chilling peach, plum and pear, passion fruit and strawberries are cultivated. Altitudes between 1500-2000 m are suitable for juicy fruits like peach, plum, pear, low chilling apple, kiwi fruit, passion fruit, walnut etc. In the upper part or top most part ranging between 2000-4000 m, some hard peel (outer coating of fruit) fruits like apple, apricot, plum, peanut, walnut, almond etc. are grown.

According to elevation, different types of crops and fruits found in Sikkim can be classified as follows:

1. *Sub-tropical Zone: Lowlands*

- Elevation: 700 -1500 amsl (ft.)
- Areas: Rangpo, Majitar, Kumrek, Kamling, Singtam, Jorethang, Jitlang, Mamring, Suntaley, Sirwani.
- Cereals and Oilseeds: Rice, Wheat, Soybean, Maize and Mustards.
- Fruit, Vegetables and Floriculture: Mango, Banana, Litchee, Guava, Brinjal, Tomato, Gourds etc.

### 2. *Temperate Zone Mid Hills*

- Elevation: 1500 to 5000 amsl (ft.)
- Areas: Khamdong, Namthang, Maniram, Sadam, Turuk, Dong, Samatar, Aho, Mulukey, Rumtek etc.
- Cereals/Pulses/Oilseeds: Rice, Wheat, Maize, Barley, Baby corn, Sweet corn, Barley, Urd, Millet etc.
- Fruit and Vegetables, Spices, Floriculture: Oranges, Kiwi, Guava, Banana, Passion fruits, Tomato, Chayote, Potato, Ginger/Turmeric etc.

### 3. *Temperate Zone High Hills*

- Elevation: 5000 ft. to 8500 amsl (ft.)
- Areas: Kabi, Okhrey, Chungthang, Pakyong, Chujachen, Lamaten, Geyzing, Sombaria, Naga, Shipgyar etc.
- Cereals/Pulses/Oilseeds: Rice, Wheat, Maize, Millet. Barley, Rajmah, Beans, Mustard, Soybean etc.
- Fruit and Vegetables: Peach, Plum, Avocado, Tree Tomato, Leafy Vegetables, Seed Potato, Cabbage, Spices, Large Cardamom, Floriculture etc.

### 4. *Alpine*

- Elevation: 9000 ft to 16000 amsl (ft.)
- Areas: Lachung, Lachen, Hilley, Barsey, Nathang, Tsangu.
- Crops: Cabbage, Apple (till 9000 ft.) (nsfm.gov.in).

The crops cultivated during kharif seasons are maize, rice and millet, while the Rabi crops include wheat, barley, mustard etc. Due to diverse levels of altitude and micro-climatic aspects, the two cropping seasons often overlap. The crops, for instance buckwheat, pre-kharif paddy etc. grown between March and June in the paddy fields of mid- and lower elevation, correspondingly may be categorized as zaid or pre-kharif crops.

In Sikkim, these two seasons are not distinct and overlap each other due to the following factors:

- i.) A very wide range of elevation (300 to 1700 meters)
- ii.) A generally low temperature with occasional fluctuation at the time of precipitation (0° to 27°)

- iii.) High rate of rainfall and occasional precipitation even during Rabi season.
- iv.) Occasional hailstorm in March-April at higher elevations.
- v.) Occasionally a longer duration dry spell in January-February.
- vi.) Longer duration of crops.

As a result of these factors Kharif sowing starts in February and harvested by December, while Rabi sowing starts in October and harvested by May depending upon the elevation and other local cropping system of various places of the state (Subba, 1984).

### **Existing Cropping Patterns during Kharif Season**

The main crops during kharif seasons of Sikkim are maize, rice, finger millet, ginger and seed potato.

#### ***Maize Based Cropping Patterns***

Maize is the chief cereal crop grown in Sikkim and it is one of the substitute foods of rural group. This is grown even in dry and sloping lands that are not appropriate for the cultivation of rice. It is cultivated in an area of 38,955 hectares, which constitutes the largest area according to progress report 2015-16 of Sikkim. Maize is cultivated in the land ranging from altitude of 300 to 2400 metres above mean sea level. In Sikkim, this crop is cultivated in all four districts, but among them South district covers the largest area (14,000 ha) followed by other districts like West (13,210 ha), East (8,991 ha) and North district (2,754 ha) respectively.

About 12 (twelve) cropping patterns have been identified in the state (Subba, 1984). The maize at the base of irrigated field or dry fields of all places of the state, irrespective of altitude, rainfall and climatic disparity, maize is the base crop. Finger millet, pulses, potato, ginger and vegetables in kharif and wheat, barley, mustard, potato, rabi maize and vegetables in rabi, and wheat in zaid are the main substitute crops of this cropping patterns.

The four districts of Sikkim have alternative crops: in East district the crops are vegetables, barley, mustard, buckwheat, millet, ginger and pulses, while in the West district millet, pulses, vegetable, potato, ginger, wheat, barley, mustard and buckwheat. In the North district the crops are vegetables, potato, wheat, barley, buckwheat, pulses and mustard and lastly in the South district alternative crop are pulses, ginger, vegetable, wheat, barley, mustard, potato, millet and buckwheat are grown. Generally, potato and ginger are inter-cropped, and millet and pulses are relay-cropped (Subba, 1984).

#### ***Rice Based Cropping Patterns***

Rice is the staple food crop in Sikkim. The name of Sikkim 'Denzong' means the 'valley of rice' which signifies the cultivation of rice. However its cultivation is possible only in the irrigated and terraced lands of Sikkim. It can be grown in the areas, which have altitude ranging from 300 to 1700 metres.

The estimated area under rice cultivations according to progress report (2015-16) of Sikkim is 10,669 hectares and most of Sikkim's rice is produced in the East and the West districts. The East district, with an area of 4,813 hectares under rice cultivation, is the largest producer of the crop in the state. The corresponding area in the West district is 3,016 hectares. The South district has only 1,920 hectares of land under rice cultivation and comes after East and West districts.

About nine (9) rice based cropping patterns have been identified in the state (Subba, 1984). The substitute crops in this cropping pattern are maize (between 300 to 900 metres elevation), wheat, buckwheat, mustard, vegetable, potato, pulses on paddy field bunds, fodder and vegetables. But maize and potato are relay cropped in triple cropping at lower altitude especially at Daramdin in West and Majitar in East districts. In East district the significant substitute crops are wheat, mustard, buckwheat, maize and vegetable, while in West district buckwheat, wheat, maize, vegetable, potato, maize fodder and mustard are the main substitutes. In North district, wheat and buckwheat are the only alternatives, but in the South district wheat, mustard, buckwheat, maize and vegetable form the important alternative crops.

#### ***Seed Potato Based Cropping Patterns***

In Sikkim, potato is considered as a horticultural crop. The total area under potato cultivation in Sikkim is 3,550 ha (2001). The areas located within 1700m above mean sea level are best suited for the cultivation of seed potato. Seed potato occupies about 65 percent of the total area under potato cultivation. It is an important crop in the West and North districts of Sikkim (Choudhury, 2004). The estimated area under potato has been increased to 188 percent i.e. 10,246 ha (2015-16) as compared to 3,550 ha in 2001. According to the 2015-16 report, West district has 4,401 ha, East has 2,738 ha, South having 2,503 ha and North district has only 604 ha.

Moreover, potato is one of the major cash crops particularly in high attitude area of Sikkim, where potato is grown as seed potato. Potato is grown as kharif potato (i.e. summer potato) which is sown in January-February and harvested in July-August. Likewise, rabi potato (i.e. winter potato) is sown in September-October and harvested during February-March.

Farmers prepare the compost by using collected forest litter and animal bedding along with animal excreta in pits. The compost is applied at the time of seed planting on furrows or pits. Pea is intercropped giving the space of 4-5 furrows between each row to avoid the shading effect and harvesting of pods is done in May-June for vegetable purpose. In some areas, farmers burn the residues openly on the entire field and then mix with the soil by ploughing. At higher elevation above 2500 m it is mono-cropped and at lower elevation crop sequences of

maize-potato, maize-rice-potato, rice-potato, and maize-ricebean-potato are most common (Subba, 2009).

Sikkim has different places where seed potato is considered as base crop, e.g. in Ribdi, Okharey, Bharang, Hattabon, Sepreynagi, Thambong, Buriakhop, Sribadam, Upper Bermiok, Hee Patal, Sankhu, Uttarey and Yoksum in the West and Ravangla in South, Pademchen and Zaluk in the East and Lachung and Lachen in the North district. West district covers the maximum area under potato cultivation. The important alternate crops in this cropping pattern are maize, pea, wheat, cabbage, barley and radish. Pea is cultivated as mixed crop especially in West district. Maize is sown as mixed crop in other areas of the state. About six (6) cropping patterns are selected in seed potato-based cropping pattern in the state

### ***Ginger Based Cropping Patterns***

Ginger is considered as one of the cash Crops of Sikkim in the group of spices. The estimated area under ginger cultivation occupies 10,115 ha (2015-16). The main areas of ginger growing are Rhenock, Rongli, Rorathang and Pendam of East district; Chakung, Zoom, Takuthang and Chuchen in the West Sikkim. But in South district, Turuk, Sumbuk, Payong, Tarku, Kalikhola, Namchi and Tokal Bermiok are appropriate places whereas in North district, cultivation of ginger is very rare.

The important substitute crops in this cropping pattern are maize and paddy. Only three cropping patterns has been identified under this cropping pattern i.e. one as pure crop and other mixed crop with maize and the third in rotational cropping with paddy crop.

### ***Millet Based Cropping Patterns***

The finger millet crop comes under cereal crop in Sikkim and is cultivated in an area of 2,853 ha (2015-16). It is grown in the marginal lands ranging in elevation between 1300m to 1800m above mean sea level. This is considered as a pure crop and is cultivated during May to August.

Millet based cropping is identifiable only in the case of "Bhadaurey" crop that is a crop transplanted during May and harvested in "Bhadhau" (August). The alternative crops of this cropping pattern are wheat and barley. Three cropping patterns are identifiable under millet based cropping patterns in Sikkim. The land is kept fallow during Rabi Season or alternated with wheat or barley crops (Subba, 1984).

### **Existing Cropping Patterns during Rabi Season**

The important crops grown in rabi season are wheat, barley and buckwheat.

### ***Wheat and Barley Based Cropping Patterns***

Wheat and barley are grown in areas above 1400 meters above mean sea level. The area covered by wheat and barley is 7,530 hectares. The agro-climatic factors for the cultivation of these two crops are identical. These two base crops are grown on marginal lands in East, West and North districts. The crops are sown in September and harvested in May. The crops associated with wheat and barley are soybean, pulses and potato. The land is kept fallow from June to August (Choudhury, 2004). As per above information it is found that two crops i.e. wheat and barley are not seen in South district.

### ***Buckwheat Based Cropping Pattern***

Buckwheat is cultivated in sloping marginal lands located usually above 1200 meters. The crop is grown as pure crop, sometimes they are alternatively cropped with maize. During kharif season the land is kept as fallow. Among other crops, the oilseeds, especially mustard, rapeseed and soybean are grown quite extensively in Sikkim. The estimated area under various oilseeds is 9990 hectares and together they rank third in the state as far as area under crop is concerned (Choudhury, 2004).

The state is estimated to have about 38,955 ha of area under maize, 10,669 ha under rice, 323 ha under wheat, 5,670 ha under various pulses, 2,853 ha under finger millets, 3,570 ha under buckwheat and 447 ha under barley (2015-16). The area under wheat is most extensive in the East and North Districts, while pulses are grown mostly in the South and West districts. The East district too has considerably large area under pulses (i.e. 760 ha) but the North District has less i.e. 267 ha only. Finger millets and buckwheat are grown in all four districts.

### ***Plantation and Other Commercial Crops***

Crops under this group include cardamom, horticultural crops such as orange, apple, other temperate fruits, guava, banana and tea. All these plants under this category are persistent crops. In general the areas occupied by horticultural crops are limited as compared to food and other crops. Most of them need explicit environmental conditions and they are either concentrated in some particular area or spread throughout the state. Orange is spread throughout the state ranging from elevation between 800 to 1500 meters. Apple is available at Lachung, Lachen, Yoksum and Hilley area of North and West districts. Tea is confined only at Temi and other fruits are grown in limited area. Large cardamom is cultivated throughout the state, occupying a total area of 17,549 hectares, and constitutes 23.84 percent of the total horticultural crops cultivated area. Out of the total area, North district has 31.39 percent, followed by East district 28.53 percent, West district 20.22 percent and South district 19.86 percent. It is a semi-irrigated crop and requires canopy.

Cropping intensity in the state is closely linked with altitudinal variations. At lower altitudes below (1000m) it is possible to do multiple cropping (pre-kharif, kharif and rabi), but with

increasing altitudes, cropping intensity declines. Double cropping (kharif and rabi) can be practiced in mid altitudes (below 2000m) but in high altitude areas (2000m-3000m) only mono-cropping is possible. Due to steep gradient and rugged terrain, agriculture is a very hard and labour-consuming task. Most of the cultivated land is terraced and are unfit for the use of modern machinery. The per unit area in case of food grain is not as remunerative as in the plains (Choudhury, 2004).

The cropping pattern in Dhankheti (paddy field) terrace rice lands are: rice-wheat, rice-mustard, rice-potato, rice-fallow, maize-rice-mustard (below 800m), and maize-rice-fallow at higher hills. Sukhabari (dry land) includes terraced, partially terraced, un-terraced fields and crops are raised under rainfed conditions. The common practice of sowing the crop is by broadcast. Yield is very poor and often crops are harvested leaving 0.5m stalk in the field. The following crop sequences are common in Sikkim depending upon the elevation: maize-fallow, maize-soybean-mustard, maize-finger millet, maize-finger millet-fallow, maize-soybean-mustard, maize-rice bean-fallow, maize-rice bean/urdf/field beans, maize-potato, maize-buckwheat, maize-barley, maize-black gram (urd), maize-vegetables, maize-ginger, maize-cassava, maize-beans (Subba, 2009).

### ***Ginger + Maize Cropping System***

Ginger locally called as “Adua” is an important spice/cash crop which is grown in Sikkim since time immemorial. The crop is a good income source for small and marginal farmers and is grown up to an altitude of 1500m above mean sea level. It occupies an area of about 10,115 ha (2015-16) and cultivated extensively for the market as green ginger and it is popular in South district.

Ginger is cultivated in raised beds; field is divided into beds of 60-80 cm and width of 15-20 cm high with a spacing of 30-40 cm between the beds and gentle slope outwards to drain the rain water. The seed rhizomes 40-60 q/ha are planted in pits and covered with organic manure (30-40t/ha) maintaining 30-45 cm distance between rows and 15-20 cm between rhizomes in the last week of February to March. Maize seeds are sown either around the periphery of beds or in the space made for draining the water between two beds. The beds are covered with leaves and twigs of various forest trees, weeds and grasses available around fields, animal breeding and surplus rice straw as the mulch keeps the soil shaded and warm, prevents the weed infestation, minimizes soil erosion and protects the young plants from heavy rain. After decomposition, manure and mulch enrich soil nutrients and meets the nutritional needs of the growing plants. Ginger is harvested twice, first during May/June when only mother rhizomes are harvested. It is known as *Mau* and is of inferior quality. The second harvesting is done after 7-8 months of planting and is also decided by market demands. Farmers harvest around 150-250 q/ha rhizomes, provided crop is not affected by rhizomes rot diseases (Subba, 2009).

### **Mandarin Intercrops**

Mandarin orange is cultivated in state since time immemorial. It is an indigenous fruit of Sikkim and is very famous in markets of Kolkata. It is the most important commercial fruit and is cultivated in an area of 12,380 ha (2015-16). A single tree produces about 300-400 fruits. The main orange producing area is in the elevation range 600m–1500m above mean sea level. The chief orange growing areas of Sikkim are Nazitam, Virkuna, Loom, Gyalshing, Zoom, Sumbuk, Khamdong and Ben. Moreover, Sikkim mandarin is intercropped almost everywhere throughout the year. The main intercrops are ginger, ginger+maize, maize-ginger, maize-urd-mustard, maize-mustard, maize-vegetables (especially beans), maize-buckwheat, and maize+cassava. The paucity of agricultural land in Sikkim hill terrain is the reason for taking intercrops in mandarian orchards to meet their food requirements and cash money through ginger+maize/ginger is done in the same method. The growing of leguminous vegetables and crops are also preferred to improve the health of soil without contending with mandarin trees.

### **Large Cardamom Agro-Forestry**

Large cardamom is a chief cash crop of Sikkim and is the world's largest producer holding a share of about 85 percent of the Indian market. Its cultivation is mainly concentrated to the sub-Himalayas in Sikkim and Darjeeling district of West Bengal. It is adopted well as agro forestry crop from 600-2200m elevations of humid milieu on steep slope hills under shade trees where other economic crops cannot be grown. The area under large cardamom in Sikkim during 2015-16 was 17,549 ha. On an average 160-200 kg/ha cured cardamom is harvested but healthy managed plantations may yield 450-500 kg/ha, but yield was 235 kg/ha in 2015-16. The time of harvesting at lower elevations is August-September and at higher elevations is November-December. It is the indigenous crop of Sikkim and there are number of cultivars amid the cultivated species, which are considered to be derived from three main distinct cultivars specifically; *Ramsai*, *Sawaney*, and *Golsai*. They are cured locally in traditional *Bhatties* using fuel wood to decrease the moisture to about 10-14 percent.

### **Zero-Tillage Cultivation of Cabbage**

In Sikkim, cabbage is an important vegetable and commercially cultivated in almost all the areas. Cabbage can be grown in large range of soils but it is suitable in the cool moist climate areas. The cabbage seedling transplanting time in mid-hills is September-November, in high hills March-April i.e. off-season, and in very high hills February-March i.e. off-season. Farming of cabbage is done at higher hills as off-season vegetable. In the month of April-May growers cut the grasses, weeds and stubbles with sickles on sloping lands and after drying, burn the same on entire field. The cabbage seedlings are raised on separate seedbeds prepared with organic manure. The field preparation is done by simple shallow digging of the field. Seedlings are now planted without any other input. No inter-culture operation is done. The cabbage is harvested and marketed in the month of June-August (Subba, 2009).

### **Vegetable Fostering**

All categories of vegetable crops like cabbage, cauliflower, broccoli, knolkhol in cole crops; tomato, brinjal, chili, capsicum, tree tomato in solanaceous; pea, beans, cowpea, French bean, in leguminous; radish, carrot turnip in roots, cucumber, pumpkin, bottle gourd, sponge gourd, ridge gourd, snake gourd, bitter gourd, sweet gourd, balsum apple, *iskus* (chayote) in cucurbitaceous; *palak*, *amaranthus*, *methi*, leafy mustard, celery, coriander, mint in leafy vegetables; onion, garlic, leek in bulbs; potato, sweet potato, cassava, colocasia, dioscorea, ginger, turmeric, in tuber and rhizomatous vegetables and okra are cultivated based on organic manuring in Sikkim. Organic compost is useful in channel or plant basis to get utmost output with minimum loss by erosion.

### **Relay Cropping of Rice bean, Urd bean, French bean, Pea, Tomato and Soybean with Maize**

Both the rice bean and urd bean are grown as relay crops with maize only at lower elevations whereas soybean is usually cultivated in all places. The three vegetables such as peas, tomato and French bean are intercropped in tiny area near the houses for off- season crop. Similarly, rice bean and soybean are intercropped in May-June in the footing of maize field at the time of inter culture. When maize becomes mature, corps are harvested leaving the stalks in the field for maintaining the intercrops, but in case of soybean only half stalk is left.

### **Legume Crops in Rotation**

When the harvesting of maize is over, the rice bean and urd bean are cultivated on rotation basis everywhere in the mid and low hills of Sikkim. Rice bean is a type of legume, which makes the soil superior by adding large amount of leafage and nitrogen fixation compared to other legumes. Urd bean is broadly cultivated after maize crop at lower and mid hills of dry areas of Sikkim for harvesting the remaining moisture in soil.

### **Kothebari (Homestead Gardening)**

Kothebari system includes the house, animal shed, tiny fruit trees, food crops, vegetables and different trees adjoining the house. There exists a large disparity in the combination of aforesaid mechanism from individual house-to-house based on availability of area and existing agro-ecosystems. The compound of trees as well as annual crops allows the continuous use of land around the house round the year. Recycling of nutrients is very important for giving the same input to other lands and farmers have to hold the inputs on head loads to particular distance. These processes not only beautify the landscape milieu but also directly benefit the crops with which they are associated.

### Cropping Pattern in Selected Gram Panchayat Units (GPUs)

The main farm production system or cropping system is: khet (maize-paddy/rice), sukha bari (maize, ginger, pulses etc), suntalo bagan (orange etc.) and alainchi bari (cardamom, trees).

**Table 5.7: Main Crops Available in Five GPUs Set I (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)**

Sl. No.	Types of land	Main Crops	Varieties
1.	Khet (Maize-Paddy/Rice cropping pattern)	1.Rice  2. Maize	Attey (Sanu & Thulo), Kalamey, Buchee, Champhey (Champasari), Chottey  Local-Seti, Paheli, Sathiya, HYV-C14-15
2.	Sukhabari (Maize, Ginger, Pulses etc.)	Maize, Pulses, Ginger, Wheat, Mustard, Potato, Cabbage, Cauliflower, Millet, Beans, Soybean and Buckwheat.	Pulses- Paheli, Seti & Kalo --- C-15, C-19, DMH 849
3.	Suntola Bagan (Orange Field)	Orange	Sikkim Mandarin, Mandarin
4.	Alainchi bari ( Cardamom)	Cardamom	Sawaney, Bharlang ,Ramsai and Golsai
5.	Kothe Bari (Home Garden)	Vegetables	Onion, Chilli, Coriander, , Spinach, Tomato,  Romeo-Tamato, Rayosaag, Coriander, Chilli, Cucumber, Tomato Brinjal, Bitter Guard, Kerala Hybrid etc

Source: Compiled by Researcher.

The above table (5.7) depicts the types of land and main crops available in the study areas of five GPUs - Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring of South district. There are five types of land that are identified which include, khet, sukhabari, suntola bagan, alainchi bari and kothe bari. The predominant crops of GPUs are rice, maize, pulses, ginger, wheat, mustard, potato, cabbage, cauliflower, millet, beans, soybean, buckwheat, orange, cardamom and vegetables. The varieties of crops like *rice*- attey (sanu & thulo), kalamey, buchee, champhey (champasari), chottey, *maize* ( local-seti, paheli, sathiya, HYV-c14-15), *orange* (Sikkim mandarin and mandarin), *cardamom*(sawaney, bharlang, ramsai and golsai) and *vegetables*-(onion, chili, coriander, spinach, tomato, romeo-tomato, rayosaag, coriander, cucumber, tomato brinjal, bitter gourd hybrid etc) are cultivated in the area.

**Table 5.8: Average Area and Household Involvement in Different Cropping Pattern of Five GPUs in % (Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring)**

Sl. No.	Main Cropping Pattern	Average Area Mean $\pm$ S.D.	Standard Error	Household Involved Mean $\pm$ S.D.	Standard Error
1.	Khet (maize-rice/paddy)	32.80 $\pm$ 19.6265	8.0124	11.30 $\pm$ 7.2663	2.9664
2.	Rainfed (Sukha bari)	47.00 $\pm$ 26.6495	10.0631	52.50 $\pm$ 23.8579	9.7399
3.	Orange	8.00 $\pm$ 4.6043	1.8797	10.66 $\pm$ 6.2609	2.5560
4.	Cardamom	2.80 $\pm$ 1.7029	.6952	3.42 $\pm$ 1.9141	.7814
5.	Kitchen Garden	8.00 $\pm$ 4.6043	1.8797	50.00 $\pm$ 25.0120	10.2111

Source: VDAP, 2011.

The table 5.8 represents the average area and household (in percent) involvement in different cropping pattern of five GPUs Namphing, Legship, Rong-Bul, Tarku & Turung-Mamring of South district, comparison amongst khet (*maize-rice/paddy*), rainfed (*sukha bari*), orange, cardamom and kitchen garden which shows the significant mean  $\pm$ S.D. and standard error. The highest available cropping land is rainfed (*sukha bari*) having (47.00%) average area and in the same cropping land of household involved (52.50%), the mean  $\pm$  S.D. 47.00 $\pm$ 26.6495 and 52.50 $\pm$ 23.8579 and their corresponding errors calculated as 10.0631 and 9.7399. The second highest available land is the cropping land khet (*maize-rice/paddy*) with an average area of (32.80 %) and household involved in kitchen garden (52.50%), the mean  $\pm$  S.D. 32.80 $\pm$ 19.6265 and 50.00 $\pm$ 25.0120 and the corresponding errors are calculated as 8.0124 and 10.2111. After rainfed (*sukha bari*), khet (*maize-rice/paddy*) and kitchen garden come orange and cardamom cropping lands that have the significant mean  $\pm$ S.D. 8.00 $\pm$ 4.6043 and 2.80 $\pm$ 1.7029 in average area, and 10.66 $\pm$ 6.2609 and 3.42 $\pm$ 1.9141 in the case of households involved.

**Table 5.9: Main Crops Available in Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)**

Sl. No.	Types of land	Main Crops	Varieties
1.	Khet (Maize-Paddy/Rice cropping pattern)	1. Rice	Attey Pant Dhan 10, Sugandha 2,
		2. Maize	Seti, Paheli (Local), Local + HYV (C14 -15)
2.	Sukha bari (Maize, Ginger, Pulses etc.)	Maize, Pulses, Ginger, Wheat, Mustard, Millet, Soybean, Buckwheat and Vegetables	Maize - baby corn, Sweet corn, Murali corn, HYV (C14-15) hybrid+local Ginger - (Gorubathaney, Bhaisaey) Pulses (Paheli, Masium) Vegetables (Tomato local, New

			variety-Romeo Tomato, Potato, Cabbage, New Variety Cauliflower, Drum stick)
3.	Suntola Bagan (Orange Field)	Orange	Sikkim Mandarin, Mandarin
4.	Alainchi bari (Cardamom)	Cardamom	Cardamom- (Ramsai, Golsai, Ceremula, Sawney and Bharlang)
5.	Kothe Bari (Home Garden)	Vegetables	Onion, Garlic, Chilli (Fire ball), Radish, Chayote, Potato, Tomato, Onion, Carrot, Beans, Cucumber, Lady finger, Pampkin, Cauliflower, Cabbage, Coriander, Broccoli, Capsicum, Bitter guard (Karela), Palak saag, (Spinach), Carrot, Radish, Mustard (Tori) saag, Garlic, Methi saag, other saag, Peas etc.

Source: Compiled by Researcher.

The above table (5.9) illustrates the types of land and main crops available in the five GPUs of Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu of South district. There are five types of land identified as khet, sukhabari, suntola bagan, alainchi bari and kothe bari. The main crops of five GPUs are rice, maize, pulses, ginger, wheat, mustard, millet, soybean, buckwheat and vegetables. The varieties of different crops like *rice* (atthey pant dhan 10, sugandha 2) *maize* (seti, paheli (local), local + HYV (C14-15), *orange* (Sikkim mandarin and mandarin), *cardamom* (ramsai, golsai, ceremula, sawney and bharlang) and *vegetables* (onion, garlic, chili (fire ball), radish, chayote, potato, tomato, onion, carrot, beans, cucumber, lady finger, pumpkin, cauliflower, cabbage, coriander, broccoli, capsicum, bitter guard (karela), palak saag, (spinach), carrot, radish, mustard (tori) saag, garlic, methi saag, other saag, peas etc.) are cultivated in the above mentioned GPUs.

**Table 5.10: Average Area and Household Involved in Different Cropping Pattern of Five GPUs (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu)**

Sl. No.	Main Cropping Pattern	Average Area Mean $\pm$ S.D.	Standard Error	Household Involved Mean $\pm$ S.D.	Standard Error
1.	Khet (maize-rice/paddy)	4.80 $\pm$ 3.0331	1.2382	6.60 $\pm$ 3.4723	1.4175
2.	Rainfed (Sukha bari)	79.00 $\pm$ 29.6984	12.1243	78.20 $\pm$ 32.1558	13.1275
3.	Orange	3.44 $\pm$ 2.2333	.1917	8.20 $\pm$ 6.4807	2.6457
4.	Cardamom	1.06 $\pm$ .7810	.3188	1.20 $\pm$ .7147	.2918
5.	Kitchen Garden	56.56 $\pm$ 28.1069	11.4746	95.20 $\pm$ 41.1679	16.8067

Source: VDAP, 2011.

The table 5.10 presents the average area and household (in percent) involvement in different cropping pattern of five GPUs Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, Wok-Omchu of South district with their significant mean  $\pm$ S.D. and standard error. The highest available cropping land is rainfed (*sukha bari*) having 79.00% in average area and highest household involvement is in kitchen gardens, i.e. 95.20%, with mean  $\pm$  S.D. 79.00  $\pm$ 29.6984 and 95.20  $\pm$ 41.1679, the corresponding error is calculated as 12.1243 and 16.8067. The second highest available cropping land is kitchen garden (56.56 %) followed by rainfed area (*sukha bari*) having 78.20%, the mean  $\pm$  S.Ds are 56.56  $\pm$ 28.1069 and 78.20  $\pm$ 32.1558, the corresponding error is calculated as 11.4746 &13.1275. After rainfed (*sukha bari*) and kitchen garden come khet (*maize-rice/paddy*) and orange cropping land, both in terms of average area and household involved, which shows the significant mean  $\pm$ S.D. 4.80  $\pm$ 3.0331& and 3.44  $\pm$ 2.2333 in average area and 6.60  $\pm$  3.4723 and 8.20  $\pm$ 6.4807 in case of household involved.

**Table 5.11: Main Crops Grown in Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan)**

Sl. No	Types of land	Main Crops	Varieties
1.	Khet (Maize-Paddy/Rice cropping pattern)	1.Rice  2. Maize	Attey, Masinu attey, Thaka attey, Champasri, Tharopatay, Tapray, Bachy, Kati etc. New varieties-Sugandha2,3, Pd10-VI-82  Seti, Paheli, Kali, Sathiya (Local) HYV (C14 -15)
2.	Sukha bari (Maize, Ginger, Pulses etc.)	Maize, Pulses, Ginger, Wheat, Mustard, Millet, Soybean, Buckwheat, Wheat and Vegetables	Maize - Seti, Paheli, Kali, Sathiya (Local) HYV (C14 -15) Ginger- (Large & Small) Wheat - New varieties-Sonali, Sonalica, Praw - 343 Vegetables - (Potato, Peas, Cabbage, Beans, Tomato etc.)
3.	Suntola Bagan (Orange Field)	Orange	Sikkim Mandarin, New Variety-Mandarin Gold
4.	Alainchi bari (Cardamom)	Cardamom	Cardamom- (Ramsai, Korlangay, Golsai, Sawney and Tharopatay New Varieties- Ramsai, Bharlang, Saramna)
5.	Kothe Bari (Home Garden)	Vegetables	Onion, Garlic, Chili (Fire ball), Radish, Chayote, Potato, Tomato, Onion, Carrot, Beans, Cucumber, Lady finger, Pumpkin, Cauliflower, Cabbage, Coriander, Broccoli, Capsicum, Bitter guard (Karela), Palka saag, (Spinach),Carrot, Radish, Mustard (Tori) saag, Garlic, Methi saag, other saag, Peas etc.

Source: Compiled by Researcher.

The table (5.11) reveals the types of land and main crops grown in the study areas of five GPUs - Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan of South district. There are five types of land identified as khet, sukhabari, suntola bagan, alainchi bari and kothe bari. The main crops of five GPUs are rice, maize, pulses, ginger, wheat, mustard, millet, soybean, buckwheat, wheat and vegetables. The different varieties of crops such as rice (atthey, masinu atthey, thaka atthey, champasri, tharopatay, tapray, bachy, kati etc. new varieties – sugandha 2, 3, Pd 10-VI-82) maize (seti, paheli, kali, sathiya (local) HYV (C14 -15), orange (Sikkim mandarin, new variety - mandarin gold), cardamom (ramsai, korlangay, golsai, sawney and tharopatay, new varieties - ramsai, bharlang, saramna) and vegetables (onion, garlic, chili (fire ball), radish, chayote, potato, tomato, onion, carrot, beans, cucumber, lady finger, pumpkin, cauliflower, cabbage, coriander, broccoli, capsicum, bitter guard (karela), palak saag, (spinach), carrot, radish, mustard (tori) saag, garlic, methi saag, other saag ,peas etc.) are cultivated in the region.

**Table 5.12: Percentagewise Average Area and Household Involved in Different Cropping Pattern of Five GPUs (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam -Rayong & Perbing-Dovan)**

Sl. No.	Main Cropping Pattern	Average Area Mean $\pm$ S.D.	Standard Error	Household Involved Mean $\pm$ S.D	Standard Error
1.	Khet (maize-rice/paddy)	13.20 $\pm$ 8.0000	3.2659	14.40 $\pm$ 9.0111	3.6787
2.	Rainfed (Sukha bari)	60.00 $\pm$ 30.5417	12.4686	74.00 $\pm$ 23.1343	9.4445
3.	Orange	5.00 $\pm$ 2.8816	1.1764	6.20 $\pm$ 3.8987	1.5916
4.	Cardamom	17.40 $\pm$ 8.1240	3.3166	21.00 $\pm$ 8.2945	3.3862
5.	Kitchen Garden	19.00 $\pm$ 12.1490	4.9598	80.00 $\pm$ 25.6982	10.4912

Source: VDAP, 2011.

The table 5.12 shows the average area and household (in percentage) involvement in different cropping pattern of five GPUs Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam - Rayong & Perbing-Dovan of South district, comparison made among Khet (*-maize-rice/paddy*), Rainfed (*Sukha bari*), Orange, Cardamom and Kitchen Garden. The highest available of cropping land is rainfed (*sukha bari*) having average area (60%) and household involved in kitchen garden is found (80%). The second highest available of cropping land is kitchen garden in the case of average area (19%) and household involved in rainfed (*sukha bari*) having (74%). After Rainfed (*sukha bari*) and kitchen garden come cardamom and khet (*-maize-rice/paddy*) cropping land in both average area and household involved which shows the 17.40(%) and 21(%) in average area and 13.20 (%) and 14.40 (%) of household involved respectively.

**Table 5.13: Percentage Distribution of Crop Combination in Study Area**

Sl. No.	Crop combination	Percentage Mean $\pm$ S.D	Standard Error
1.	Paddy-Pulses-Vegetables	11.56 $\pm$ 7.1154	2.9211
2.	Paddy-Vegetables-Fallow	4.03 $\pm$ 1.2372	.5050
3.	Paddy-Ginger	6.20 $\pm$ 3.8987	1.5916
4.	Maize-Paddy-Vegetables	22.96 $\pm$ 14.3805	5.8708
5.	Maize-Soybean-Vegetables	8.04 $\pm$ 5.9665	2.4358
6.	Maize-Buckwheat-Vegetables	2.63 $\pm$ 1.5975	.6521
7.	Paddy +Pulses	5.07 $\pm$ 3.8987	1.5916
8.	Paddy + Pulses+ Vegetables	5.15 $\pm$ 3.8987	1.5916
9.	Maize+ Pulses+ Vegetables	14.89 $\pm$ 10.3150	4.2111
10.	Any others (Maize+ Ginger)	19.47 $\pm$ 9.5446	3.8965
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The above data given in table 5.13 shows the percentage distribution of crop combination in the study area, viz. paddy-pulses-vegetables, paddy-vegetables-fallow, paddy-ginger, maize-paddy-vegetables, maize-soybean-vegetables, maize-buckwheat-vegetables, paddy +pulses, paddy+pulses+vegetables, maize+pulses+vegetables and any others (maize+ ginger) with their significant mean  $\pm$ S.D. and standard error. It is found that the highest percentage is found in maize-paddy-vegetables which has the significant mean  $\pm$ S.D. of 22.96 $\pm$ 14.3805 and standard error is calculated as 5.8708. Likewise, maize+ ginger come under second position which shows the significant mean  $\pm$ S.D. as 19.47 $\pm$ 9.5446 and standard error is calculated 3.8965. The category of the others (maize+pulses +vegetables) holds third position and its significant mean  $\pm$ S.D.is 14.89 $\pm$ 10.3150 and standard error is calculated as 4.2111. According to above data maize-buckwheat-vegetables is found less in comparison to other types of cropping.

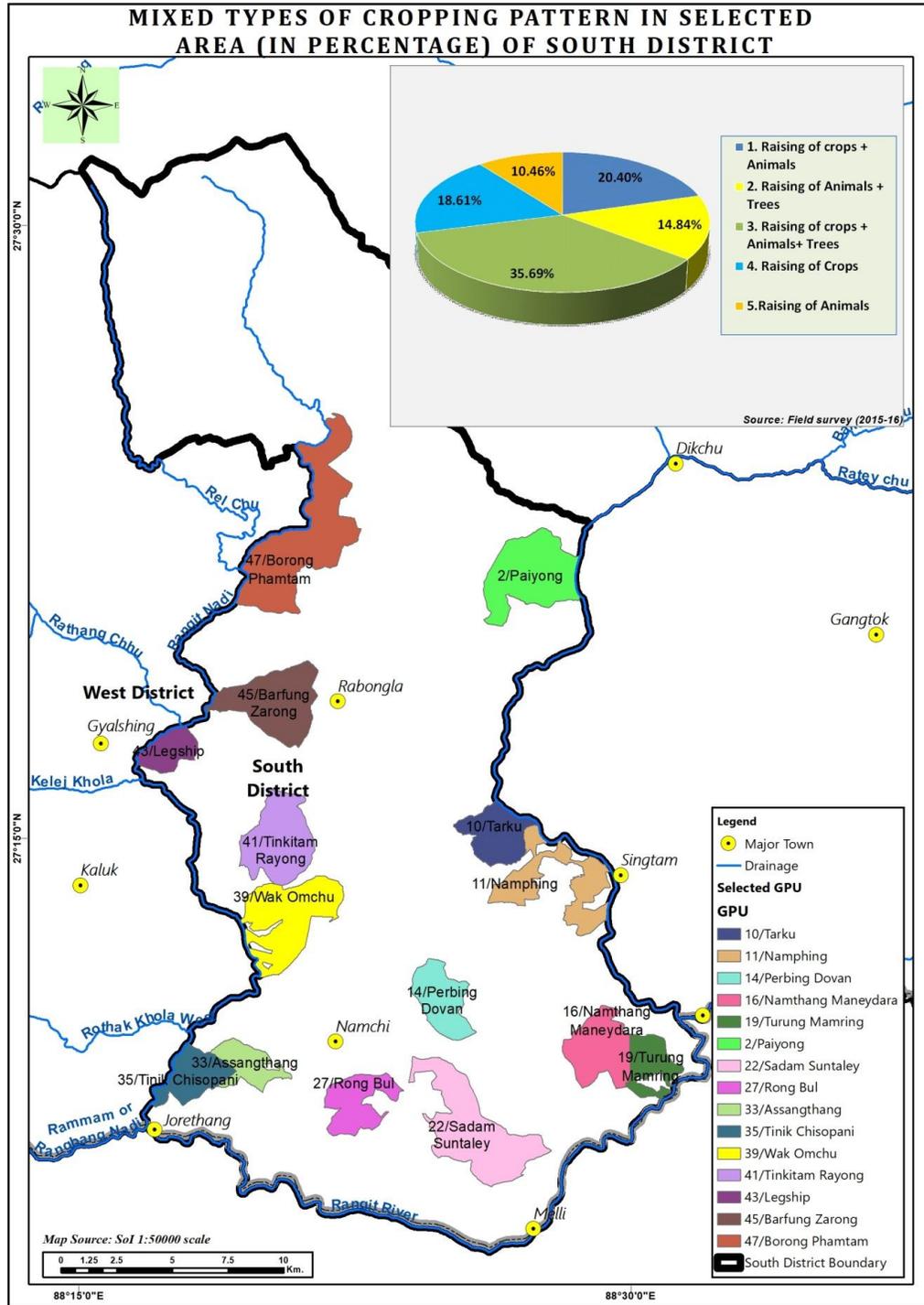
**Table 5.14: Pattern of Mixed Farming in the Study Area (in Percent)**

Sl. No.	Cropping Pattern	Percentage Mean $\pm$ S.D	Standard Error
1.	Raising of Crops + Animals	20.40 $\pm$ 10.5071	4.2895
2.	Raising of Animals + Trees	14.84 $\pm$ 9.5078	3.8815
3.	Raising of Crops + Animals +Trees	35.69 $\pm$ 17.9888	7.3439
4.	Raising of Crops	18.61 $\pm$ 11.7473	4.7958
5.	Rearing of Animals	10.46 $\pm$ 7.2938	2.9776
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The table 5.14 illustrates mixed cropping pattern, e.g. raising of crops + animals (20.40%), raising of animals + trees (14.84%), raising of crops + animals +trees (35.69%), raising of crops and rearing of animals which are seen in the study area. People of this area are not engaged with single type of cropping but are much attached mixed farming.

**Map No. 15**



**Table 5.15: Duration of Fallow (Land Remains Uncultivated) in a Year (in Percent)**

Sl. No	Months (Land Remains Uncultivated)	Percentage
1.	1 Month	4.64
2.	2 Months	30.19
3.	3 Months	42.88
4.	More than 3 Months	22.29
	Total	100.00

*Source:* Field Survey, 2015-16.

As per the table 5.15, land remains uncultivated (fallow) in a year for durations ranging from 1 month, 2 months, 3 months and more than 3 months. This is due to scarcity of water as well as lack of proper irrigational facilities. After the retreating south-west monsoon the land starts drying and there is no artificial irrigational mechanism to preserve the moisture content in soil. Actually the inception of dry season starts from November till March-April, and for a minimum of three months land remains uncultivated. Sometimes for more than four months the land remains uncultivated.

**Table 5.16: Frequency of Cropping in Study Area (in Percent)**

Sl. No.	Response	Percentage
1.	Two or more crops	70.16
2.	One or two crops	29.84
	Total	100.00

*Source:* Field Survey, 2015-16.

According to the responses from the field survey, 70.16 percent farmers grow two or more crops in a field, whereas 29.84 percent farmers grow only one or two crops.

**Table 5.17: Relay Cropping in the Study Area (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	63.89
2.	No	36.11
	Total	100.00

*Source:* Field Survey, 2015-16.

The table 5.17 shows the response of farmers regarding planting seedlings of next crop after the harvest of previous crops signifying the relay cropping pattern under process. Of late the government is inspiring the farmers to grow multiple crops and is also motivating them to use the land so as not to turn them into fallow. The farmers willing to grow and produce good quality organic crops are assured incentives by the Government.

**Table 5.18: Traditional Crops versus New Crops (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	67.15
2.	No	32.85
	Total	100.00

*Source:* Field Survey, 2015-16.

Majority of the farmers (67.15 percent) in the study area grow same crops as their elders did. They prefer to rely on age-old experience and knowledge of seeds, seasonality and productivity of traditional crops. However, there are some trend-setters, and 32.85 percent farmers try new and different varieties of crops.

**Table 5.19: Change in Production of Rice and Maize (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Increasing	47.60
2.	Decreasing	52.40
	Total	100.00

*Source:* Field Survey, 2015-16.

As per above table, 47.60 percent farmers reported that there is increase in production of rice and maize but at the same time 52.60 percent reported decrease in crop production. Some respondents believe that due to banning of chemical fertilizers production is decreasing. It is to be noted that the Government of Sikkim has restricted the use of chemical fertilizers in agriculture land because they reduce the moisture holding capacity of soil. According to some farmers, crop production is increasing as they are using high yielding variety (HYV) of seeds and applying some modern techniques. According to field survey, the factors which affect the productivity of rice and maize are:

- Low rainfall/lack of irrigational facilities.
- Destroy by wild animals.
- Inconsistent climate.
- Low fertility of soil.
- Landslides and natural disasters.
- Lack of manure/fertilizer.
- Hike in the rate of agricultural labour.
- Lack of durability in HYV seeds.
- Financial crunch.

**Table 5.20: Whether Satisfied With Farm Production (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	19.37
2.	No	80.63
	Total	100.00

*Source:* Field Survey, 2015-16.

Table 5.20 shows the response on whether the farmers are satisfied with the farm production. It is revealed that 80.63 percent of farmers are not satisfied with farm production whereas 19.37 percent farmers are satisfied with their farm production. Some of the reasons for the farmers' dissatisfaction are:

- Scarcity of water (lack of irrigational facilities).
- Crops being eaten / destroyed by wild animals.
- Climatic conditions.
- Lack of newer and modern equipments introduction in agricultural fields.
- Low production as it does not meet the current demands.

**Table 5.21: Agricultural Land Taken for Non-Farm Use (Construction of Roads)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	32.29
2.	No	67.71
	Total	100.00

*Source:* Field Survey, 2015-16.

Table 5.21 shows the responses of farmers on agricultural lands that got converted for non-farm activities, namely construction of roads. The responses indicate that 67.71 percent of respondents did not lose their lands whereas 32.29 percent of respondents did mention the conversion of their agricultural lands into roads.

**Table 5.22: Agricultural Land Taken by Factories/Pharmaceutical/Power line**

Sl. No.	Response of Farmers	Percentage
1.	Yes	2.09
2.	No	97.91
	Total	100.00

*Source:* Field Survey, 2015-16.

Table 5.22 shows the responses of farmers on agricultural lands taken by factories/pharmaceutical/power line, etc. The responses indicate that 97.91 percent of

respondents did not lose their lands whereas 2.09 percent of respondents did mention the conversion of their agricultural lands for the construction of factories/pharmaceutical /lying of power lines.

**Table 5.23: Agricultural Land Damaged during Landslides**

Sl. No.	Response of Farmers	Percentage
1.	Yes	17.96
2.	No	82.04
	Total	100.00

*Source:* Field Survey, 2015-16.

The table 5.23 shows the responses of farmers on agricultural land damage during landslides. The responses indicate that 82.04 percent of respondents did not lose their land during landslides whereas, while 17.96 percent respondents confirmed the damage of their agricultural lands during landslides.

**Table 5.24: Compensation Given to Farmers for Crops Damage (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	83.97
2.	No	16.03
	Total	100.00

*Source:* Field Survey, 2015-16.

As per the above table Government and concerned Departments take initiatives to compensate crop damage to a certain extent. The field report also indicates that some of the farmers are deprived of such compensatory incentives as per their crop damage.

**Table 5.25: Agricultural Loan Taken from Different Institutions (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	18.49
2.	No	81.51
	Total	100.00

*Source:* Field Survey, 2015-16.

Table 5.25 shows the responses of farmers on agricultural loan taken through different lending institutions. The responses indicate that 81.51 percent have not availed the loans whereas 18.49 did make use of the lending institutions.

Many nationalised as well as state banks of India also provide agricultural loans for helping the farmers in their concerned fields. Some of the farmers take loans for agricultural purpose

from different banks such as State Bank of India bank, SISCO Bank (Sikkim) etc. of amounts ranging from Rs. 20,000 to Rs.10,000,00 (Rupees Twenty thousand to One lakh).

*Kisan* Credit Cards are provided by the Government of Sikkim to every farmer in order to ensure financial support from Central and State government for agricultural purpose.

Farmer's Club plays a vital role for the improvement of economic life of farmers as well as for the development of the villages. Every block in South district has formed Farmer's Club. According to farmers, the main focus of Farmer's Club is to give training to the farmers, provide seeds, help the farmer's in the cultivation process, additionally provide loans as well as marketing awareness etc

**Table 5.26: Availability of Labourers during Cropping Seasons (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	33.89
2.	No	66.11
	Total	100.00

*Source:* Field Survey, 2015-16.

According to the respondent farmers, availability of agricultural labourers is difficult during cropping season. Peoples' engagement in other employment activities, lesser wages, peoples engagement in construction work that provides better wages, hike in labour cost, participation in MGNREGA programme, nucleated families etc. are the factors that are making cropping difficult.

**Table 5.27: Wages Rate in Agricultural Field (in Percent)**

Sl. No.	Wage per day (Rs.) Class Interval	Percentage Mean $\pm$ S.D	Standard Error
1.	100-200	10.17 $\pm$ 7.6157	3.1091
2.	200-300	36.19 $\pm$ 18.2098	7.4341
3.	300-400	40.66 $\pm$ 24.3063	9.9230
4.	400-500	8.89 $\pm$ 6.0663	2.4765
5.	500-600	4.09 $\pm$ 2.6076	1.0645
	Total	100.00 $\pm$ 25.3456	10.3473

*Source:* Field Survey, 2015-16.

The wages rate in agricultural field is apparent in the above table. The agricultural labour rate varies according to the nature of work and spatial variation. The wages range from Rs.100 to Rs.600 per day. From the above data it is clear that most of the labourers are paid wages ranging between Rs.300-Rs.400. The wages between Rs.200-Rs.300 come a close second. Some farm labourers get wages as low as Rs.100-Rs.200. Very few farmers get wages above Rs. 500-Rs.600 per day.

**Table 5.28: Plough Rate per Day in Field (in Percent)**

Sl.No.	Class Interval (Rs.)	Percentage Mean $\pm$ S.D	Standard Error
1.	200-400	3.34 $\pm$ 2.1316	.8702
2.	400-600	78.22 $\pm$ 42.7083	17.4356
3.	600-800	16.33 $\pm$ 12.2963	5.0199
4.	800-1000	2.11 $\pm$ 1.574	.642
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The above table indicates the Plough Rate per Day in Field with mean  $\pm$ S.D. and standard error. The plough rate per day varies according to nature of work and spatial variation. The rates range from Rs.200-Rs.1000. The plough rate of Rs. 400-Rs.600 is most frequently observed having the significant mean  $\pm$  S.D. 78.22 $\pm$ 42.7083 and standard error as 17.4356. In some places the rates hover between Rs. 600-Rs.800 with its significant mean of  $\pm$  S.D. that is 16.33 $\pm$ 12.2963 and standard error as 5.0199. The plough rate may sometimes be as high as Rs. 800-Rs.1000 but the significant mean $\pm$  S.D. is only 2.11 $\pm$ 1.2790 and standard error is calculated as .642. There are two types of rate for bullock per day. The rate is different due to types of lands - in the case of khet (irrigated land) the rate is on a higher side compared to bari (unirrigated land). The plough rate is different according to temporal-spatial phenomena, therefore the rates keep changing.

### **Tools and Implements**

Agriculture becomes handicapped due to different physical and cultural parameters such as steep and hilly terrain, climate hazards, uneconomic spread of holdings comprising of shallow and stony soils. The primitive types of tools and equipment are being used by the farmers in Indian Himalayan ranges since time immemorial.

A plough is still a primary tool used in farming for soil preparation, for sowing seed or planting and to loosen or turn the soil. Ploughs are traditionally drawn by working animals such as cattle (oxen). A plough may be made of wood or iron. In hilly area like Sikkim it is impossible to practice/use machine in the fields due to topographical structure of the land, and therefore, plough still holds an important place. The most important function of ploughing is to rotate over the upper layer of the soil, bringing unmarked nutrients to the surface, while burying weeds and the remains of previous crops and allowing them to rupture down.

The conventional farm tools and equipments for self sustenance have been developed /customized through experience over generations to meet socio-economic and farming challenges. The type of soil and topographic environment largely control the type, size and shape of particular tillage tools/equipments.

**Table 5.29: Types of Tools and Equipments Used in Agricultural Farm**

Sl. No.	Tools/Equipments	Percentage Mean $\pm$ S.D	Standard Error
1.	Wooden Plough ( <i>Halo</i> )	30.51 $\pm$ 17.6068	7.1879
2.	Power Tiller	2.01 $\pm$ 1.2976	.5297
3.	Harrow ( <i>Kata</i> )	31.76 $\pm$ 20.5718	8.3984
4.	Hoe ( <i>Kodalo</i> )	24.73 $\pm$ 17.8773	7.2984
5.	Fork ( <i>Datey</i> )	7.11 $\pm$ 5.0990	2.0816
6.	Others	3.88 $\pm$ 1.8825	.7685
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The above table shows the types of tools and equipments used in agricultural farm. The farmers use traditional as well as modern tools - wooden plough, power tiller, *kata* (harrow), *kodalo* (hoe), *datey* and others in agricultural land. Some other equipments are also being used in agricultural farms based on their availability and nature of land. Though the power tiller is distributed to the progressive farmers by the Agriculture Department, Government of Sikkim it has remained only as a trial and error tool. Power tiller's success in a hill state like Sikkim is yet to be proven.

**Table 5.30: Family Members Engaged in Agricultural Activity in the Study Area**

Sl. No.	Class Interval (Members Engaged)	Percentage Mean $\pm$ S.D	Standard Error
1.	1-2 Members	34.51 $\pm$ 19.1206	7.8059
2.	2-3 Members	27.69 $\pm$ 16.2726	6.6432
3.	3-4 Members	20.76 $\pm$ 12.8218	5.2345
4.	4-5 Members	11.58 $\pm$ 9.2736	3.7859
5.	5-6 Members	5.26 $\pm$ 3.7416	1.5275
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey, 2015-16.

The table (5.30) shows number of the family members engaged in agricultural activity. The above data makes it clear that participation of 1-2 members of a family in agricultural activity is higher and its significant mean  $\pm$  S.D. is 34.51 $\pm$ 19.1206 and standard error is 7.8059. In the second position comes 2-3 Members from a family and its significant mean  $\pm$  S.D. is 27.69 $\pm$ 16.2726 and standard error is 6.6432. The families having 3-4 members engaged in agricultural activity ranks third with significant mean  $\pm$  S.D. 20.76 $\pm$ 12.8218 and standard error as 5.2345. The families having 5-6 members engaged in agricultural activity are very few in numbers with mean  $\pm$  S.D. of 5.26 $\pm$ 3.7416 and the corresponding error as 1.5275. Participation of family members in agricultural activity has been decreasing due to fewer family members, nuclear families, reluctance to be engaged in agricultural sectors,

government employment, school going children, etc. which have tremendously impacted the agricultural activities.

### **Use of Fertilizers in Agriculture**

Farmers turn to fertilizers because these substances contain plant nutrients such as nitrogen, phosphorus, and potassium. The government of Sikkim used to provide chemical fertilizers to increase production of food grains in order to meet the demand of growing population. After 2003, Sikkim government suddenly banned the use of chemical fertilizers in the agricultural field and instead encouraged organic farming only. At the same time, the government of Sikkim gave more emphasis on the modern ways of cropping pattern; such as supplying of HYV seeds, green house, poly pipe, water tank, power tiller, training to farmers etc. Government is encouraging the line sowing method instead of broadcasting of crops. Due to change in temperature and scarcity of water farmers are adopting off season cropping, green house vegetables and the roof rainwater harvesting system. In 2016, Sikkim was declared as the first fully organic state in India. Nowadays the farmers are using only organic manures in their agriculture field.

**Table 5.31: Types of Fertilizers Used by Farmers in Study Areas (in Percent)**

Sl. No.	Types of Pesticides/Insecticides/Fertilizers	Percentage
1.	Pesticides (Organic)	2.98
2.	Insecticides (Organic)	2.13
3.	Organic manure provided by government	20.37
4.	Manure of livestock prepared at home	74.52
	Total	100.00

*Source:* Field Survey, 2015-16.

In the above table the percentage of fertilizers used by farmers - pesticides (organic), insecticides (organic), organic manure provided by government and manure of livestock prepared at home are shown. From the above data it is clear that the manure of livestock prepared at home is used in highest quantities in the agricultural fields. The second highest fertilizer used is Organic manure which is provided by the government. Pesticides (Organic) and Insecticides (Organic) are also being used but in smaller amount.

**Table 5.32: Change in Cultivation Practices in Study Areas (in Percent)**

Sl. No.	Response of Farmers	Percentage
1.	Yes	48.67
2.	No	51.33
	Total	100.00

*Source:* Field Survey, 2015-16.

The changes in the cultivation practices of different crops are also important for food security. Farmers often change cultivation system for enhancing crop production.

According to the response of farmers, a little less than 50% farmers are changing cultivation practice and while more than 50% are still following the same cultivation style as their elders have adopted.

A great variation has been witnessed in farmers' approach towards cultivation from the past till the present. In the past, farmers used to follow the traditional way of farming in every sector related to agriculture. In the earlier days, farmers used to depend on natural phenomena like the monsoon and rainfall. They simply used to cultivate their lands with the help of manual mechanism. To fulfill the shortage of labourers, farmers used to practice the 'Parma System' (exchange of agricultural labourers) from one family to other family during the time of cultivation. However, 'Parma System' has slowly disappeared due to decrease in the number of family members, individual involvements in various other vocations, and the onset of compulsory education policies of the government.

In the current scenario, the view towards cultivation has changed and the new concept has emerged. With the advancement of science and technology agricultural equipments also have evolved for the betterment of agriculture. Farmers are aware of the financial implications which could be materialized through agriculture. The Government of Sikkim through the concerned Department has been taking concerted initiatives to explore the possibilities of agricultural perspectives. The farmers are being trained from time to time and also given agricultural aids like green houses, hybridism, roof rainwater harvesting, plastic storage of water (dug pond), power tiller, organic fertilizer etc. as some of the major components in today's advanced agricultural approaches. Farmers are also made aware on the benefits of cash crops and relay cropping. Through these collective means, the approach towards agriculture has been changing and the socio-economic scenarios of the cultivators have also changed to certain extent.

## References

Choudhury, Maitreyee. 2004. "State of Agriculture in Sikkim" In *The Himalayan Miscellany*, Vol.15. CHS, University of North Bengal: 29

GoS (Government of Sikkim). 1978. *Land Reform Report F 16 (16) LL/1978*. Gangtok Sikkim: Department of Law and Legislative, GoS.

-----2004. *Sikkim Study Series, Geography & Environment*. Mahendra P. Lama (ed.), Volume-I, Department of Information and Public Relation, GoS: 94-95.

----- -2011. *Village Development Action Plan; A Plan For Realizing of A Poverty Free Sikkim*. Gangtok Sikkim: Department of Rural Management and Development, GoS.

----- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS: 225-234.

----- -2014. *Hand Book on Agriculture Sikkim 2013-14*. Gangtok Sikkim: Department of Food Security and Agriculture Development and compiled by Agriculture Census & EARAS Unit, GoS: 48-63.

----- 2016. *State of Environment Report Sikkim (Draft) 2016 ENVIS Sikkim*. Gangtok Sikkim: Department of Forest Department, GoS: 76.

Subba, J.R. 1984. *Agriculture in the Hills of Sikkim*. Gangtok, Sikkim: Sikkim Science Society: 47-49.

----- 1998. "Vegetables crops in Sikkim," In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma, 399-412 Dehru Dun, India, Bishen Singh and Mahendra Pal Singh: 399-412.

----- 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 82.

Subba,J.R. 2009 "Indigeneous Knowledge on bio-resources management for livelihood of the people of Sikkim." In *Indian Journal of Traditional knowledge*, Vol.8 (1) January, 2009:56-64. Available at: [www.nopr.niscair.res.in](http://www.nopr.niscair.res.in) ( Accessed on June 25, 2016).

Singh, Jasbir and Dhillion, S.S. 2006. *Agricultural Geography*. New Delhi: Tata McGraw, Hill Publishing Company Limited: 49-50.

Upadhyaya, R.C. 1998. In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh: 94-98.

### **Web Link**

[agricoop.nic.in](http://agricoop.nic.in) (Accessed on July 25,2015).

[sikenvis.nic.in](http://sikenvis.nic.in) (Accessed on March 30, 2016).

[fsm.gov.in](http://fsm.gov.in)>Tripura Workshop>Sikkim (Accessed on May 03, 2016).

[www.agriinfo.in](http://www.agriinfo.in) (Accessed on June 24, 2016).

[www.wikipedia.org](http://www.wikipedia.org) (Accessed on July 07, 2016).

<http://ec.europa.eu/agriculture/rural-area-economics> (Accessed on July 07, 2016).

<http://soilsmatter.wordpress.com> (Accessed on July 07, 2016).

[www.wikipedia.org>wiki>Plough](http://www.wikipedia.org/wiki/Plough) (Accessed on July 07, 2016).

[www.archive.india.gov.in](http://www.archive.india.gov.in) (Accessed on July 11, 2016).

[www.fao.org/docrep/005/y4671e](http://www.fao.org/docrep/005/y4671e) (Accessed on September 23,2016).

# Chapter 6

## Agricultural Production and Productivity Trends

### Introduction

Production is a process of combining various material inputs and immaterial inputs (plans, know-how) in order to make something for consumption (the output). It is an act of creating output, a good or a service which has value and contributes to the utility of individuals.

The productivity has been used with different meanings and has aroused many conflicting interpretations. Sometimes it is considered as the overall efficiency with which a production system works, while others have defined it as a ratio of output to resource expanded separately or collectively. This term has been used incorrectly and interchangeably with production. In reality, production refers to the volume of output, while productivity signifies the output in relation to resources expanded. The quantum of production can be increased by employing more resources without increasing productivity and productivity per unit terms can be increased without increasing production by employing less input for the same production level. It is commonly agreed that productivity is the ability of a production system to produce more, economically and efficiently. Therefore, agricultural productivity can be defined as a measure of efficiency in an agricultural production system which employs land, labour, capital and other related resources (shodhganga.inflibnet.ac.in). Productivity is an average determinant of the effectiveness of production. It can be articulated as the ratio of output to inputs used in the production method, i.e. output per unit of input. When all outputs and inputs are incorporated this is measured in productivity.

In recent years many attempts have been made to define the connotation of agricultural productivity. Dewett (1966;66) explains it as, “productivity expresses the varying relationship between agricultural output and one of the major inputs, like, land or labour or capital, other complementary factors remaining the same...” It may be kept in mind that productivity is physical rather than a value concept. The connotation of agricultural productivity engaged the attention of many an economist at the 23<sup>rd</sup> Annual Conference of the Indian Society of Agricultural Economics. Some economist suggested that the yield per acre should be considered to express agricultural productivity. A number of objections were raised against this because it considers only land which is just one factor of production while other factors are also responsible, and therefore, it will be arbitrary to attribute productivity entirely to land and express it per hectare of land. It was suggested, for instance, that productivity should also be measured in terms of per unit of labour and different regions be compared on that basis.

After a thorough discussion, it was generally agreed that the yield per hectare may be considered to represent the agricultural productivity in a particular region, and that other factors of production be considered as the possible cause for the variations while comparing it with the other regions ([shodhganga.inflibnet.ac.in](http://shodhganga.inflibnet.ac.in)).

Sikkim is called as Drenjong which means “valley of rice” according to Tibetan language, while the Bhutias call it Beyul Demazong , which means “the hidden valley of rice”. The Lepcha people called it Nye-mae-el, meaning “paradise”. The name itself signifies the meaning of agriculture to the people of Sikkim. Agriculture is the chief occupation of the majority of the people. It provides not only employment but also food for most of them. There is substantial variation in agriculture practices in the state because some areas are not appropriate for agriculture, some areas are arid and infertile and some thinly populated while some are fertile. Density of population in different districts also has an influence on the agriculture practice of a particular district.

Sikkim is a hilly State in the Eastern Himalayas where agricultural practices and adaptations are highly variable in time and space due to varying altitudes and agro-climatic situations. The net cultivable area in Sikkim is estimated to be around 79,000 hectare (11.13%); with irrigated area of 15 percent of the total operational holdings of 1,10,000 hectares. About 80 percent of the people are directly or indirectly dependent on scarce land resources for their livelihood. The state being hilly has little scope of industrial growth, and hence has not adequately succeeded in decreasing the pressure on agriculture/horticulture as the agrarian population has decreased at minimal since its merger in the Indian Union in 1975 ([www.visva-bharati.ac.in](http://www.visva-bharati.ac.in)). Policies have been opted for agriculture and horticulture development in Sikkim in order to improve yield and also to maintain the major production systems through appropriate management of resources. The endeavor is to establish ecologically sustainable, economically beneficial and resources proficient cropping systems along with the generation of employment to attain a positive looking transformation.

The Central Government has sponsored many Schemes in order to improve different crop production like Oilseeds Production Programme, National Pulses Development Programme, Coarse Cereals, Rice Minikit Programme, Accelerated Maize Development Programme, and National Watershed Development Programme for rainfed area and has also been steering the spread and timely delivery of scientific and better farm technologies to the grass-root levels in the state. Newly initiated centrally sponsored schemes through Macro-Management mode are initiated to add more in intensification of infra-structure (Strategic Research and Extension Plan of South District-2006).

Agriculture in Sikkim is the major economic activity that is practiced on terraced fields which have been laboriously created from steep hillsides. Sikkim is the largest producer of

cardamom and also boasts to utilize largest area for its cultivation. Tea is exported to USSR & Germany. Sikkim's economy broadly depends on agriculture which provides livelihood to the majority of population in the state (sikkim.nic.in).

### **Sikkim's Geography and Agriculture**

Physical features of the state of Sikkim have made agricultural environment extremely varied. Sikkim's altitude and slope play a vital role to determine the agriculture milieu. The agro-climatic zones of the state have significant variations from sub-tropical to warm-temperate and the cool-temperate to alpine zones; hence there are different agro-ecosystems that exist to create agricultural biodiversity.

Basically, largest part of the land available for cultivation is located within elevation ranges from 300-1800 m. In areas like Lachen, Lachung, Dzongu, Phadamchen, Ribdi, Bharyang, and Uttaray, subsistence agriculture is being practiced up to 3000m. Some crops like oil seeds, leafy vegetables, potatoes, and medicinal plants are cultivated in high elevations (3000-4000m) up to Thangu and Muguthang in North District. Under certain traditional practice, farmers grow huge number of local and conventional varieties and land races of crops to maintain food security.

### **Agrarian Community in Sikkim**

The economy of Sikkim is associated with agriculture that renders the source of livelihood and economic security of large native population. The development however, has been constrained because of biotic and abiotic factors. It has been estimated that more than 80 percent of the rural population depends on agriculture and other allied sectors in order to secure their economic, food and nutritional aspects. The agriculture systems accomplished in Sikkim are incorporated in environments that have produced through years of experimentation by the farmers. A marginal improvement has been seen in the lifestyle of the farmers due to the implementation of modern technologies.

Agriculture is dominated by the Nepalis who are industrious and practice intensive agriculture (Bhasin and Bhasin, 1996). The Bhutias, in north Sikkim, with their large animal herds practice pastoral economy on high altitudes, while Lepchas practice subsistence agriculture (Khawas, 2012).

The original natives of Sikkim were not agriculturists; actually, they led a very primitive lifestyle. The natives were engaged in collecting wild roots, fruits, hunting, and fishing in order to sustain their family. When Bhutia people migrated to Sikkim, they started semi-pastoral economy and sedentary form of farming. They located flat pieces of land in areas adjoining meadows and started to plough those lands. The settled agriculture got initiated in Sikkim only with the arrival of Nepali community. These people were active, hard working

and innovative, and at the very first instant after their arrival they started clearing large tracts of forest land for making them suitable for agriculture purpose.

Sikkim is a tiny hilly state lying in the lap of Eastern Himalayas where agricultural adaptations and practices are extremely inconsistent in tempo-spatial factors due to varying elevation and agro-climatic conditions. The total geographical area about 15.22 percent (total operated land except forest area as per 2016 landuse data) is devoted to agriculture but the available area of agricultural purpose is declining due to conversion of cultivable land into non-agricultural purposes such as development of industries, expansion of town, roads construction, hydel-power projects, construction of different buildings etc. Farming has become handicapped due to small and fragmented holdings, inadequate irrigation facilities and lack of proper farm mechanization and regular occurrences of natural hazards like landslides, earthquakes etc. The above indicators suggest that emphasis should be given to intensive and cautious use of limited land so that the per capita land yield and production is supported to some extent. As per 2015-16 agriculture +horticulture land use covers of South district is estimated to be around 41790 hectare about 5.89 percent of the total geographical area.

### Major Agricultural Crops

The principal food crops cultivated in the area include maize, rice, wheat, finger- millet, barley, buckwheat, pulses, oilseeds and cash crops such as cardamom, ginger, orange and tea. The annual growth of Gross State Domestic Product of Sikkim at current prices in 2014-15 accounted by agriculture is 13.35 percent. Sikkim's Gross Domestic Product was estimated at US dollar 1.57 billion in 2014 and it constitutes the third smallest GDP among other states in India. But the crop productivity (production per unit area) in Sikkim was far below the national and regional average for major field crops.

### Crop Production

The tables given below present the crop production in Sikkim during the periods 1975-76 to 1995-96 and 2005-06 to 2015-16.

**Table 6.1: Crop Production of Sikkim (1975-76 to 1995-96) in 000' Tons**

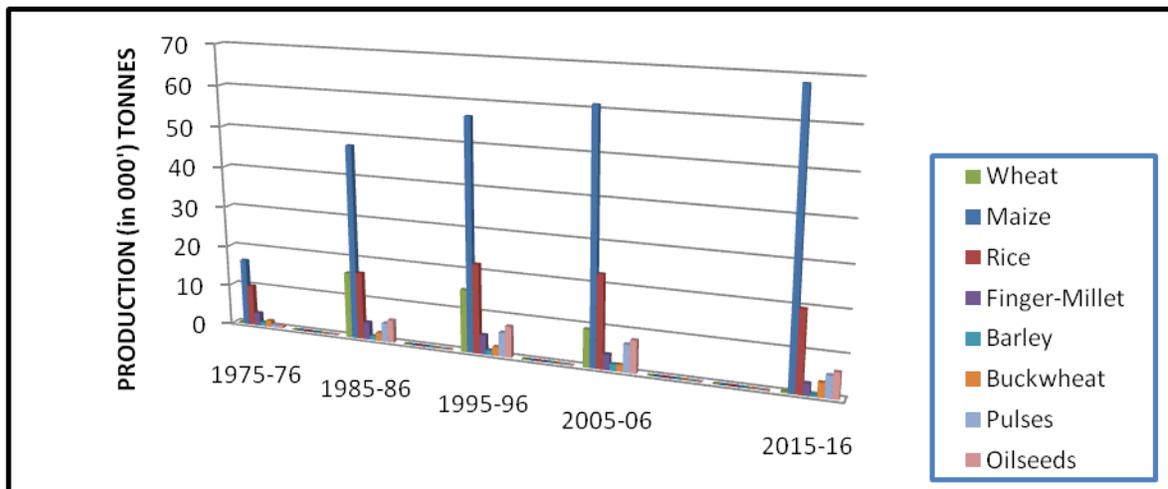
Crops	1975-76 Mean $\pm$ S.D.	Standard Error	1985-86 Mean $\pm$ S.D.	Standard Error	1995-96 Mean $\pm$ S.D.	Standard Error
Maize	16.50 $\pm$ 9.8590	4.0249	47.60 $\pm$ 18.7510	7.6550	56.56 $\pm$ 15.4660	6.3140
Rice	10.00 $\pm$ 5.6213	2.2949	16.50 $\pm$ 9.8590	4.0249	21.87 $\pm$ 14.3805	5.8708
Wheat	0.15 $\pm$ .0892	.0364	16.20 $\pm$ 9.6332	3.9327	15.30 $\pm$ 8.6487	3.5308
Finger- Millet	3.20 $\pm$ 2.6734	1.0914	4.30 $\pm$ 2.6076	1.0645	4.75 $\pm$ 3.0331	1.2382
Barley	0.90 $\pm$ .6723	.2744	1.00 $\pm$ .6841	.2792	1.08 $\pm$ .8369	.3416
Buck- wheat	1.50 $\pm$ 1.0881	.4442	2.00 $\pm$ 1.1471	.4683	2.19 $\pm$ 1.5025	.6134
Pulses	0.70 $\pm$ .4604	.1879	4.60 $\pm$ 3.0331	1.2382	5.92 $\pm$ 3.5777	1.4605
Oilseed	0.70 $\pm$ .4604	.1879	5.55 $\pm$ 3.8987	1.5916	7.63 $\pm$ 5.8020	2.3686

Source: DESME, 2002, 2006-07, Economic Survey-2006-07, Progress Report-2015-16.

**Table 6.2: Crop Production of Sikkim (2005-06 to 2015-16) in 000' Tons**

Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standard Error
Maize	61.10 $\pm$ 20.4254	8.3386	68.31 $\pm$ 25.3929	10.3666
Rice	22.69 $\pm$ 9.0774	3.7058	19.69 $\pm$ 11.2427	4.5898
Wheat	9.20 $\pm$ 6.3245	2.5819	0.35 $\pm$ 19.35	.0797
Finger-Millet	3.78 $\pm$ 2.5343	1.0346	2.91 $\pm$ 2.0503	.8370
Barley	1.59 $\pm$ 1.0507	.4289	0.47 $\pm$ .2429	.0991
Buckwheat	1.64 $\pm$ 1.1242	.4589	3.47 $\pm$ 2.1128	.8625
Pulses	6.76 $\pm$ 4.2426	1.7320	5.38 $\pm$ 3.7416	1.5275
Oilseeds	7.95 $\pm$ 3.4641	1.4142	6.31 $\pm$ 3.8987	1.5916

Source: DESME, 2002, 2006-07, Economic Survey-2006-07, Progress Report-2015-16



**Figure 6.1: Crop Production of Sikkim (1975-76 to 2015-16) in 000' Tons**

The above tables (6.1 & 6.2) illustrate crop production of Sikkim (1975-76 to 2015-16) in 000' tons which shows the significant mean  $\pm$ S.D. and standard error of eight different crops such as maize, rice, wheat, finger-millet, barley, buckwheat, pulses and oilseeds. The highest production of crop has been seen in maize and it is rising in every decade from 1975-76 to 2015-16, the mean  $\pm$ S.D. in 1975-76 (16.50 $\pm$ 9.8590), 1985-86 (47.60 $\pm$ 18.7510), 1995-96 (56.56 $\pm$ 15.4660), 2005-06 (61.10 $\pm$ 20.4254) and 2015-16 (68.31 $\pm$ 25.3929) and their corresponding errors are calculated as 1975-76 (4.0249), 1985-86 (7.6550), 1995-966 (.3140), 2005-06 (8.3386) and 2015-16 (10.3666). The second highest crop production is of rice which has been fluctuating in every decade and the significant mean  $\pm$ S.D. in 1975-76 (10.00 $\pm$ 5.6213), 1985-86 (16.50 $\pm$ 9.8590), 1995-96 (21.87 $\pm$ 14.3805) 2005-06 (22.69 $\pm$ 9.0774) and 2015-16 (19.69 $\pm$ 11.2427) and its corresponding errors are calculated 1975-76 (2.2949), 1985-86 (4.0249), 1995-966 (5.8708), 2005-06 (3.7058) and 2015-16 (4.5898). After maize and rice, other crops come such as wheat, finger-millet, barley, buckwheat, pulses and oilseeds

and their production is not progressively increasing. Wheat come under third position from 1985-86 to 2005-06, but less production of wheat has been seen in 2015-16.

Maize is the principal crop grown in Sikkim. The crop is easily grown in dry and sloping lands that are not suitable for the cultivation of rice (Choudhury, 2006). The production of maize tremendously increased from 1975-76 to 2015-16. Amongst the other crops maize production is maximum in the state of Sikkim. Similarly, rice is the main food item and ranks second after maize. The per capita availability of rice in the state is 158 gms/day, which is far below the National average of 417 gm during 2001-02. Wheat production was slowly increasing during 1995-96, but the trend in 2005-06 and 2015-16 shows decrease in production. The production of other crops has also been fluctuating during every decade according to annual report.

### Crop productivity

Crop productivity is a multi-dimensional concept, which includes technological advancement, effective management of available resources, and organizational setup for crop production. These factors in turn affect the relative crop production in the region. It may be pointed out, that the development of agriculture should be assessed by evaluating the use of various inputs i.e., the extent of cultivated area, provision of irrigation, fertilizers, improved varieties of seeds and labour availability. It provides food for growing population and helps to extend the secondary and tertiary sectors and thereby increase the income for the welfare of the population living in rural areas (shodhganga.inflinet.ac.in).

**Table 6.3: Crop Productivity of Sikkim (1975-76 to 1995-96) Kg/Ha**

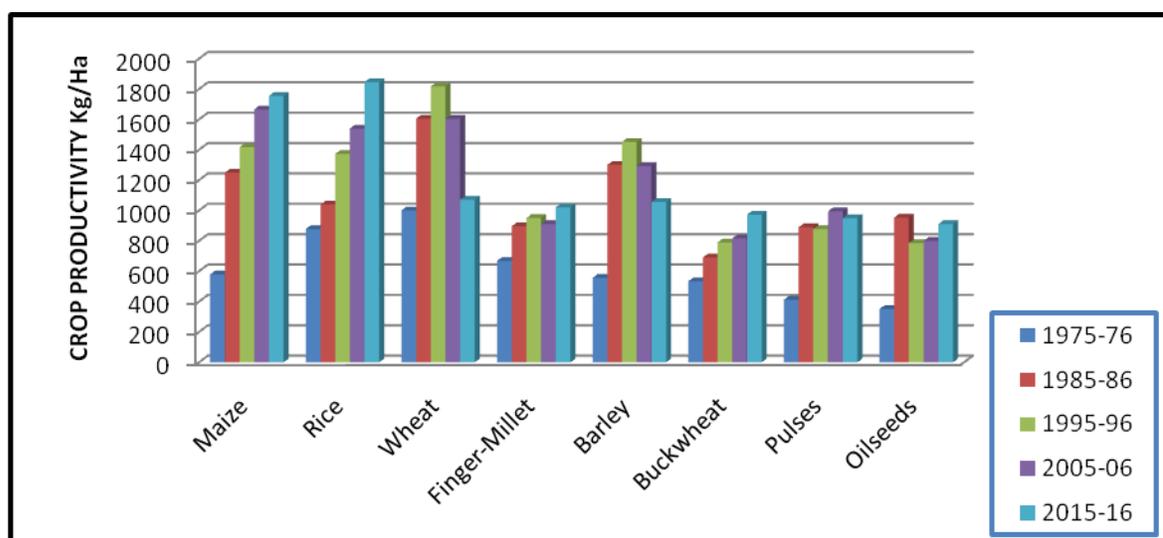
Crops	1975-76 Mean ±S.D.	Standard Error	1985-86 Mean ±S.D.	Standard Error	1995-96 Mean ±S.D.	Standard Error
Maize	579±24.8596	10.1488	1249±23.1257	9.4410	1416±17.6522	7.2064
Rice	877±22.5831	9.2195	1038±15.4402	6.3034	1372±27.3056	11.1475
Wheat	1000±29.2232	11.9303	1604±26.0000	10.6144	1817±19.1520	7.8187
Finger- Millet	667±32.2924	13.1833	896±24.2239	9.8893	950±19.2873	7.8740
Barley	556±22.7332	9.2808	1300±21.8174	8.9069	1451±23.2292	9.4833
Buckwheat	533±16.8166	6.8653	690±31.4579	12.8426	790±27.6767	11.2989
Pulses	412±7.7974	3.1832	889±20.8134	8.4970	878±19.1891	8.0911
Oilseeds	350±19.2769	7.8697	953±23.6896	9.6712	785±24.5601	10.0266

Source: DESME, 2002, 2006-07, Economic Survey-2006-07, Sikkim Gazatteer-2013, Progress Report-2015-16.

**Table 6.4: Crop Productivity of Sikkim (2005-06 to 2015-16) Kg/Ha**

Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standard Error
Maize	1665 $\pm$ 25.8843	10.5672	1754 $\pm$ 28.7262	11.7274
Rice	1539 $\pm$ 20.9666	8.5596	1845 $\pm$ 19.4422	7.9372
Wheat	1603 $\pm$ 20.3273	8.2985	1071 $\pm$ 29.8529	12.1874
Finger-Millet	911 $\pm$ 17.9220	7.3166	1020 $\pm$ 25.7837	10.5261
Barley	1293 $\pm$ 24.8435	10.1423	1055 $\pm$ 23.9448	9.7672
Buckwheat	816 $\pm$ 16.6973	6.8166	972 $\pm$ 23.1430	9.4481
Pulses	994 $\pm$ 19.6875	8.0374	949 $\pm$ 28.8929	11.7954
Oilseeds	799 $\pm$ 18.9631	7.7416	910 $\pm$ 26.8700	10.9696

Source: DESME, 2002, 2006-07, Economic Survey-2006-07, Sikkim Gazetteer-2013, Progress Report-2015-16.



**Figure 6.2:** Crop Productivity of Sikkim (1975-76 to 2015-16) Kg/Ha

The table and figure given above show the crop productivity of eight different crops such as maize, rice, wheat, finger-millet, barley, buckwheat, pulses and oilseeds of Sikkim in various years. In the latest data i.e. 2015-16, the highest productivity is in rice and maize, the mean  $\pm$ S.D. are (1845 $\pm$ 19.4422) and (1845 $\pm$ 19.4422) and its corresponding errors are calculated as (7.9372) and (11.7274).

The crop productivity (production per unit area) in Sikkim is far below the national and regional average for major field crops (*Sikkim Gazetteer*, 2013). In order to assess crop productivity in each district of Sikkim at an interval of five years in 2010-11 to 2014-15,

Yang's (1965) 'Crop Yield Index' method is applied for the calculation of crop productivity. Some of the major crops grown in the districts are considered for the productivity analysis.

**Table 6.5: Crop Yield Index for East District of Sikkim**

Crops (Cereals)	Yield in Kg/Ha		Area under crop in district (in '000 ha)	Crop yield in district as a percentage of the entire state Col.3/Col.2×100	Percentage multiplied by area under crops (Col.4×Col.5)
	Average yield in State	Average yield in each district			
1	2	3	4	5	6
Maize	1687.67	1479.05	9.03	87.64	791.39
Rice	1772.78	1778.47	4.91	100.32	492.57
Wheat	1044.76	1156.67	0.58	110.71	64.21
Finger-Millet	984.36	1012.86	0.84	102.90	86.44
Barley	991.35	985.56	0.28	99.42	27.84
Buckwheat	943.32	963.90	1.44	102.18	147.14
<b>Total</b>			<b>17.08</b>		<b>1609.59</b>

*Crop Yield Index for East district=1609.59/17.08=94.23 percent*

**Table 6.6: Crop Yield Index for West District of Sikkim**

Crops (Cereals)	Yield in Kg/Ha		Area under crop in district (in '000 ha)	Crop yield in district as a percentage of the entire state Col.3/Col.2×100	Percentage multiplied by area under crops (Col.4×Col.5)
	Average yield in State	Average yield in each district			
1	2	3	4	5	6
Maize	1687.67	1702.00	13.86	100.84	1397.64
Rice	1772.78	1858.98	3.55	104.86	372.25
Wheat	1044.76	896.32	0.43	0.86	0.37
Finger-Millet	984.36	1008.77	0.79	1.02	0.81
Barley	991.35	935.50	0.03	0.94	0.03
Buckwheat	943.32	894.05	0.98	0.95	0.93
<b>Total</b>			<b>19.64</b>		<b>1772.03</b>

*Crop Yield Index for North district=1772.03/19.64=90.23 percent*

**Table 6.7: Crop Yield Index for North District of Sikkim**

Crops (Cereals)	Yield in Kg/Ha		Area under crop in district (in '000 ha)	Crop yield in district as a percentage of the entire state Col.3/Col.2×100	Percentage multiplied by area under crops (Col.4×Col.5)
	Average yield in State	Average yield in each district			
1	2	3	4	5	6
Maize	1687.67	1479.05	2.825	87.63	247.55
Rice	1772.78	1287.17	0.995	72.60	72.23
Wheat	1044.76	980.00	0.260	93.80	24.39
Finger-Millet	984.36	1884.34	0.605	191.42	115.81
Barley	991.35	1125.07	0.140	113.45	15.88
Buckwheat	943.32	891.32	0.195	94.49	18.43
<b>Total</b>			<b>5.020</b>		<b>494.29</b>

*Crop Yield Index for North district=494.29/5.020=98.46 percent*

**Table 6.8: Crop Yield Index for South District of Sikkim**

Crops (Cereals)	Yield in Kg/Ha		Area under crop in district (in '000 ha)	Crop yield in district as a percentage of the entire state Col.3/Col.2 ×100	Percentage multiplied by area under crops (Col.4×Col.5)
	Average yield in State	Average yield in each district			
1	2	3	4	5	6
Maize	1687.67	1694.62	14.32	100.41	1437.87
Rice	1772.78	1842.76	2.14	103.94	222.43
Wheat	1044.76	1088.34	0.26	104.17	27.08
Finger-Millet	984.36	961.34	0.75	97.66	73.25
Barley	991.35	872.90	0.12	88.05	10.57
Buckwheat	943.32	965.49	1.43	102.35	146.36
<b>Total</b>			<b>19.02</b>		<b>1917.56</b>

*Crop Yield Index for North district=1917.56/19.02=100.82 percent*

The procedure for calculating 'Crop Yield Index' of four districts of Sikkim has been taken from Yang's Crop Yield Index.

The computed values of productivity indices for each district of the state are explained below.

*I. Productivity Districts Based on Cereal Crops Yield Index:*

According to Crops Yield Index there are four productivity districts (regions) for cereal crops (maize, rice, wheat, finger-millet, barley and buckwheat) in Sikkim. These are:

i. *Very High Productivity District*

The South district is characterized by very high productivity in cereal crops with an index value of 100.82 percent.

ii. *High Productivity District*

The North district possesses high productivity in cereal crops with an index value of 98.46 percent.

iii. *Medium Productivity District*

The East district has medium productivity of cereal crops with the index values of 94.23 percent.

iv. *Low Productivity District-*

The West district possesses shows low productivity in cereal crops with an index value of 90.23.

II. *Productivity Districts Based on Pulse Crops Yield Index*

The cultivation of pulses is very significant in the state of Sikkim. The pulses productivity varies according to the tempo-spatial variation of the state. The areas of high, medium and low productivity can be seen within four districts of Sikkim.

i. *High Productivity District*

High productivity region covers two districts i.e. South and East districts of Sikkim with the index values of 100.67 and 102.47 percent respectively.

ii. *Medium Productivity District*

Medium productivity is confined to the West district of Sikkim with the index value of 93.90 percent.

iii. *Low Productivity District*

The low productivity region covers only one district i.e. North district having index value of 70.83 percent and lying in the northern part of state.

III. *Productivity District Based on Oilseed Crops Yield Index*

The areas of high, medium and low productivity of oilseeds within four districts of Sikkim are given below:

i. *High Productivity District*

High productivity region covers two districts i.e. South and East of Sikkim with the index values of 103.11 and 103.01 percent respectively.

*Medium Productivity District*

West district of Sikkim having index value of oilseed is 97.02 percent has medium productivity.

iv. *Low Productivity District*

The low productivity region covers only one district i.e. North district having index value of 86.41 percent.

### **Production and Productivity of the Study Area (South District)**

Where land resources are scarce, the principal means of raising production to keep pace with the growth of population is by raising yield per hectare. However, raising the productivity of land does not mean only raising the yield of individual crops. It encompasses the whole output of a farm or country in relation to the total area of farm land, and which may also be raised by changing the pattern of crop production and towards more intensive system of cultivation or towards higher value crops (shodhganga.inflibnet.ac.in).

**Table 6.9: Area (in 000'ha) of Major Crops in South District (2000-01 to 2005-06)**

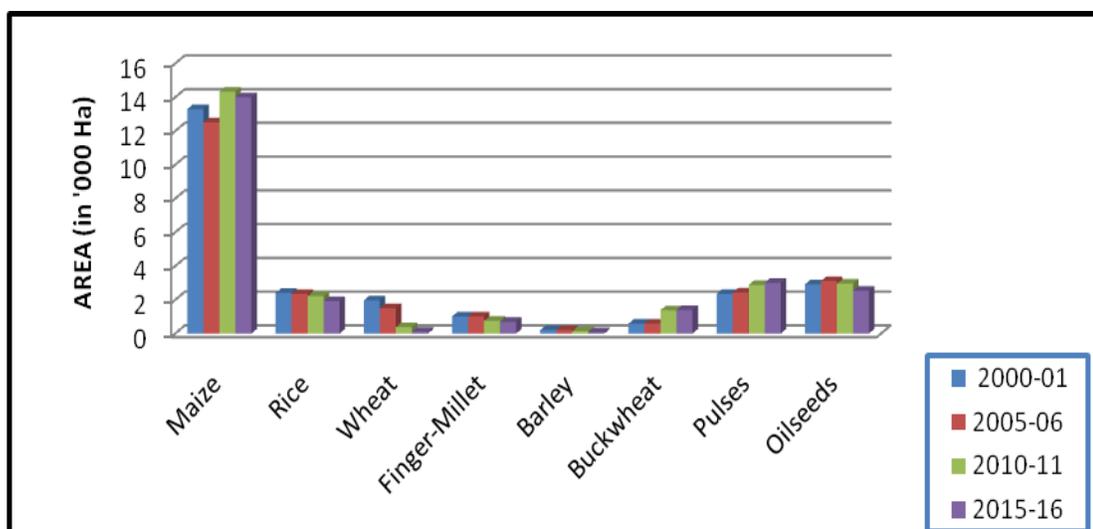
Sl. No.	Crops	2000-01 Mean ± S.D.	Standard Error	2005-06 Mean ± S.D.	Standard Error
1.	Maize	13.30±9.9799	4.0743	12.50±.1982	.0809
2.	Rice	2.40±1.3130	.5360	2.34±1.5165	.6191
3.	Wheat	1.96±1.2176	.4971	1.50±1.0749	.4388
4.	Finger-Millet	1.00±.6841	.2792	1.01±1.0881	.4442
5.	Barley	0.20±.1056	.0431	0.20±.1056	.0431
6.	Buckwheat	0.58±.3045	.1243	0.58±.3045	.1243
7.	Pulses	2.35±1.4601	.5961	2.42±1.5401	.6287
8.	Oilseeds	2.91±.2475	.1010	3.10±2.1511	.8781

Source: DESME, 2004-05, 2006-07, Progress Report 2005-06 & 2015-16.

**Table 6.10: Area (in 000'ha) of Major Crops in South District (2010-11 to 2015-16)**

Sl. No.	Crops	2010-11 Mean ± S.D.	Standard Error	2015-16 Mean ± S.D.	Standard Error
1.	Maize	14.33 ±6.0663	2.4765	14.00 ±5.7619	2.3523
2.	Rice	2.22 ±1.3206	.5391	1.92 ±1.3244	.5407
3.	Wheat	0.37 ±.1381	.0563	0.11 ±.0583	.0238
4.	Finger-Millet	0.75 ±.2625	.1071	0.70 ±.4604	.1879
5.	Barley	0.14 ±.0509	.0208	0.07 ±.4604	.1879
6.	Buckwheat	1.38 ±.6706	.2737	1.40 ±1.0469	.4274
7.	Pulses	2.88 ±1.3446	.5489	3.01 ±2.1156	.8637
8.	Oilseeds	2.95 ±1.6260	.6638	2.54 ±1.6994	.6937

Source: DESME, 2004-05, 2006-07, Progress Report 2005-06 & 2015-16.



**Figure 6.3:** Area (in 000'ha) of major crops in South District (2000-01 to 2015-16)

Area under different crops of South district can be seen in tables (6.9 & 6.10) at an interval of five years i.e. 2000-01 (53.85 %), 2005-06 (52.85%), 2010-11(57.28%) and 2015-16 (58.95%). All through the years, area under maize has been highest and much above other crops. The areas under pulses, oilseeds and rice are almost same. Wheat, buckwheat and finger millet have much less area while barley has least area. As per 2015-16 agricultural land use covers of South district is estimated to be around 23750 hectare about 3.34 percent of the total geographical area.

**Table 6.11: Major Crop Production (000' Tons) in South District (2000-01 to 2005-06)**

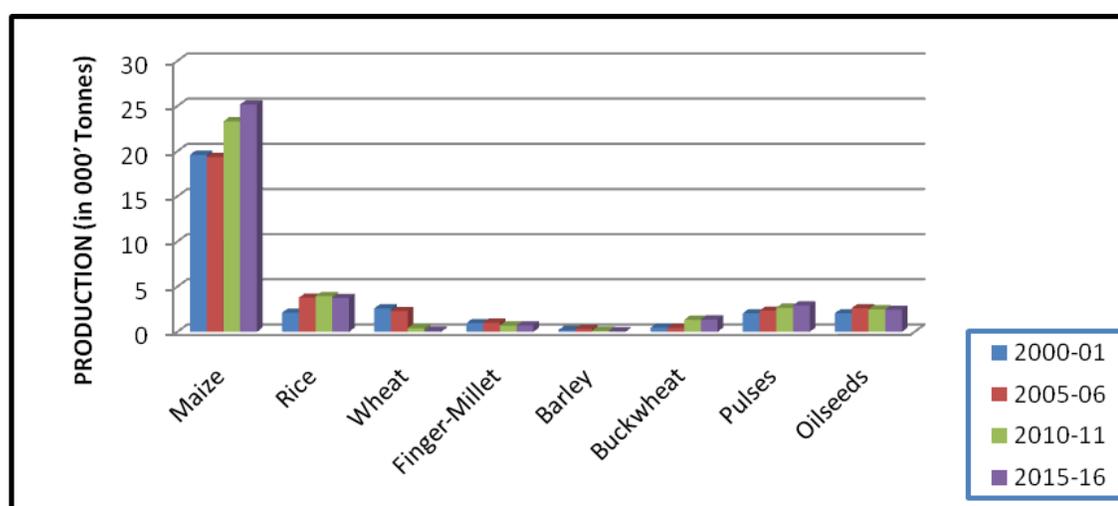
Sl. No.	Crops	2000-01 Mean $\pm$ S.D.	Standard Error	2005-06 Mean $\pm$ S.D.	Standard Error
1.	Maize	19.60 $\pm$ 13.4313	5.4833	19.36 $\pm$ 13.4014	5.4711
2.	Rice	2.11 $\pm$ .1574	.0642	3.77 $\pm$ 2.1061	.8598
3.	Wheat	2.59 $\pm$ 1.5849	.6470	2.30 $\pm$ 1.4014	.5721
4.	Finger-Millet	0.95 $\pm$ .7010	.2862	1.01 $\pm$ 1.0881	.4442
5.	Barley	0.20 $\pm$ .1056	.0431	0.32 $\pm$ .3200	.2112
6.	Buckwheat	0.46 $\pm$ .3033	.1238	0.44 $\pm$ .2150	.0877
7.	Pulses	2.05 $\pm$ 1.3205	.5391	2.33 $\pm$ 1.6456	.6718
8.	Oilseeds	2.05 $\pm$ 1.3250	.5391	2.62 $\pm$ 1.9266	.7865

Source: DESME, 2004-05, 2006-07, Progress Report 2010-11 and 2015-16.

**Table 6.12: Major Crop Production (000' Tons) in South District (2010-11 to 2015-16)**

Sl. No.	Crops	2010-11 Mean ± S.D.	Standard Error	2015-16 Mean ± S.D.	Standard Error
1.	Maize	23.31±15.1261	6.1752	25.18±14.7918	6.0387
2.	Rice	3.95±2.1621	.8827	3.74±2.2369	.9132
3.	Wheat	0.41±.1740	.0710	0.12±.0641	.0252
4.	Finger-Millet	0.69±.3974	.1622	0.71±.4604	.1879
5.	Barley	0.12±.0641	.0252	0.06±.0405	.0165
6.	Buckwheat	1.33±.9528	.3890	1.36±1.7933	.4258
7.	Pulses	2.67±2.0049	.8185	2.92±1.7933	.7321
8.	Oilseeds	2.49±1.8740	.7650	2.44±1.3446	.5489

Source: DESME, 2004-05, 2006-07, Progress Report 2010-11 and 2015-16.



**Figure 6.4:** Production (in 000' Tons) of major crops in South Sikkim (2000-01 to 2015-16)

Though maize is never a part of the staple food item it is taken as substitute food in absence of rice in Sikkim. Its production still contributes over 70 percent of the total food grains production in Sikkim. The production of maize in South District has always been at the top among all crops. A noteworthy increase in the production of maize has been seen in above table as per 2000-01 to 2015-16 data. Rice is the main staple food crop in Sikkim and it occupies second position in crops production. The production of rice, pulses and oilseeds is not satisfactory. The production of wheat and buckwheat is also less, but higher compared to finger-millet and barley.

**Table 6.13: Productivity (Kg/Ha) of Major Crops in South District (2000-01 to 2005-06)**

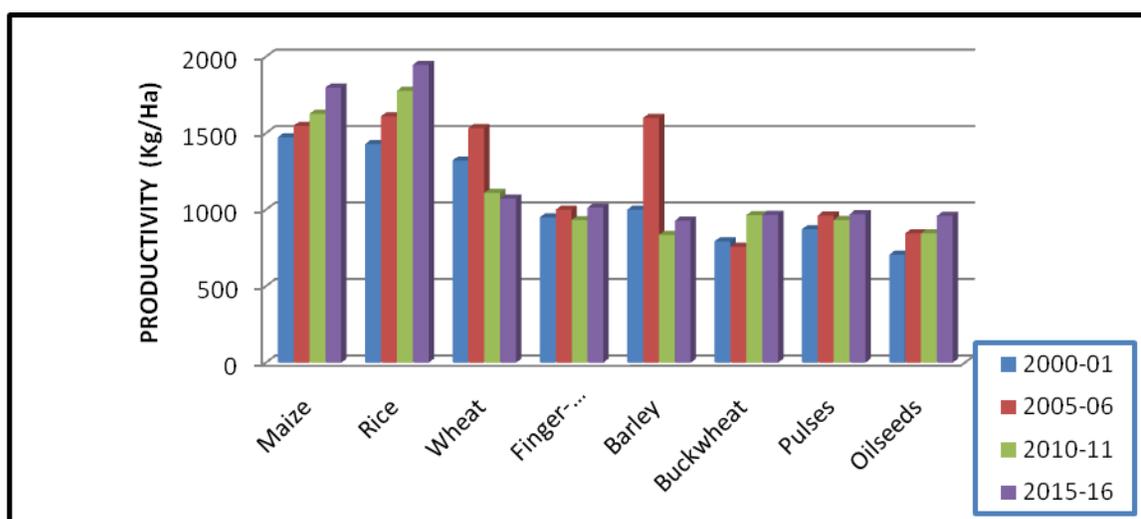
Sl. No.	Crops	2000-01 Mean ± S.D.	Standard Error	2005-06 Mean ± S.D.	Standard Error
1.	Maize	1473.68 ±.3312	.1356	1548.80 ±32.5453	13.2865
2.	Rice	1429.16 ±.2737	.1117	1611.11 ±20.2385	8.2623
3.	Wheat	1321.42 ±.3320	.1355	1533.33 ±28.4464	11.6132
4.	Finger-Millet	950.00 ±31.8622	13.0076	1000.00 ±29.3802	11.9944
5.	Barley	1000.00 ±29.3802	11.9944	1600.00 ±23.0391	9.4056
6.	Buckwheat	793.10 ±23.4520	9.5742	758.62 ±25.4872	10.4051
7.	Pulses	872.34 ±31.7285	12.9531	962.81 ±28.7888	11.7530
8.	Oilseeds	705.84 ±37.7518	15.4121	845.16 ±24.3557	9.9431

Source: DESME, 2004-05, 2006-07, Progress Report 2010-11 and 2015-16.

**Table 6.14: Productivity (Kg/Ha) of Major Crops in South District (2010-11 to 2015-16)**

Sl. No.	Crops	2010-11 Mean ± S.D.	Standard Error	2015-16 Mean ± S.D.	Standard Error
1.	Maize	1627.00±22.5299	9.1978	1798.57±32.7597	13.3741
2.	Rice	1778.20±19.9298	8.1363	1946.88±29.0998	11.8799
3.	Wheat	1110.00±22.6892	9.2628	1072.73±21.9271	8.9517
4.	Finger-Millet	932.00±29.6175	12.0913	1014.29±24.3228	9.9297
5.	Barley	835.80±22.7332	9.2808	928.57±26.0537	10.6364
6.	Buckwheat	965.00±26.5103	10.8228	966.66±27.0628	11.0483
7.	Pulses	932.77±17.8213	7.2755	971.10±32.3975	13.2262
8.	Oilseeds	845.93±29.1667	11.8827	959.50±23.7149	9.6816

Source: DESME, 2004-05, 2006-07, Progress Report 2005-06 & 2015-16.



**Figure 6.5: Productivity (in Kg/Ha) of Major crops in South Sikkim (2000-01 to 2015-16)**

The productivity of maize has been increasing. Within a period of five years it has increased by 4.9 percent from 2000-01 to 2005-06, likewise from the years of 2005-06 to 2010-11 increased by 4.8 percent, and again by 9.5 percent from 2010-11 to 2015-16. The productivity of rice was low in the year of 2000-01, but the productivity has suddenly increased from 2005-06 to 2015-16 and it is increased by 11.3 percent from 2000-01 to 2005-06, likewise from 2005-06 to 2010-11 it was increased by 9.4 percent, and 8.7 percent from 2010-11 to 2015-16. In the case of wheat the productivity has increased from 2000-01 to 2005-06, but after that productivity came down. The remaining crops like finger-millet, barley and buckwheat experience fluctuations in yield in every five years. But oilseeds production is seen to be increasing steadily. There are two groups of oilseeds in Sikkim i.e. rape & mustard, and soybean. The use of pulses with cereals is a very general practice in India. The practice is measured to be very scientific because of the high protein stuffing in the pulses, which are required for balanced food for a large population in the country dependent upon vegetarian food. Pulses like *kalo dal* and *paheli dal* are commonly grown in Sikkim.

### **Crop Combination - Weaver's Method**

A simple and suitable method of finding out the crop combinations with significant share in the total cropped area has been suggested by Weaver. He compared the actual percentage area under each crop on the basis of hypothetical percentage. Actually, this theoretical percentage share of a crop is diverse in different hypothetical situations. For instance, in a hypothetical monoculture area, the theoretical percentage share of a crop is 100 percent. For a two crop combination area it is 50 percent for each crop. For a three-crop combination it is 33½ percent for each and so on.

Thus to work out crop combination, first the areas under different crops as percentage to the total cropped area are calculated. Its highest percentage is then compared with the assumed value of one crop region i.e. 100. In the next step first two highest percentages are taken and compared to get the assumed values of a two-crop combination region i.e. 50 and 50. Similarly three highest percentages with 33½, 33½ and 33½ and four highest percentages with 25, 25, and 25 so on are compared. In each step it will get some value of  $\sigma^2$ . The theoretical percentage which gives the minimum value of  $\sigma^2$  is considered to be matching best with the reality and hence, the area is identified with it (Mahmood, 1998).

**Table 6.15: Percentage wise distribution of average area for the period of three years (2013-14 to 2015-16) for eight (8) different crops of South District**

Sl.No.	Crops	Percentage of average area for three years (2013-14 to 2015-16)
1.	Maize	58.66
2.	Pulses	12.46
3.	Oilseeds	11.16
4.	Rice	8.28
5.	Buckwheat	5.86
6.	Finger-Millet	2.66
7.	Wheat	0.56
8.	Barley	0.36
	Total	100.0

Source: Compiled by Researcher.

Percentage wise distribution of average area for the period of three years (2013-14 to 2015-16) for eight (8) different crops of South district are calculated following Weaver's method to identify the significant crops of the district.

***One Crop***

Hypothetical%	100	Summation
Observed%	58.66	
Difference	41.34	
d <sup>2</sup>	1708.99	
d <sup>2</sup> /n	1708.9	

***Two Crops***

Hypothetical%	50	50	Summation	
Observed%	58.66	12.46		
Difference	-8.66	37.54		
d <sup>2</sup>	74.99	+1409.25		=1484.24
d <sup>2</sup> /n				<b>742.12</b>

***Three Crops***

Hypothetical%	33.3	33.3	33.3	Summation	
Observed%	58.66	12.46	11.16		
Difference	-25.36	20.84	21.7		
d <sup>2</sup>	643.12	+435.31	+470.89		=1549.32
d <sup>2</sup> /n					<b>516.44</b>

***Four Crops***

Hypothetical%	25	25	25	25	Summation	
Observed%	58.66	12.46	11.16	8.28		
Difference	-33.66	12.54	13.84	16.72		
d <sup>2</sup>	1132.99	+157.25	+191.55	+279.56	=1761.35	
d <sup>2</sup> /n					<b>440.34</b>	

***Five Crops***

Hypothetical%	20	20	20	20	20	Summation	
Observed%	58.66	12.46	11.16	8.28	5.86		
Difference	-38.66	7.54	8.84	11.72	14.14		
d <sup>2</sup>	1494.59	+56.85	+78.12	+137.35	+199.94	=1966.85	
d <sup>2</sup> /n						<b>393.37</b>	

***Six Crops***

Hypothetical %	16.66	16.66	16.66	16.66	16.66	16.66	Summation	
Observed%	58.66	12.46	11.16	8.28	5.86	2.66		
Difference	-42	4.2	5.5	8.38	10.8	14		
d <sup>2</sup>	1764	+17.64	+30.25	+70.22	+116.64	+196	=2194.75	
d <sup>2</sup> /n							<b>365.79</b>	

***Seven Crops***

Hypothetical %	14.28	14.28	14.28	14.28	14.28	14.28	14.28	Summation	
Observed %	58.66	12.46	11.16	8.28	5.86	2.66	0.56		
Difference	-44.38	1.82	3.12	6.00	8.42	11.62	13.72		
d <sup>2</sup>	1969.58	+3.31	+9.73	+36.00	+70.89	+135.02	+188.23	=2412.76	
d <sup>2</sup> /n								<b>344.68</b>	

***Eight Crops***

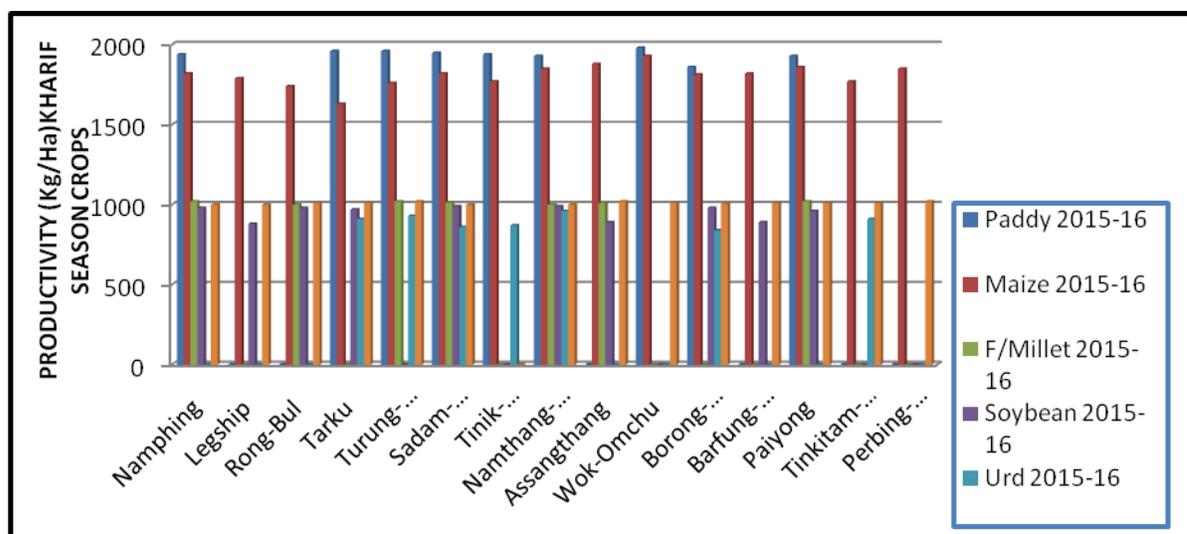
Hypothetical %	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	Summation
Observed %	58.66	12.46	11.16	8.28	5.86	2.66	0.56	0.36	
Difference	-46.16	0.04	1.34	4.22	6.64	9.84	11.94	12.14	
d <sup>2</sup>	2130.75	+0.0016	+1.79	+17.81	+44.09	+96.82	+142.56	+147.38	=2581.19
d <sup>2</sup> /n									<b>322.65</b>

According to Weaver's method of crop combination, the South district may therefore be identified as a six to eight crops region and maize as the most dominating crop followed by pulses, oilseeds, rice and remaining four crops region (as the value of the index is lowest) of buckwheat, finger-millet, wheat and barley.

**Table 6.16: Productivity (Yield Kg/Ha) of Kharif Season Crops in Study Areas 2015-16**

Sl. No	Name of GPU's	Paddy	Maize	F/Millet	Soybean	Urd	Other Pulses
		2015-16	2015-16	2015-16	2015-16	2015-16	2015-16
1.	Namphing	1940	1820	1020	980	0	1000
2.	Legship	0	1790	0	880	0	1000
3.	Rong-Bul	0	1740	1000	980	0	1010
4.	Tarku	1960	1630	0	970	910	1010
5.	Turung-Mamring	1960	1760	1020	0	930	1020
6.	Sadam-Suntaley	1950	1820	1012	990	860	1000
7.	Tinik-Chisopani	1940	1770	0	0	870	0
8.	Namthang-Maneydara	1930	1850	1000	990	960	1000
9.	Assangthang	0	1880	1010	890	0	1020
10.	Wok-Omchu	1980	1930	0	0	0	1010
11.	Borong-Phamthang	1860	1814	0	980	840	1007
12.	Barfung-Zarung	0	1820	0	890	0	1010
13.	Paiyong	1930	1860	1020	960	0	1010
14.	Tinkitam-Rayong	0	1770	0	0	910	1010
15.	Perbing-Dovan	0	1850	0	0	0	1020

Source: Progress Report 2015-16.



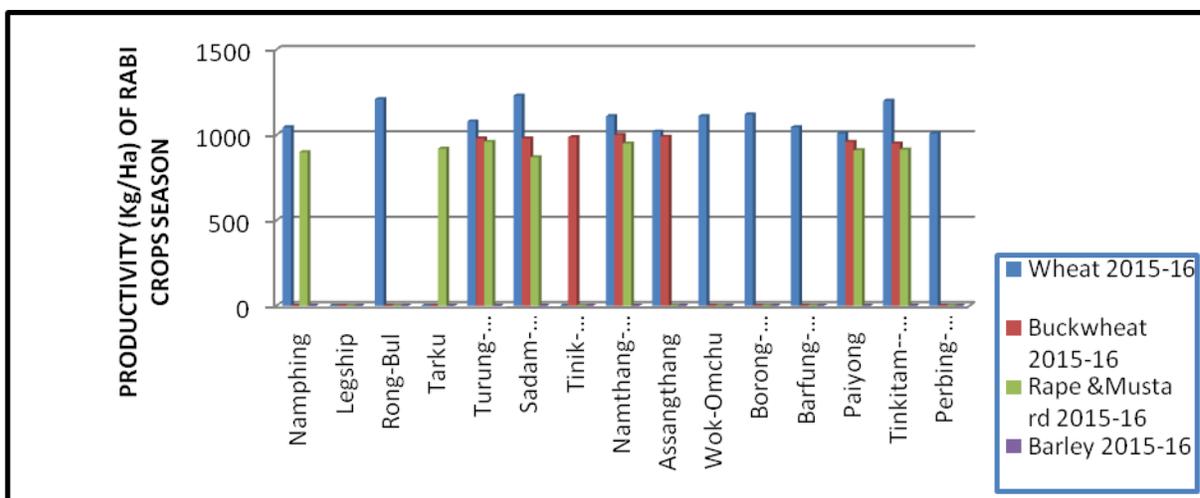
**Figure 6.6:** Productivity (Yield Kg/Ha) of Kharif Season Crops of the Study areas of South District (2015-16)

The above table 5.16 shows productivity pertaining to kharif crops which indicates paddy and maize to be predominant in almost all the study areas. Productivity of other crops such as finger-millet, soybean, urd and other pulses are almost in the same line in every study area. Among 15 GPUs only two GPUs i.e. Sadam-Suntaley and Namthang-Maneydara have grown all kharif crops. Similarly crop i.e. maize is grown in every study area.

**Table 6.17: Productivity (Yield Kg/Ha) of Rabi Season Crops in Study Areas 2015-16**

Sl. No.	Name of GPU's	Wheat	Buckwheat	Rape & Mustard	Barley
		2015-16	2015-16	2015-16	2015-16
1.	Namphing	1045	0	900	0
2.	Legship	0	0	0	0
3.	Rong-Bul	1210	0	0	0
4.	Tarku	0	0	920	0
5.	Turung-Mamring	1080	980	960	0
6.	Sadam-Suntaley	1230	980	870	0
7.	Tinik-Chisopani	0	987	0	0
8.	Namthang-Maneydara	1110	1000	950	0
9.	Assangthang	1020	990	0	0
10.	Wok-Omchu	1110	0	0	0
11.	Borong-Phamthang	1120	0	0	0
12.	Barfung-Zarung	1045	0	0	0
13.	Paiyong	1010	960	910	0
14.	Tinkitam--Rayong	1200	950	915	0
15.	Perbing-Dovan	1010	0	0	0

Source: Progress Report 2015-16.



**Figure 6.7:** Productivity (Yield Kg/Ha) of Rabi Season Crops of study areas (2015-16)

The above table 5.17 shows productivity pertaining to rabi crops which indicates wheat as the predominant crop followed by buckwheat and rape & mustard. The above data shows no GPU's have grown rabi crop like barley. Among 15 GPU's only 5 GPU's i.e. Turung-Mamring, Sadam-Suntaley, Namthang-Maneydara, Paiyong and Tinkitam--Rayong have cultivated all crops except barley. Some GPU's do not grow crops like wheat, buckwheat, rape & mustard.

### Horticulture in Sikkim

Sikkim enjoys certain privileges as far as horticulture is concerned. The range of sub-tropical to cold -temperate climate in the state has favoured cultivation of a wide variety of fruits, vegetables, root and tuber crops, spices and flowers. Sikkim is a prolific grower of fruits like mandarin orange, plum, peach, pear, avocado, guava, banana etc., vegetables such as, cabbage, cauliflower, pumpkin, bitter gourd, cucumber, tomato, a large variety of beans and leafy vegetables, and root and tuber crops, viz. potato, radish, carrot, turnip, cassava, sweet potato, yams, etc. Among the spices grown in Sikkim, large cardamom is by far the most important. Other than cardamom, ginger and turmeric are also grown profusely (Choudhury, 2006).

In relation to horticultural crops, the area covered by spices is maximum as per the report of 2015-16. Large cardamom alone accounts for 17.55 thousand ha. The crop has significant place in Sikkim's agro forestry. Cardamom plants grow well in places with lot of shade and ground moisture. Most of the cardamom plantations are accompanied by the forests particularly of a local species called Uttis (*Alnus Nepalensis*).

In contrast to cardamom, other crops like ginger and turmeric are grown in comparatively dry and open areas. Apart from these Asiatic spices, exotic spices like basil, thyme, oregano and parsely are also being tried on Sikkim soil on experimental basis. The fruit orchards in Sikkim

cover about 6 thousand ha out of which orange orchards account for 4.25 ha. As for production, the vegetables rank first due to the bulk of the produce. The spices occupy the second place while potato and other tubers comes a close third, followed by fruits (Choudhury, 2006).

The conventional method of agriculture in Sikkim households has a diversity of horticultural crops which append significant amount of income to the marginal farmers. Horticulture is nowadays gaining popularity for domestic consumption as well as marketability. Over the last one decade the concept has been changed from traditional to commercial horticulture and it is introduced in Sikkim in order to enhance socio-economic status. Horticulture in the state generally consists of mandarin orange, passion fruit, pear, kiwi etc., vegetables such as beans, garden pea tomato, cabbage, carrot, radish, chayote, tuber crops etc., spice crops such as large cardamom, ginger, turmeric, cherry pepper (dale khorsani/fire ball) and flowers.

Horticultural crops such as large cardamom, ginger and mandarin orange are the main cash crops which support the ecology and agro-climatic conditions of Sikkim. Fruit trees play a vital role in the agroforestry systems, farmlands, and home-gardens too. The above crops are basically important for their socio-economic values, and also for building up pliability to changes in the case of agro-ecosystems. Local growers of cardamom, mandarin and ginger are commercially exploited and can only just be replaced by any other newly introduced commercial farming systems.

Horticulture is one of the chief economic activities of the people of Sikkim. Large cardamom, ginger and turmeric are the principal spice crops, while mandarin orange, guava, mango, banana and so on are the principal fruits grown in the state. The department of Horticulture is deeply involved in motivating and providing technical guidance to local farmers. Sikkim is also famous for flowers. Gladioli, anthuriums, lilliums, primulas, rhododendrons, orchids as well as many other floral species thrive here. The state is home to an amazing 450 species of exotic orchids alone. There is immense potential for developing floriculture on a commercial basis here, and the department of horticulture is making concerted efforts to turn this sector into an export-oriented industry ([sikkim.nic.in](http://sikkim.nic.in)).

Sikkim has penetrated in new era of serious development after the remarkable constitutional change of April 1975; then state joined the mainstream of national life after becoming the 22<sup>nd</sup> State of Indian Union. The government decided to implement the policy of development with sustainability, making horticulture a main concern sector for higher income generation to farming community as well as to give attention to maximum crop production of agricultural crops and supervision primarily on agro-resources like soil, water and bio-diversity. Incorporated farming, an ideally appropriate system, is commonly followed by farmers in the State, which carries the potential to change the developmental process by making Sikkim an organic state. Sikkim was declared as the first fully Organic State of India on January 2016,

after the announcement made by Prime Minister of India Shri Narendra Modi. As a corollary to the Chief Minister's announcement of November, 2017, vegetables grown inorganically, outside the state have been banned in Sikkim after 31<sup>st</sup> March, 2018.

Livelihoods of about 80 percent people of the state are directly or indirectly dependent on scarce land resources. Engagement in practicing horticulture will boost state's domestic product that will have important implications. The horticulture sector receives priority attention for higher levels of rural prosperity. Horticulture crops play a distinctive role in Sikkim as well as in India's economy by improving the income status of the rural people. Cultivation of horticulture crops is labour intensive and as such they create a number of employment opportunities for the rural population. Basically, fruits and vegetables has high source of vitamins, minerals, proteins carbohydrates, etc. and are essential to every human being. Hence, these are referred to as defending foods and implicit great importance as nutritional security for the people.

Cash and commercial crops like large cardamom, ginger, orange, seed potato, flower and off-season vegetables along with other horticultural crops (varieties of fruits, root and tuber crops, mushroom, honey, nuts, spice crops like turmeric, seed spices etc., medicinal and aromatic plants) are dealt by the Horticulture & Cash Crops Development Department since its creation in 1996 ([www.visva-bharati.ac.in](http://www.visva-bharati.ac.in)).

The scheme of Horticulture Mission for North East and Himalayan States (HMNEH) stands as a back bone of horticulture development in Sikkim as through it there has been a considerable enhancement in funding and amendment in pattern of assistance than earlier. The basic aims of the Mission is to achieve horizontal and vertical combination of horticultural programmes to enhance production, by providing appropriate timely and concurrent attention to all associated in production, post-harvest management and consumption sequence to maximize economic, ecological and social benefits to the people.

### **Horticulture Transformation**

Sikkim's diverse ecological conditions ranging from tropical to alpine support the cultivation of a variety of fruits, vegetables, in and out of season, and are also excellent for commercial crops like cardamom, ginger, orange, etc. The present trends towards rapid expansion of horticultural crops will have positive implications for improving food and economic security of the farmers of Sikkim. However, perusal of yield data and other parameters like net income per ha, market demand, peak season of arrivals and price trend in major markets should be kept in mind to regulate the production-marketing chain. Ginger, Vegetable farming, seed potato farming in horticulture and also livestock rearing especially dairying has particularly helped small and marginal farmers of Sikkim to come out of poverty trap. The concern of such

small and marginal farmers today is sustainability of the option and not the alternative (Subba, 2008).

The NABARD has funded the project like Bagan Development Project (WADI) which was implemented by Krishi Vigyan Kendra (KVK) of South Sikkim. It mainly focuses on tribal villages of South district under the Agro-climatic zones which is highly appropriate for persistent plantation of fruits like orange, guava and lemon at the low altitude. According to this project some subsidy has been give to tribal villagers for the plantation of horticultural crops. Moreover, the central part of WADI programme is a wider developmental project in order to create a sustainable living with the “Tree Based Farming System”. In the core part, the programme evolves and shapes into a complete effort that deals with short term and long term need in the course of array of mechanism for managing a natural resource and develop varied source of income and help for the improvement of quality of life.

The Bagan Development Project (WADI) mainly targets to cover total 400 households as well as 400 acres of land taken up in two phases. The project is being implemented in tribal villages of South Sikkim and its adjoining area i.e. Namthang covering 400 acres of land and around 400 tribal households have been benefited - 96 households at Lower Kateng Bokrang, Upper Kateng, Bokrang - 50 households, 40 households in Palitam-Ruchung, Kabrey - 80 households, Rabikhola - 36 households, Rabitar - 48 households and Manghim - 50 households.. In the 1<sup>st</sup> Phase only 150 households were taken up and in 2<sup>nd</sup> Phase remaining 250 households were covered.

### Horticultural Crop Production

Production is a cumulative term involving the implications of various material inputs and immaterial inputs in order to produce something for consumption.

**Table 6.18: Horticultural Crops Production in Sikkim (1975-76 to 1995-96)**

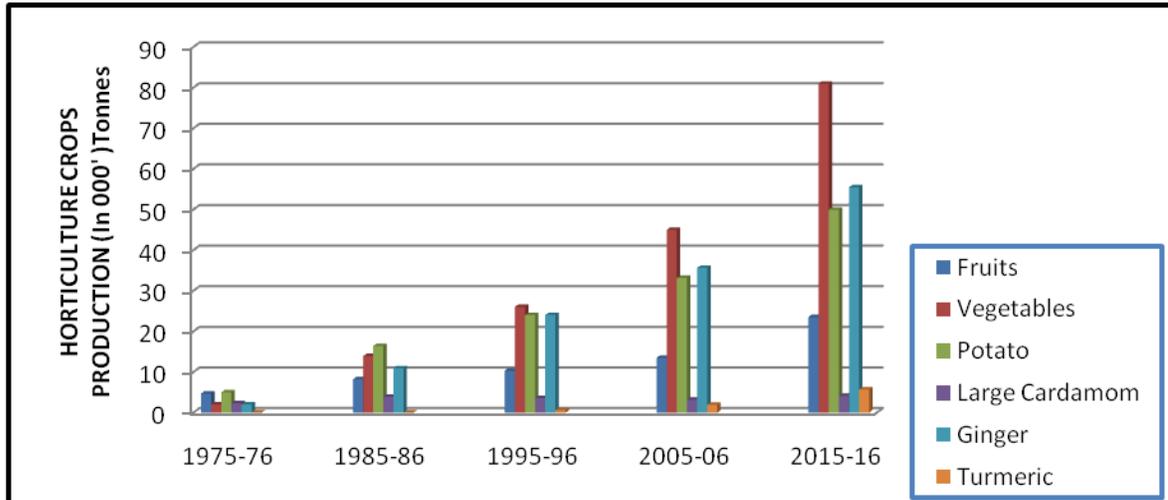
Sl. No.	Crops	1975-76 Mean ± S.D.	Standard Error	1985-86 Mean ± S.D.	Standard Error	1995-96 Mean ± S.D.	Standard Error
1.	Fruits	4.70±3.0216	1.2335	8.20±6.4807	2.6457	10.30±6.6932	2.7325
2.	Vegetables	2.00±1.1189	.4568	13.90±7.8230	3.1937	26.00±12.6332	5.1575
3.	Potato	5.00±2.8816	1.1764	16.40±8.1486	3.3266	24.00±10.2761	4.1952
4.	Large Cardamom	2.30±1.3589	.5547	3.90±2.2387	.91339	3.60±2.4404	.9963
5.	Ginger	2.00±1.1189	.4568	10.90±6.6030	2.6956	24.00±10.2761	4.1952
6.	Turmeric	000	000	000	000	0.60±.2423	.0989

Source: Gazetteer of Sikkim-2013, Office Record (Horticulture Department)-2015-16.

**Table 6.19: Horticultural Crops Production of Sikkim (2005-06 to 2015-16)**

Sl. No.	Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standard Error
1.	Fruits	13.47 $\pm$ 8.1731	3.3366	23.53 $\pm$ 9.9398	4.0579
2.	Vegetables	44.97 $\pm$ 19.9699	8.1527	80.96 $\pm$ 30.3842	12.4043
3.	Potato	33.14 $\pm$ 14.9398	6.0991	49.93 $\pm$ 20.9284	8.5440
4.	Large Cardamom	3.16 $\pm$ 2.3004	.9391	4.12 $\pm$ 3.0331	1.2382
5.	Ginger	35.63 $\pm$ 15.6588	6.3927	55.45 $\pm$ 25.7449	10.5103
6.	Turmeric	1.91 $\pm$ 1.3311	.5434	5.68 $\pm$ 3.8987	1.5916

Source: Gazetteer of Sikkim-2013, Office Record (Horticulture Department)-2015-16.



**Figure 6.8:** Horticultural Crops Production of Sikkim (1975-76 to 2015-16) In 000' Tons

The above tables (6.18 & 6.19) depict horticultural crops production of Sikkim from (1975-76 to 2015-16) in 000' tons which shows the significant mean  $\pm$ S.D. and standard error of six different horticultural crops such as fruits, vegetables, potato, large cardamom, ginger and turmeric. Among the different horticultural crop production, vegetables have the highest production and it is rising in every decade from 1985-86 to 2015-16 with mean  $\pm$ S.Ds in 1985-86 (13.90 $\pm$ 7.8230), 1995-96 (26.00 $\pm$ 12.6332), 2005-06 (44.97 $\pm$ 19.9699) and 2015-16 (80.96 $\pm$ 30.3842) and their corresponding errors are calculated as 1985-86 (3.1937), 1995-96 (5.1575), 2005-06 (8.1527) and 2015-16 (80.96 $\pm$ 30.3842). But in 1975-76 vegetables production was not up to the mark, it went down compared to fruits and potato. Ginger comes after vegetables and it is also rising in every decade from 1995-96 to 2015-16, having the following mean  $\pm$ S.Ds: 1995-96 (24.00 $\pm$ 10.2761), 2005-06 (35.63 $\pm$ 15.6588) and 2015-16 (55.45 $\pm$ 25.7449) and the corresponding errors are calculated 1995-96 (4.1952), 2005-06

(6.3927) and 2015-16 (10.5103). Ginger had low production in 1975-76 and 1985-86 compared to potato. The third position is held by potato and it is rising in every decade from 1975-76 to 2015-16 and the mean  $\pm$ S.Ds are: 1975-76 (5.00 $\pm$ 2.8816), 1985-86 (16.40 $\pm$ 8.1486), 1995-96 (24.00 $\pm$ 10.2761), 2005-06 (33.14 $\pm$ 14.9398) and 2015-16 (49.93 $\pm$ 20.9284) and their corresponding errors calculated as 1975-76 (1.1764), 1985-86 (3.3266), 1995-96 (4.1952), 2005-06 (6.0991) and 2015-16 (8.5440). The production of every horticulture crops since 1975 up to 2016 may be credited to governmental initiatives and rigorous practicing and actualization of its policies.

### Horticultural Crop Productivity

Crop productivity is a multi-dimensional concept, which includes technological advancement, effective management of available resources, and organizational setup for crop production. These factors in turn affect the relative crop production in the region. It may be pointed out, that the development of agriculture should be assessed by evaluating the use of various inputs i.e., the extent of cultivated area, provision of irrigation, fertilizers, improved varieties of seeds and labour availability. It provides food for growing population and helps to extend the secondary and tertiary sectors, increases the income, and provide welfare to the population living in rural areas.

**Table 6.20: Horticulture Crops Productivity of Sikkim (1975-76 to 1995-96) In Kg/Ha**

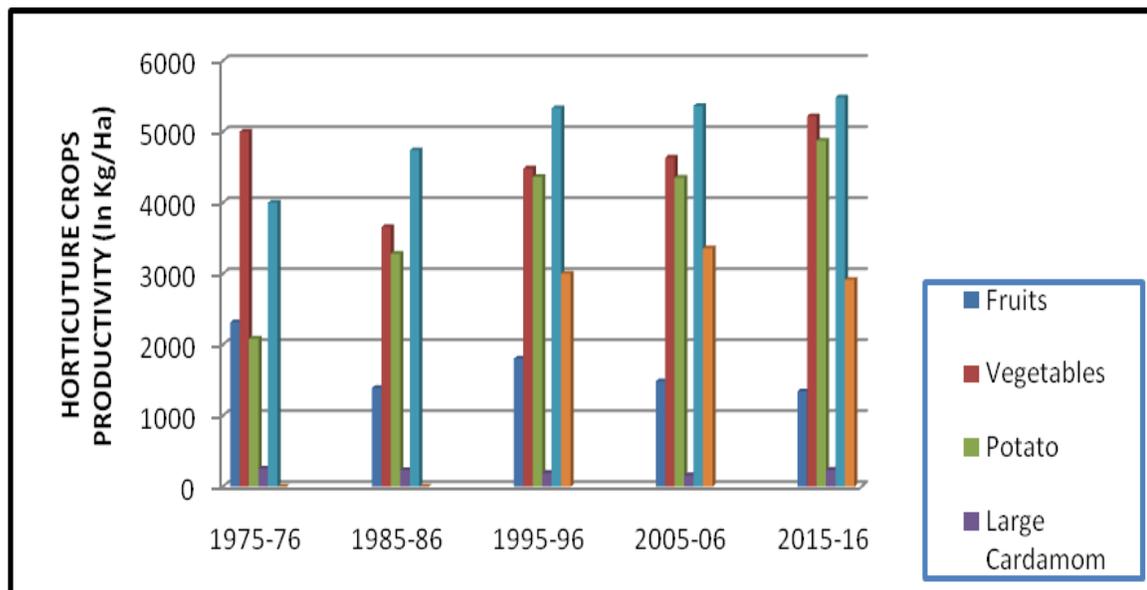
Sl. No.	Crops	1975-76 Mean $\pm$ S.D.	Standard Error	1985-86 Mean $\pm$ S.D.	Standard Error	1995-96 Mean $\pm$ S.D.	Standard Error
1.	Fruits	2315 $\pm$ 14.9264	6.0937	1391 $\pm$ 21.7899	8.8956	1803 $\pm$ 22.8735	9.3380
2.	Vegetables	5000 $\pm$ 23.1257	9.4410	3657 $\pm$ 205718	8.3984	4482 $\pm$ 28.0214	11.4397
3.	Potato	2083 $\pm$ 30.3512	12.3908	3280 $\pm$ 22.5920	9.2231	4363 $\pm$ 22.5831	9.2195
4.	Cardamom	255 $\pm$ 26.0076	10.6176	233 $\pm$ 15.2970	6.2450	191 $\pm$ 22.4321	9.1578
5.	Ginger	4000 $\pm$ 22.9782	9.3808	4739 $\pm$ 20.149	8.2259	5333 $\pm$ 16.8404	6.8750
6.	Turmeric	000	00	000	000	3000 $\pm$ 19.6875	8.0374

*Source:* Gazetteer of Sikkim-2013, Office Record (Horticulture Department)-2015-16.

**Table 6.21: Horticulture Crops Productivity of Sikkim (2005-06 to 2015-16) In Kg/Ha**

Sl. No.	Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standard Error
1.	Fruits	1483 $\pm$ 30.4827	12.4445	1342 $\pm$ 21.7071	8.8619
2.	Vegetables	4633 $\pm$ 16.8641	6.8847	5218 $\pm$ 21.3447	8.7139
3.	Potato	4350 $\pm$ 21.8174	8.9069	4873 $\pm$ 20.7171	8.4577
4.	Cardamom	158 $\pm$ 16.8166	6.8653	235 $\pm$ 27.5971	11.2664
5.	Ginger	5363 $\pm$ 25.4165	10.3762	5482 $\pm$ 29.4482	12.0222
6.	Turmeric	3357 $\pm$ 23.5796	9.6263	2914 $\pm$ 20.7171	8.4577

Source: Gazetteer of Sikkim-2013, Office Record (Horticulture Department)-2015-16.



**Figure 6.9:** Horticulture Crops Productivity of Sikkim (1975-76 to 2015-16) In Kg/Ha

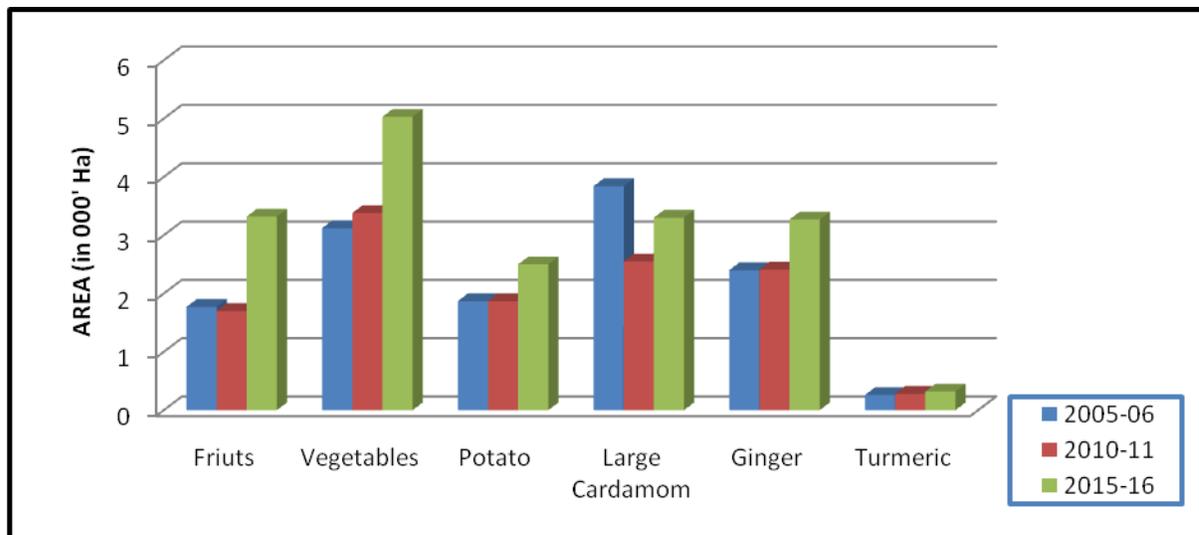
The tables (6.20 & 6.21) and figure illustrate horticulture crops productivity of Sikkim from (1975-76 to 2015-16) in kg/ha. Among the different horticultural crops, vegetables have seen highest productivity in 1975-76 with the mean  $\pm$ S.D.is 5000 $\pm$ 23.1257 and its corresponding error is calculated as 9.4410. But the overall highest productivity has been seen in ginger and it is continuously increasing from 1975-76 (4000 $\pm$ 22.9782), 1985-86 (4739 $\pm$ 20.149), 1995-96 (5333 $\pm$ 16.8404), 2005-06 (5363 $\pm$ 25.4165) and 2015-16 (5482 $\pm$ 29.4482) and their corresponding errors are calculated as 1975-76(9.3808), 1985-86 (8.2259), 1995-96 (6.8750), 2005-06 (10.3762) and 2015-16 (12.0222). The second position is secured by ginger productivity and it is also rising in every decade from 1985-86 to 2015-16, the mean  $\pm$ S.D. 1985-86 (3657 $\pm$ 205718), 1995-96 (4482 $\pm$ 28.0214), 2005-06 (4633 $\pm$ 16.8641) and 2015-16

(5218±21.3447) and the corresponding errors are calculated 1985-86(8.3984), 1995-966 (11.4397), 2005-06 (6.8847) and 2015-16 (8.7139). The third position is held by potato and it is rising in every decade from 1975-76 to 2015-16 and the mean ±S.D.1975-76 (2083±30.3512), 1985-86 (3280±22.5920), 1995-96 (4363±22.5831), 2005-06 (4350±21.8174) and 2015-16 (4873±20.7171) and their corresponding errors calculated as 1975-76 (12.3908), 1985-86 (9.2231), 1995-96 (9.2195), 2005-06 (8.9069) and 2015-16 (8.4577). The production of two remaining crops such as fruits and large cardamom are much less. But the productivity of turmeric crop has been drastically increased from 1985-86 to 1995-96, then slightly decreased from 2005-06 to 2015-16.

**Table 6.22: Area of Major Horticultural Crops of South District (2005-06, 2010-11 and 2015-16) in 000' Ha**

Crops	2005-06 Mean ±S.D.	Standard Error	2010-11 Mean ±S.D.	Standard Error	2015-16 Mean ±S.D.	Standard Error
Fruits	1.77±1.1377	.4645	1.70±.6899	.2816	3.32±2.1808	.8903
Vegetables	3.12±1.0564	.4312	3.38±.2170	.0886	5.03±3.4641	1.4142
Potato	1.87±.8000	.3266	1.87±.2348	.0958	2.50±1.3228	.5400
Large Cardamom	3.84±.9316	.3803	2.55±.1792	.0731	3.30±2.2871	.9337
Ginger	2.4±1.3084	.5341	2.41±.2083	.0850	3.27±2.1475	.8767
Turmeric	0.26±.1554	.0634	0.28±.0946	.0886	0.62±.3875	.1582

Source: DESME 2006-07 and Annual Progress Report 2010-11 & 2014-15.



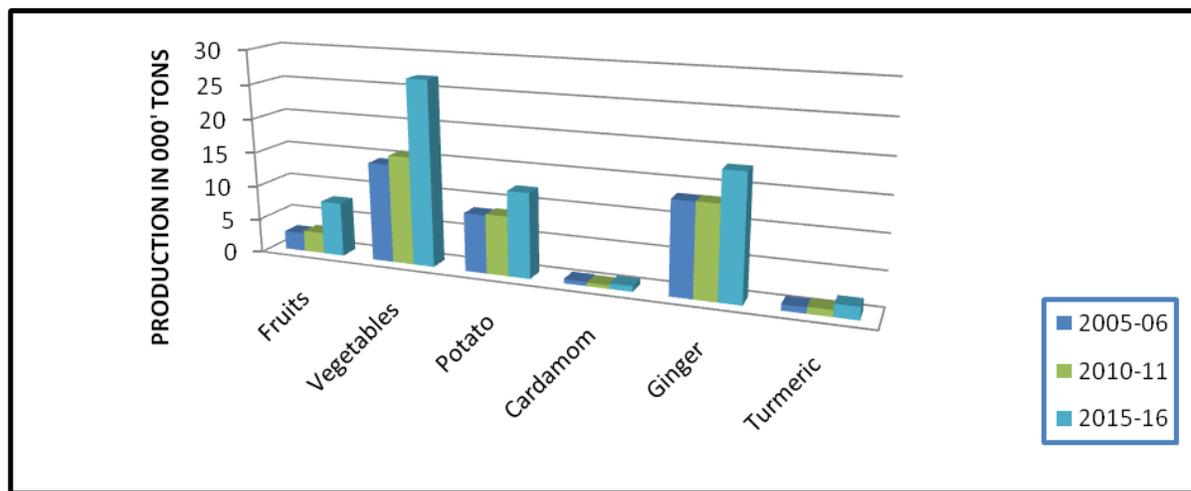
**Figure 6.10: Area (in 000'ha) of major horticultural crops in South District (2005 to 2015-16)**

The above table (6.22) shows the area under major horticultural crops in South district (2005-06, 2010-11 and 2015-16) and shows the significant mean  $\pm$ S.D. and standard error of six different crops such as fruits, vegetables, potato, large cardamom, ginger and turmeric. In case of large cardamom, the cultivated area was high in 2005-06, which decreased in 2010-11 but again increased in 2015-16. It has the mean  $\pm$ S.Ds. are 2005-06 (3.84 $\pm$ .9316), 2010-11 (2.55 $\pm$ .1792) and 2015-16 (3.30 $\pm$ 2.2871) and their corresponding errors calculated as 2005-06 (.3803), 2010-11 (.0731) and 2015-16 (.9337). The area under ginger crop is almost similar in 2005-06 and 2010-11, but it has suddenly increased in 2015-16. It has the mean  $\pm$ S.D.2005-06 (2.4 $\pm$ 1.3084), 2010-11 (2.41 $\pm$ .2083) and 2015-16 (3.27 $\pm$ 2.1475) and the corresponding errors are calculated 2005-06 (.5341), 2010-11 (.0850) and 2015-16 (.8767). The area under fruit and potato crops increased tremendously in 2015-16 compared to 2005-06 & 2010-11. The area of turmeric crop has been increasing consistently but at a slow pace. As per 2015-16 horticulture land use covers of South district is estimated to be around 18040 hectare about 2.54 percent of the total geographical area.

**Table 6.23: Production of Major Horticultural Crops of South District (2005-06, 2010-11 and 2015-16) - (in 000' Tons)**

Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2010-11 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standard Error
Fruits	2.71 $\pm$ 1.3130	.5360	3.08 $\pm$ .2085	.0851	7.90 $\pm$ 4.4271	1.8073
Vegetables	14.41 $\pm$ 6.6030	2.6956	15.74 $\pm$ .2137	.0872	26.89 $\pm$ 7.5630	3.0876
Potato	8.47 $\pm$ 5.9665	2.4358	8.63 $\pm$ .1947	.0795	12.28 $\pm$ 8.4142	3.4351
Cardamom	0.61 $\pm$ .2160	.0882	0.51 $\pm$ .2007	.0819	0.81 $\pm$ .2886	.1178
Ginger	13.36 $\pm$ 6.1644	2.5166	13.39 $\pm$ .2173	.0887	17.89 $\pm$ 9.9398	4.0579
Turmeric	0.86 $\pm$ .3717	.1517	0.95 $\pm$ .2513	.1026	1.81 $\pm$ 1.3928	.5686

Source: DESME 2006-07 and Annual Progress Report 2010-11 & 2014-15.



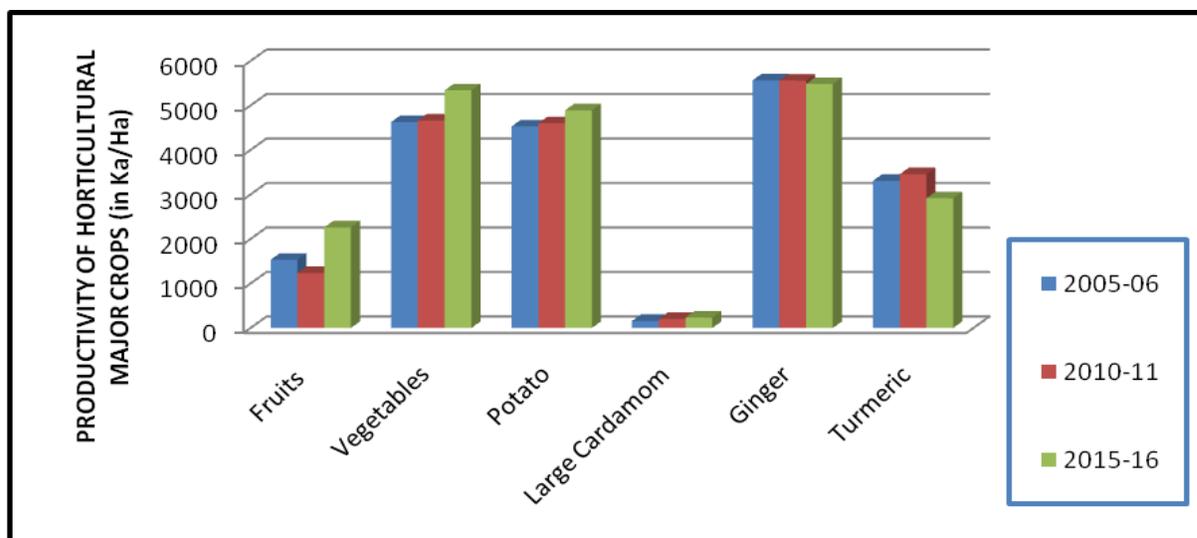
**Figure 6.11: Area (in 000'ha) of major horticultural crops in South District (2005 to 2015-16)**

The above table (6.23) illustrates production of major horticultural crops of South district (2005-06, 2010-11 and 2015-16). Amongst the different horticultural crops, production of vegetables is higher and has been increasing in every five years, but in 2015-16 production increased tremendously and it has mean  $\pm$ S.D.2005-06 (14.41 $\pm$ 6.6030), 2010-11 (15.74 $\pm$ .2137) and 2015-16 (26.89 $\pm$ 7.5630) and their corresponding errors are calculated as 2005-06 (2.6956), 2010-11 (.0872) and 2015-16 (3.0876) respectively. As far as production of ginger is concerned, it is almost similar in 2005-06 and 2010-11, but it has suddenly increased in 2015-16. It has the mean  $\pm$ S.D.2005-06 (13.36 $\pm$ 6.1644), 2010-11 (13.39 $\pm$ .2173) and 2015-16 (17.89 $\pm$ 9.9398) and the corresponding errors are calculated 2005-06 (2.5166), 2010-11 (.0887) and 2015-16 (4.0579) respectively. Potato production seems to be almost same in 2005-06 and 2010-11, but it has increased in 2015-16 and the mean  $\pm$ S.D.2005-06(8.47 $\pm$ 5.9665), 2010-11 (8.63 $\pm$ .1947) and 2015-16 (12.28 $\pm$ 8.4142) and their corresponding errors calculated as 2005-06 (2.4358), 2010-11 (.0795) and 2015-16 (3.4351). The production of fruit has increased tremendously in 2015-16 compared to 2005-06 & 2010-11. The productions of turmeric and large cardamom crops have been increasing consistently but at a slower pace.

**Table 6.24: Productivity of Major Horticultural Crops of South District (2005-06, 2010-11 & 2015-16) - (in Kg/Ha)**

Crops	2005-06 Mean $\pm$ S.D.	Standard Error	2010-11 Mean $\pm$ S.D.	Standard Error	2015-16 Mean $\pm$ S.D.	Standar d Error
Fruits	1534 $\pm$ 19.6977	8.0415	1237 $\pm$ 18.2537	.7420	2261 $\pm$ 24.9719	10.1947
Vegetables	4627 $\pm$ 15.3883	6.2822	4663 $\pm$ 19.1206	7.8059	5340 $\pm$ 21.3447	8.7139
Potato	4528 $\pm$ 14.5327	5.9329	4600 $\pm$ 26.1457	10.6739	4892 $\pm$ 19.6672	8.0291
Cardamom	160 $\pm$ 22.6715	9.2556	201 $\pm$ 23.3152	9.5184	234 $\pm$ 16.3340	6.6683
Ginger	5565 $\pm$ 26.2526	10.7175	5560 $\pm$ 26.3438	10.7548	5482 $\pm$ 29.4482	12.0222
Turmeric	3308 $\pm$ 21.4755	8.7673	3456 $\pm$ 21.8632	8.9256	2915 $\pm$ 17.5271	7.1554

Source: DESME 2006-07 and Annual Progress Report 2010-11 & 2014-15.



**Figure 6.12:** Area (in 000' Kg/Ha) of Major Horticultural Crops in South Sikkim (2005 to 2015-16)

The table (5.24) depicts the Productivity of major horticultural crops of South district (2005-06, 2010-11 and 2015-16) Among the different horticultural crops, productivity of vegetables has been increasing at regular intervals, but in 2015-16 productivity increased greatly and it has mean  $\pm$ S.D. 2005-06 (4627 $\pm$ 15.3883), 2010-11 (4663 $\pm$ 19.1206) and 2015-16 (5340 $\pm$ 21.3447) and their corresponding errors are calculated as 2005-06 (6.2822), 2010-11 (7.8059) and 2015-16 (8.7139) respectively. Productivity of ginger is almost similar in 2005-06 and 2010-11, but it has slightly decreased in 2015-16. It has the mean  $\pm$ S.D. 2005-06 (5565 $\pm$ 26.2526), 2010-11 (5560 $\pm$ 26.3438) and 2015-16 (5482 $\pm$ 29.4482) and the corresponding errors are calculated 2005-06 (10.7175), 2010-11 (10.7548) and 2015-16 (12.0222) respectively. Likewise, productivity of potato seems to be slightly increasing from 2005-06, 2010-11 and 2015-16 and the mean  $\pm$ S.D. 2005-06 (4528 $\pm$ 14.5327), 2010-11 (4600 $\pm$ 26.1457) and 2015-16 (4892 $\pm$ 19.6672) and their corresponding errors calculated as 2005-06 (5.9329), 2010-11 (10.6739) and 2015-16 (8.0291). The productivity of turmeric and fruits crops have been fluctuating, but the productivity of large cardamom crop has been increasing gradually.

### **Area Expansion Programme of 2015-16, Department of Horticulture and Cash Crops, South district**

#### ***Fruits***

Some of the vital fruits like, mandarin orange, guava, papaya, banana and litchi have started growing on commercial basis in the state.

#### ***Mandarin orange***

Sikkim Mandarin is one of the chief fruit crop having great commercial possibility. Various biotic and abiotic factors determine the production and productivity of orange. During Area

Expansion Programme many new orchards came up in villages like Sadam, Chisopani, Boomtar, Ruchung , Rateypani, Lamaten, Suntaley, Nalick, Tingmoo Kritipur,, Kamargoan, Dhargoan, Mamley, Gagyong, Zarrong, Sripatam and Anethang. According to Progress Report of 2014-15, under the Area Expansion Programme many new villages are aimed to cover, the villages include, Kamrang, Pabomg, Sumbuk, Tingley, Yangang, Lingi, Lingding, Turuk, Rabikhola, Chalamthang, Todey and Wok. The impact of Area Expansion Programme is evidently observed in mandarin fruit as a result of tremendous encouragement it received. In association with HCCDD and RMDD plantation of oranges is done as per the manual.

### ***Orange replenishment***

South district has a significant place where one of the important fruit crops like mandarin orange can grow. It is mainly grown in regions such of Turuk, Yangang, Tirikhola, Rateypani, Lingi, Lingmoo, Tingley, Rabitar, Kamrang, Pabong, Sumbuk, Todey and Tarku. However, because of the ageing of the trees, lesser care, and dominance of diseases and insect-pests, many orchards have become less productive and are in a declining phase. Such orchards are being revived in a phase wise manner. The beneficiaries have been provided with some crucial inputs after giving the training by utilizing the service of subject expert on the spot. These measures may bring hope and encourage farmers which would have a bearing on rejuvenation of the orchards and thereby augmentation in the production of the fruits.

### ***Guava***

The horticulture department has initiated to distribute guava seedlings at low elevation areas of Aifaltar, Namlung, Kamrang, Kitam, Pabong, Chalamthang, Barfung , Turuk and Kateng. High density planting of guava varieties such as Allahabad safeda and L-49 has been found booming in Turuk, Bermoik, and Chalamthang. According to the Progress Report of 2014-15 under the Area Expansion Programme many new villages such as, Turuk, Dong, Mellidara, Wok, Sumbuk, Lingi, Lingmoo, Tarku, Salghari, Zarong and Lingzo have been included. Guava also is included in junction programme.

### ***Litchi***

The farming of litchi crop has been started at Samatar, Sikip, Lower Goam, Belbotey of Rabong Sub-Division. As per Progress Report of 2014-15 the Area Expansion Programme has incorporated many new villages like, Kitam, Wok and Namthang of Namchi sub-division whereas Bermiok and Chalamthang come under Rabong sub-division under the scheme.

### ***Papaya***

Papaya seedlings are being distributed by the department to the progressive farmers in selected areas like Donak, Niya Brum, Lower Kateng and Turuk.

### ***Banana***

Banana suckers has been distributed by the department to the farmers in different places such as Kamrang, Lungkhiya, Samatar, Lower Kateng, Rong, Mainabotey, Lower Kabrey, Upper Pamphok, Pakjer and Nalick.

### ***Vegetables***

As far as the vegetables production is concerned South district stands at 1<sup>st</sup> position in the state. The remarkable improvement has been seen in vegetable production in the district. During the main seasons, vegetables are grown in more or less all area of South district. On the other hand, department always encourages the farmers to produce vegetables either early, late or in off-season so as to obtain a good market price. Some of the villagers are popular in particular commercial vegetables farming such as bottle-gourd of Pakzor, Chumlik and Samatar, Rong, Turuk, Passi-Rateypani, Lungchok-Pabong and Niya. Tomato of Sadam, Phongla, Tinzir, Cauliflower of Simkharka, Diu, Temi-Tarku and Chubba-Perbing, cabbage and broccoli of Salleybong and Chisopani, Carrot, Palak, Bhindi, Letuce of Chisopani and Samatar, Green peas of Rabong, Ghurpisay, Perbing and Temi.

Off-season cabbages are mostly produced at Khop, Perbing, Jaubari and Diu-Damthang areas and are economically very lucrative. The areas such as Perbing and Jaubari are the producers of radish, palak and coriander throughout the year. The places like Bikmat, Ramaram, Sadam and Suiram are famous for early season iskush (chayote) are produced by the farmers which obtains better price at local areas as well as outside the state. Recently, South district has been producing significant amount of off-season vegetables like cabbage, tomato and cauliflower. The positive impact of scheme on vegetable production has been seen because more farmers have been benefitted. Consequently, many farmers' livelihoods are based on vegetable farming.

### ***Large cardamom***

Large cardamom is one of the important cash crops of South district. In fact, it is the native crop of local farmers of high elevation areas. Generally, cardamoms are planted in agro-forestry milieu and it thrives well due to its shade loving environment. Many aged and fruitless cardamom orchards still has a place which needs to be uprooted to establish new orchards. The arrangement of complete removal of aged and ailing plants followed by composting of biomass has to be followed continuously, and in a phase wise manner. After the convergence with RMDD since 2014, the plantation of cardamom has been done extensively. The Horticulture and Cash Crops Department, Government of Sikkim in collaboration with MGNREGS scheme started distributing cardamom (sawaney, bharlang etc.) seedlings/plantings in the month of July 2016 to the interested and progressive farmers. It had distributed seedlings of cardamom free of cost to the farmers the numbers of seedlings ranging

between 200-1000 sticks to every family according to their needs and demands in south Sikkim.

### ***Ginger***

Ginger is one of the main spice crops of South district, which is grown in nearly all the parts, within in mid and low altitude areas. Healthy planting resources are made accessible to the farmers from the certified seeds growers under ginger seed village scheme. For many farmers' livelihood, ginger has significant role in establishing itself as a main sources of income. Positive impact of the Area Expansion Programme has been observed in ginger cropping thereby, benefitting many poor farmers.

### ***Turmeric***

The Horticulture and Cash Crop Department has initiated large level farming of turmeric since last few years. But recently, a turmeric seed has been distributed to the farmers in a ratio of about 1 acre of land to 4 monds (40kgs) of seed for cultivation purpose. As a result, many farmers are cultivating this crop with full interest and enthusiasm. New variety called Roma and Lakadang is being promoted in the district. The achievements of these varieties are good. Turmeric crop might replace ginger in lower altitude.

### **Transfer of Technology**

Training to farmers is one of the important programmes under transfer of technology. Farmers training programmes is the regular feature of the department. Crop specific trainings programmes are conducted at project area in class room environment. With the introduction of new technology, need of imparting training and creating awareness among the farming communities is must. The response from the farmers on training within the state and outside the state is very encouraging .More and more progressive farmers are coming forward to take training in and outside state, especially for floriculture, off-season vegetables and vegetables cultivation in protected condition (Annual Progress Report-2012-13, HCCDD, South Sikkim). Cash and commercial crops like large cardamom, ginger, orange, seed potato, flowers and off-season vegetables along with other horticultural crops (varieties of fruits, root and tuber crops, mushroom, honey, nuts, spice crops like turmeric, seed spices etc, medicinal and aromatic plants) are dealt by the Horticulture & Cash Crops Development Department since its creation in 1996.

### **References**

Choudhury, Maitreyee. 2006. *Sikkim: Geographical Perspectives*. New Delhi: Mittal Publications: 59-61.

GoS (Government of Sikkim). 2002. *Sikkim: A Statistical Profile 2002*. Gangtok Sikkim: Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

-----2007. *Economic Survey 2006-2007*. Gangtok Sikkim: Department of Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

-----2011. *Annual Progress Report 2010-2011*. Krishi Bhawan , Tadong, Gangtok: Development of Food Security and Agriculture, GoS.

-----2011. *Annual Progress Report 2010-11*. South Sikkim: Department of Horticulture & Cash Crops, GoS.

-----2013. *Annual Progress Report 2012-13*. South Sikkim: Department of Horticulture & Cash Crops, GoS.

-----2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS: 230.

-----2016. *Annual Progress Report 2015-16*. South Sikkim: Department of Horticulture & Cash Crops, GoS.

Khawas , V. 2012. "Agriculture in the Sikkim Himalayas: A Geographical Note," In *Politics, Society and Development*, edited by Mohammad Yasin and Durga P. Chhetri, 192. Delhi: Kalpaz Publications.

Lekhi, R.K. and Singh Joginder. 2001. *Agricultural Economics*. Ludhiana, India: Kalyani Publishers.

Mahmood, A. 1998. *Statistical Methods in Geographical Studies*. New Delhi: Rajesh Publications: 115.

Subba, J.R. 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 82.

### **Web Link**

[www.visva-bharati.ac.in](http://www.visva-bharati.ac.in) > AERC\_DETAIL (Accessed on July 16, 2016).

[Sikkim.ac.in](http://Sikkim.ac.in)>SWS>home\_eco (Accessed on July 27, 2016).

[Shodhganga.inflibnet.ac.in](http://Shodhganga.inflibnet.ac.in) (Accessed on August 08, 2015).

<https://en.m.wikipedia.org>>wiki>production (Accessed on July 07,2016).

# Chapter 7

## Mountain Agriculture and Food Security in Sikkim

### Introduction

Food security is a situation pertaining to the supply of food and individual's right to use it. The term "food Security" was defined with an emphasis on supply in 1974 during World Food Conference. Moreover, food security is considered with the availability at all times the adequate food supplies with respect to basic foodstuffs in order to sustain a steady expansion of food consumption and to equalize fluctuations in production and prices.

As far as mountain agriculture is concerned, food grain production has not been able to meet the food requirements of mountain households. As in the case of mountain farmers, there are reports indicating the lack of attention and interest in farming, thus drastically decreasing the proportion of people indulged in agriculture. In the past multiple livelihood strategies through diversification of households' activities have been the main management strategy to meet food and other requirements. However, these options for maintaining livelihoods are becoming substandard in quality and also moving back over time.

It is more understood that gradually marginal lands have scope to ensure food security in near future in view of the limited alternatives for most mountain households. There should be changes in older approaches and newer concepts such as decentralization and use of ingenious approaches should be considered in order to diversify crop production, as the conventional high-yielding practices have meager relevance.

Subsistence agriculture is undergoing modification in several mountain places in India. With the enhancement of convenience (i.e. roads, market, and support services etc.), more and more people are taking advantage from crop diversification and cultivation of horticultural and other high value crops. However, diversification is not possible without addressing the issue of food security in terms of availability of food, purchasing power, and efficient distribution system.

### Food Security in Sikkim

The most important reason of less profitability of food grains in the sloping marginal lands of the state is due to the inherent marginality of production of food grains. The sloping marginal lands are three to four times less efficient in meeting the food needs of calorie and protein

because it can hardly sustain three to four persons per ha per annum against the sustainability of nine to ten persons in a plain land. Further, intensive cropping on sloping marginal lands cannot be done continuously more than three to four years (Awasthi and Prasad; 1987 & Subba; 2008). However, development of horticulture holds great promise for this region. Horticultural products in this region may yield higher returns per unit of land than that of food grains.

India stood as second largest producer of vegetables in the world with 232 million tons in 2011-12. Sikkim being one of the least populated states of India and also the second smallest in terms of area with 7096 sq. km. of land mass is creating a mark as organic vegetable grower. The state which made national headlines by declaring that its farms are totally organic in 2016, has set its eyes on what can be called a major mission on cultivation of vegetables in India.

The officials of Horticultural Department, Government of Sikkim, were hasty to adopt and get acquainted to the central government launched scheme in 2007 i.e. 'Vegetable Initiative' at the national level under the Rashtriya Krishi Vikas Yojana. The state has been benefited from another centrally sponsored scheme particularly the Horticulture Mission for North-East and Himalayan states – which was launched during 2001-02 under the Technology Mission for North-East for integrated development of horticulture. Through this scheme, the state was granted Rs.43 crores for its annual plan, and an additional budget of Rs.3 crores for green houses and training purposes. Accordingly, as a beneficiary of the above schemes, the state has been able to extend the area under horticulture crops: under fruits by 1,093 hectares, vegetables 775 hectares, 470 hectares in the case of flowers and for aromatic plants and spices 1,252 hectares respectively.

Sikkim government initiated an action plan especially in Gangtok, East district and Namchi, the South district headquarter, for practicing the vegetable initiative scheme. Besides this, development of horticulture was also made an import component of 'Mission: Poverty-Free Sikkim' with the purpose of generating improved income for people through suitable management of crop production systems.

The state has also benefited well under various promotional schemes like National Horticulture Board, which includes commercial production, set up of cold storages, technology and market orientation. Sikkim has also more progressive beneficiaries through the National Vegetable Initiative for Urban Clusters (NVIUC) that was launched by the central government during the year of 2011-12. Horticulture crops almost cover 57 percent of gross cropped area and around 80 percent of the farmers fall under small and medium category. After the announcement and implementation of different schemes, the horticultural production has been increasing rapidly.

In Agriculture sector, the state due to its difficult terrain, practices terrace farming for food security where crops like paddy, maize, wheat, millets etc. are cultivated. Rice constitutes the staple diet for the people living in this region, but maize has been the state's major production. In the past, crops were sufficient to use within the state for domestic consumption but due to rise in population, unequal land distribution/inadequate land reform and low investment in Agriculture sector have started to become major hurdles for the state in becoming food sufficient (Chakrabarti, 2010).

Agriculture is the mainstay of majority rural population of Sikkim. The economy of the State is associated with agriculture that renders the sources of livelihood and economic security of considerable native population. The economic activity of mountainous region like Sikkim is primarily a mixed farming - agriculture, horticulture and livestock rearing, in limited cultivable land resources. According to 2011 census about 75 percent of the populations of Sikkim are living in the rural areas and the changing levels of production of different agricultural and diversified horticultural crops since 1975-76 are observed.

Agriculture pattern has been changing slowly in Sikkim with the advancement of concepts and agricultural technology. Agricultural pattern has transformed itself from shifting to subsistence and in the recent past has oriented itself towards commercial production, the reasons being the cultivation of off- season vegetables in order to sell them for generating good income.

The Food Civil Supplies & Consumer Affairs Department is the nodal department for implementing the schemes under the Targeted Public Distribution System and is entrusted with the task of providing quality food grains at subsidized prices and other essential commodities to the eligible ration card holders of the State. The department has duty of procuring, storing, and distributing food grains at rates fixed by the government as well as monitoring and enforcing regulatory orders of the government under Public Distribution System (Achievement-FCS&CA-2016).

The state is deficit in food production and thus the State Government obtains food grains such as rice 45,849 tons and wheat 636 tons annually under different Centrally Sponsored and State programme from FCI and distribute to the consumers through PDS (Subba, 2008). Economic Survey 2006-07 stated that Sikkim continues to remain a highly food deficit State. The deficits are seen more remarkably in oilseeds and pulses production.

During 2007 the state submitted a proposal to the Union Ministry of Consumer Affairs, Food and Public Distribution for a special package of 5000 metric tons of rice as a buffer stock as a precaution against exigency during the monsoon.

In his Presidential address to the parliament on 4<sup>th</sup> June, 2009 on Food Security the President of India opined that: “My Government proposes to enact a new law, the National Food Security (NFS) Act that will provide a statutory basis for a framework which assures food security for all. Every family below the poverty line in rural as well as urban areas will be entitled by law, to 25 kg of rice or wheat per month at Rs. 3 per kg. This legislation will also be used to bring about broader systemic reform in the public distribution system.”

According to Prof. M.S. Swaminathan, food security legislation would be the most significant among the laws enacted by parliament. It would mark the fulfillment of Mahatma Gandhi’s call for a hunger-free India. He further said that a sustainable food security system could be developed only with homegrown food, not imports. The Food Security Act promised change to save nearly 40 percent of India’s population from the hunger trap (Sikkim Express-2010).

In a bid to make Sikkim food secure, the following schemes were announced by the state on the eve of Independence Day, 2009.

- 1) *Mukhya Mantri Poustha Ahaar Yojana* – monthly free distribution of 4 kg mixed deal to BPL families.
- 2) *Mukhya Mantri Jeevan Rakshyak Kosh*.

It was acknowledged by the state authorities that within the aerial distance of 115 km there are five climate zones from tropical to alpine making Sikkim an ideal place for cultivation of wide range of crops and food products. Therefore, production under agriculture, horticulture, floriculture sectors and harnessing the rich pool of medicinal plants and herbs and activities under animal husbandry sector can be the road to prosperity. The statistics (2010) in terms of demand-supply statement in the domestic market of Sikkim were as follows:

1. The annual requirement of fruits and vegetables in the state was 18,254 tons and 60,134 tons respectively.
2. There was a shortfall of 2050 metric tons of beef per annum against the annual demand of 2095 MT (metric tons).
3. There was a total shortfall of 380 metric tons of pork per annum against the annual demand of 750 MT.
4. There was a total shortfall of 135.24 lakh eggs per annum against the annual demand of 150.00 lakh.
5. There was a total shortfall of 1000 metric tons chicken per annum against the annual demand of 1500 MT. The Chief Minister encouraged the people to go for commercial venture in the production of cash crops, vegetables and fruits (Sikkim Express-2009).

Sikkim produces around 1 lakh metric tons of food grain and imports around 60,000 metric tons of food grains annually. In this state storage capacity is limited and due to repeated landslide communication is frequently disrupted. As per the Annual Progress Report 2010-11 of Food Security and Agriculture Department, Government of Sikkim it is estimated that over

80 percent of the rural population depends on agriculture and allied sectors for economic, food, and nutritional security as well. The net cropped area has decreased due to change to non-agricultural uses like development of crucial infrastructure. There is a deficit of nearly 72,000 MT in food grain, 12,500 MT in pulses, and 3,500 MT in oilseeds respectively.

### **Poverty Level**

In India the percentage of people living below the poverty line has fallen to 26.1 as per poverty estimates meant for the year 1999-2000. This means a sizeable drop of nearly 10 percent from the poverty estimates of 36 percent as in 1992-93. The percentage of population living below poverty line in Sikkim in the year 2006 was 19.33. But for the year 2011-12 it fell to 8.19. This means a considerable go down of nearly 11 percent from the poverty estimates percentages as in 2011-12. Sikkim has higher percentages of below poverty line during 2011-12 than other states like Goa (5.09 %), Kerala (7.05%) and Himachal Pradesh (8.06 %) respectively. This means that the incomes of about 8-10 percent of people are not in a position to buy sufficient food. The state is trying to reduce the level of poverty through different schemes/programmes by improving social security vis-a-vis food security.

According to SSEC (State Social-Economic Census) 2006, it was found that out of 1,11,830 households 21,618 households were found to be BPL (Below Poverty Line) which constituted 19.33 percent of the total households of the state. Moreover, there were 43,428 BPL families and 4, 30,547 APL (Above Poverty Line) card holder in the state. Further, the state was allotted 43,400 quintals of rice every month under APL and BPL scheme and 2,450 quintals of wheat. An amount of 35kgs of rice was provided to every BPL family per month as per the Food & Civil Supplies Department through 1,414 fair price shops in the state (Sikkim Express, 11.05.2010).

### **Individual Food Security and Nutrition**

Food and nutrition security essentially means that all people at all times have access to safe and nutritional food and maintain health and active life. The need for food and nutrition security arises primarily due to the fluctuation in food production and non-availability of sufficient quality food from domestic sources (Kalita et.al. 2006).

The nutritional effectiveness of resources in the household mainly depends on a number of inter-related components like income control and allocation of resources within the household. Since the capability to utilize food to their maximum benefits is prejudiced by aspects like child care, access to health and approving sanitary environment receive due importance. Insufficient food intake by adults in household could be seen in low body mass indices and in children by levels of anthropometric traits.

In a holistic approach of household food security analysis, the nutritional status of every individual in the household is crucial. Three factors influence an individual's food and nutritional security: adequacy, equity and efficiency. Adequacy of nutrition of individuals in conditions of nutrient intake (calorie and protein) is determined to examine the relative position of individuals according to age and sex.

### Nutritional Status

Nutritional adequacy is the comparison between the nutrient requirement and the intake of a certain individual or population. In population groups, the prevalence of nutrient inadequacy can be assessed by the probability approach or using the Estimated Average Requirement (EAR) cut-point method ([www.ncbi.nlm](http://www.ncbi.nlm)).

World Health Organization (WHO) stated that nutritional adequacy as the level of intake that will balance energy requirements and make sure that individual body size and work and level of physical activity regularly with good health that allow the performance of economically and socially desirable tasks for longer term.

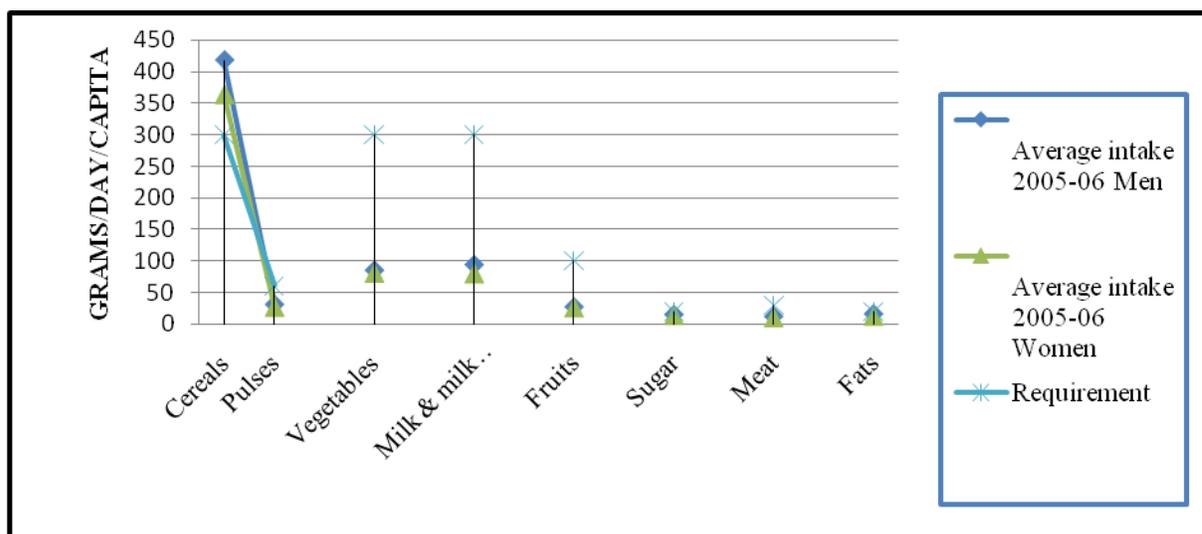
Like actual food intake, calorie intake by individuals also reflects their nutritional security position. The quantity of calorie requirement by individuals, however, depends on the body weight, nature of work, age, sex, and climate. The Indian Council of Medical Research (ICMR) has recommended a per capita daily norm of 386 gm of cereals (Radhakrishna, 1991 & De, 2006). There is a standard norm of per capita 2,400 calories and 2,100 calories per day for rural and urban areas respectively (De, 2006).

**Table 7.1: India: Average Intake and Requirement of Food Items (grams/day/capita) 2005-06**

Food Items	Average intake 2005-06				Requirement (Mean ± S.D.)	Standard Error
	Men (Mean ± S.D.)	Standard Error	Women (Mean ± S.D.)	Standard Error		
Cereals	418.00 ±18.7723	7.6637	365.00 ±25.7526	10.5134	300.00 ±68.9260	28.1389
Pulses	31.00 ±18.8148	7.6811	27.00 ±15.1261	6.1752	60.00 ±24.5519	16.0233
Vegetables	85.00 ±23.0130	9.3950	81.00 ±26.3590	10.7610	300.00 ±68.9260	28.1389
Milk & milk products	94.00 ±25.8224	10.5419	80.00 ±25.6359	10.4658	300.00 ±68.9260	28.1389
Fruits	27.00 ±15.1261	6.1752	26.00 ±16.3340	6.6683	100.00 ±25.3456	10.3473

Sugar	15.00 ±10.1980	4.1633	14.00 ±10.7888	4.4045	20.00 ±14.0854	5.7503
Meat	12.00 ±9.0553	3.6968	10.00 ±5.6213	2.2949	30.00 ±21.4569	8.7597
Fats	16.00 ±12.8841	5.2599	13.00 ±9.9196	4.0496	20.00 ±14.0854	5.7503

Source: NNMB Report 2005-06; R.C. Tiwari 2010 p. 266.



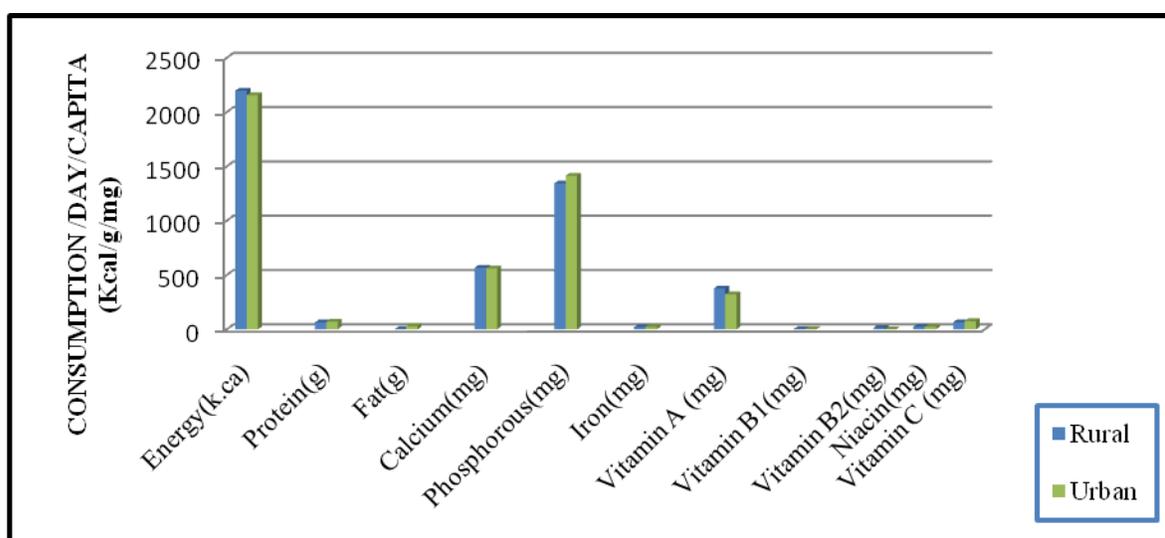
**Figure 7.1:** Average Intake and Requirement of Food Items (grams/day/capita) 2005-06 (India)

The table 7.1 indicates average intake and requirement of food items (grams/day/capita) of India during 2005-06 and a comparative data of different food items like cereals, pulses, vegetables, milk & milk products, fruits, sugar, meat and fats and average intake among men and women and their requirement in terms of the significant mean  $\pm$ S.D. and standard error. It is found that the highest number of average intake of cereals by men and women as per the daily requirement and their corresponding mean  $\pm$ S.D. are (men 418.00  $\pm$ 18.7723), (women 365.00  $\pm$ 25.7526) & (requirement 300.00  $\pm$ 68.9260) and standard errors calculated as 7.6637, 10.5134 and 28.1389 respectively. Likewise, milk & milk products for men and vegetables for women come under second position but it is low in terms of requirement and it shows the following significant mean  $\pm$ S.D. (men 94.00  $\pm$ 25.8224), (women 81.00  $\pm$ 26.3590) & (requirement 300.00  $\pm$ 68.9260) and standard errors are calculated as 10.5419, 10.7610 and 28.1389. But the average intake of different food items like pulses, fruits, fats, sugar and meat by men and women is below the daily requirement standard. Lastly, it is observed that except cereal food item, all other food items are below average intake requirement in India.

**Table 7.2: Average Intake of Nutrients in Sikkim (Consumption per capita per day) 1997**

Nutrient	Rural (Mean ± S.D.)	Standard Error	Urban (Mean ± S.D.)	Standard Error
Energy (Kcal)	2197.00±26.5706	10.8474	2157.00±19.0473	7.7760
Protein (g)	64.50±22.2530	9.0847	70.20±22.4053	9.1469
Fat (g)	2.50±1.5504	0.6329	31.30±16.6012	6.7774
Calcium (mg)	566.20±23.2206	9.4798	560.80±17.0293	6.9522
Phosphorous (mg)	1343.00±18.0554	7.3711	1413.70±20.8326	8.5049
Iron (mg)	21.00±14.1703	5.7850	22.50±15.8619	6.4756
Vitamin A (mg)	376.10±21.1849	8.6487	322.00±20.0299	8.1772
Vitamin B1(mg)	1.50±1.0749	0.4388	1.70±1.1535	.4709
Vitamin B2 (mg)	13.00±9.9196	4.0496	1.30±.7823	.3193
Niacin (mg)	23.60±15.6588	6.3927	22.90±17.8101	7.2709
Vitamin C (mg)	64.80±26.8849	10.9757	75.40±21.4196	8.7445

Source: Department of Women and Child Development, GOI (1997) (Subba, 2008).



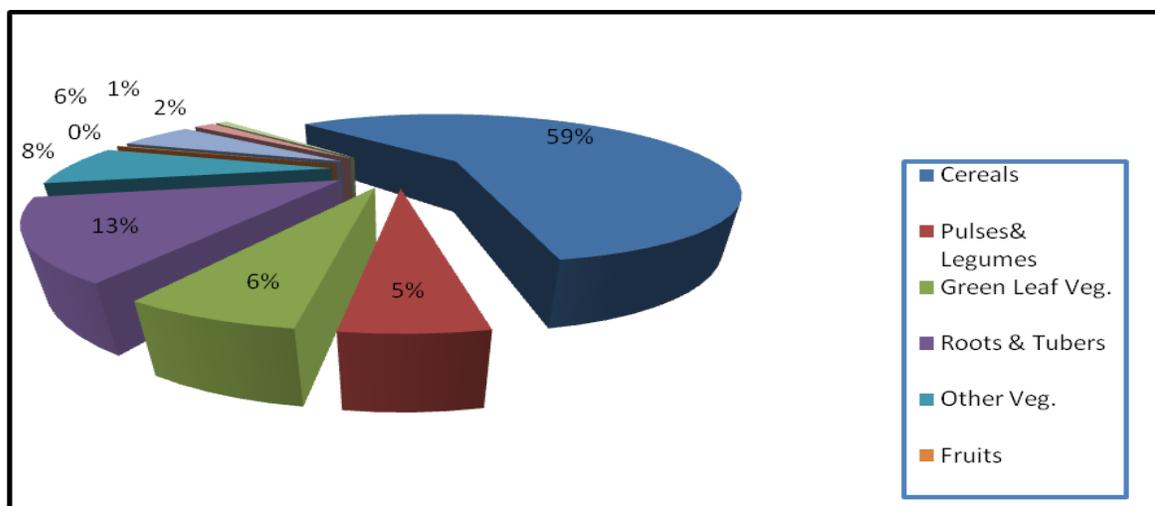
**Figure 7.2: Average Intake of Nutrients in Sikkim (Consumption/capita/day) 1997**

The figure 7.2 depicts the average intake of nutrients in Sikkim (Consumption per capita per day (Kcal/g/mg) and shows a comparison of Energy (Kcal) and consumption of different nutrients such as Protein (g), Fat (g), Calcium (mg), Phosphorous (mg), Iron (mg), Vitamin A (mg), Vitamin B1 (mg), Vitamin B2 (mg), Niacin (mg) and Vitamin C (mg) in the rural and urban areas of Sikkim with significant mean  $\pm$ S.D. and standard error. The highest consumption of nutrient has been seen in Energy (Kcal) both in rural and urban places and the significant mean  $\pm$ S.Ds. are (rural 2197.00 $\pm$ 26.5706) and (urban 2157.00 $\pm$ 19.0473) and their corresponding errors are calculated as 10.8474 and 7.7760. The next highest consumption of nutrient, both in rural and urban areas is of Phosphorous (mg), the significant mean  $\pm$ S.D. (rural 343.00 $\pm$ 18.0554) and (urban 1413.70 $\pm$ 20.8326) and their corresponding errors are calculated as 7.3711 and 8.5049. Next comes Calcium (mg), consumption ratio of nutrient is almost same in both rural and urban areas: significant mean  $\pm$ S.D. (rural 566.20 $\pm$ 23.2206) and (urban 560.80 $\pm$ 17.0293) and standard errors calculated as 9.4798 and 6.9522. Vitamin A (mg) secured fourth place both in rural and urban with significant mean  $\pm$ S.D. (rural 376.10 $\pm$ 21.1849) and (urban 322.00 $\pm$ 20.0299) and standard errors are calculated 8.6487 and 8.1772. The consumption of other nutrients is much less.

**Table 7.3: Average Consumption (g/cu/day) of different Foods in Sikkim**

Sl. No.	Food Items	Average consumption Mean $\pm$ S.D.	Standard Error
1.	Cereals	465.9 $\pm$ 19.7382	8.0581
2.	Pulses & Legumes	39.3 $\pm$ 16.8878	6.8944
3.	Green Leafy Vegetables	49.1 $\pm$ 17.8101	7.2709
4.	Roots & Tubers	106.6 $\pm$ 18.8042	7.6768
5.	Other Vegetables	62.7 $\pm$ 20.8518	8.5127
6.	Fruits	1.6 $\pm$ .6249	.2551
7.	Milk product	44.0 $\pm$ 19.8897	8.1199
8.	Fats & Oils	12.5 $\pm$ 8.9218	3.6423
9.	Sugar	7.4 $\pm$ 5.7619	2.3523

**Source:** Singh et.al. 2006.



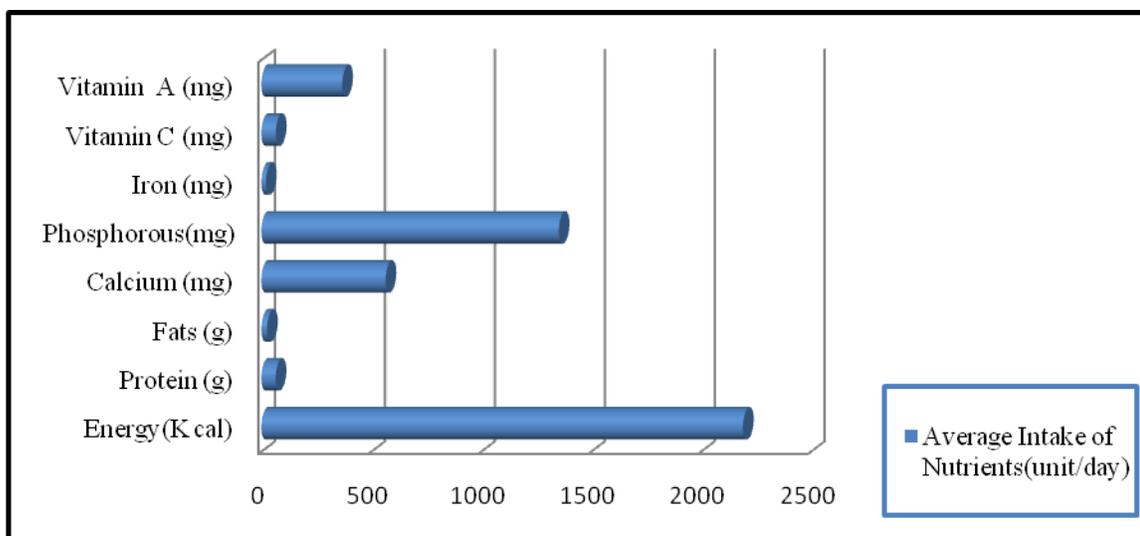
**Figure 7.3:** Average Consumption (g/cu/day) of different Foods in Sikkim

The figure 7.3 reveals that the average consumption (g/cu/day) of different food items in Sikkim such as cereals, pulses & legumes, green leafy vegetables, roots & tubers, other vegetables, fruits, milk product, fats & oils and sugar and the significant mean  $\pm$ S.D. and standard error. It is found that the highest average consumption of food items is in cereals and the corresponding mean  $\pm$ S.D.  $465.9 \pm 19.7382$  and standard error is calculated as 8.0581. Since rice is the staple food, its consumption is unsurprisingly high. The second highest consumption of food items has been seen in roots & tubers having considerable mean  $\pm$ S.D.  $106.6 \pm 18.8042$  and its corresponding error is 7.6768. The other vegetables have significant role in food items and it occupies third position in average consumption and it has significant mean  $\pm$ S.D.  $62.7 \pm 20.8518$  and standard error is calculated as 8.5127. After cereals, roots & tubers and other vegetables come green leafy vegetables ( $49.1 \pm 17.8101$ ), milk product ( $44.0 \pm 19.8897$ ), pulses & legumes ( $39.3 \pm 16.8878$ ), fats & oils ( $12.5 \pm 8.9218$ ), sugar ( $7.4 \pm 5.7619$ ) and fruits ( $1.6 \pm 6.249$ ) respectively.

**Table 7.4: Average Intake of Nutrients (Consumption unit/day) in Sikkim**

Sl. No.	Nutrients	Average Intake of Nutrients (unit/day) Mean $\pm$ S.D.	Standard Error
1.	Energy (K cal)	$2191 \pm 25.7060$	10.4944
2.	Protein (g)	$65 \pm 19.1102$	7.8017
3.	Fats (g)	$26 \pm 15.5048$	6.3298
4.	Calcium (mg)	$565 \pm 23.1084$	9.4339
5.	Phosphorous (mg)	$1353 \pm 17.8213$	7.2755
6.	Iron (mg)	$21 \pm 13.6528$	5.5737
7.	Vitamin C (mg)	$66 \pm 16.3584$	6.6783
8.	Vitamin A (mg)	$368 \pm 21.0238$	8.5829

Source: Singh et.al. 2006.



**Figure 7.4:** Average Intake of Nutrients (Consumption unit/day) in Sikkim

The figure 7.4 shows the average intake of nutrients in Sikkim (Consumption unit per day (Kcal/g/mg/ug) such as Energy (Kcal), Protein (g), Fat (g), Calcium (mg), Phosphorous (mg), Iron (mg), Vitamin C (mg) and Vitamin A (mg), their significant mean  $\pm$ S.D. and standard error. The highest consumption of nutrient unit per day has been seen in Energy (Kcal) and the significant mean  $\pm$ S.D.  $2191 \pm 25.7060$  and their corresponding error calculated as 10.4944. The next highest consumption of nutrient is of Phosphorous (mg) having the significant mean  $\pm$ S.D.  $1353 \pm 17.8213$  and their corresponding error is calculated 7.2755. After Energy and Phosphorous comes Calcium (mg) and the significant mean  $\pm$ S.D.  $565 \pm 23.1084$  and its corresponding error calculated as 9.4339. The consumption of Vitamin A (mg) secured fourth place and its significant mean  $\pm$ S.D.  $368 \pm 21.0238$  and standard error calculated 8.5829. The consumption of other nutrients is less than Energy, Phosphorous, Calcium and Vitamin A.

**Table 7.5: Per capita and Per Consumer Unit Adjusted Intake of Calorie, Protein and Fat per day of Sikkim (Rural) 2011-12**

Particulars	Mean $\pm$ S.D.	Standard Error
Percentage expenditure on Food	51.70 $\pm$ 18.0776	7.3801
Percentage expenditure on Cereals	10.90 $\pm$ 8.0746	3.2964
Per capita/day intake of	Calorie(Kcal)	1614.00 $\pm$ 22.5743
	Protein (gm)	41.20 $\pm$ 16.8878
	Fat (gm)	36.10 $\pm$ 17.4241
Per consumer unit /day intake of	Calorie(Kcal)	1962.00 $\pm$ 15.4658
	Protein (gm)	50.10 $\pm$ 21.6979
	Fat (gm)	43.90 $\pm$ 20.3960

Source: NSS Report No. 560 Nutritional Intake 2011-12.

**Table 7.6: Per capita and Per Consumer Unit Adjusted Intake of Calorie, Protein and Fat per day of Sikkim (Urban) 2011-12**

Particulars		Mean $\pm$ S.D.	Standard Error
Percentage expenditure on Food		43.50 $\pm$ 20.3960	8.3266
Percentage expenditure on Cereals		8.70 $\pm$ 6.4187	2.6204
Per capita/day intake of	Calorie(Kcal)	1890.00 $\pm$ 31.7867	12.9769
	Protein (gm)	49.10 $\pm$ 19.8997	8.1240
	Fat (gm)	45.40 $\pm$ 20.5621	8.3944
Per consumer unit /day intake of	Calorie(Kcal)	2250.00 $\pm$ 27.2616	11.1295
	Protein (gm)	58.50 $\pm$ 15.7607	6.4342
	Fat (gm)	54.10 $\pm$ 23.0824	9.4233

Source: NSS Report No. 560 Nutritional Intake 2011-12.

Household food expenditure pattern is an excellent indicator of existing economic condition of a community and behaviour of variables like food consumption and calorie/protein intake in relation to the level of food expenditure is the important input of nutritional analysis (Sukhatme; 1987).

The above tables (7.5 & 7.6) illustrate per capita and per consumer unit adjusted intake of Calorie, Protein and Fat per day (rural and urban) of Sikkim with comparisons made among Percentage expenditure on food, Percentage expenditure on Cereals, Per capita/day intake of (Calorie (Kcal), Protein (gm) & Fat (gm) and Per consumer unit /day intake of (Calorie (Kcal), Protein (gm) & Fat (gm) in both rural and urban areas with the indication of significant mean  $\pm$ S.D. and standard error. In the percentage expenditure on Food in rural and urban areas, it is seen that rural is little higher than urban and their significant mean  $\pm$ S.D. are (rural-51.70 $\pm$ 18.0776) and (urban-43.50 $\pm$ 20.3960) and standard errors are 7.3801 and 8.3266. In percentage expenditure on cereals rural has higher expenditure compared to urban and the significant mean  $\pm$ S.D. are (rural-10.90 $\pm$ 8.0746) and (urban-8.70 $\pm$ 6.4187) and corresponding errors are calculated as 3.2964 and 2.6204. But the per capita/day intake of Calorie, Protein and Fat are higher in urban area and the significant mean  $\pm$ S.D. are: urban Calorie (Kcal) 1890.00 $\pm$ 31.7867, Protein (gm) 49.10 $\pm$ 19.8997 & Fat (gm) 45.40 $\pm$ 20.5621) and rural Calorie (Kcal) 1614.00 $\pm$ 22.5743, Protein (gm) 41.20 $\pm$ 16.8878 & Fat (gm) 36.10 $\pm$ 17.4241) and their corresponding errors are calculated as: urban Calorie (Kcal) 12.9769, Protein (gm) 8.1240 & Fat (gm) 8.3944) and rural: Calorie (Kcal) 9.2159, Protein (gm) 6.8944 & Fat (gm) 7.1133). Again it is found that per consumer unit/day intake of Calorie, Protein and Fat are higher in urban area than rural and the significant mean  $\pm$ S.D. are: urban Calorie (Kcal) 2250.00 $\pm$ 27.2616, Protein (gm) 58.50 $\pm$ 15.7607 & Fat (gm) 54.10 $\pm$ 23.0824) and rural Calorie (Kcal) 1962.00 $\pm$ 15.4658, Protein (gm) 50.10 $\pm$ 21.6979 & Fat (gm) 43.90 $\pm$ 20.3960) and their corresponding errors are calculated as: urban Calorie (Kcal) 11.1295, Protein (gm) 6.4342 & Fat (gm) 9.4233) and rural Calorie (Kcal) 6.3139, Protein (gm) 8.8581 & Fat (gm) 8.3266) respectively.

**Table 7.7: Percentage of Total Adjusted Intake of Calorie and Protein Derived from Different Groups of Food Items for Households of Sikkim (Rural) 2011-12**

Category	Items	Mean $\pm$ S.D.	Standard Error
Percentage of total intake of calorie from	Cereals	61.10 $\pm$ 26.2526	10.7175
	Other Food	38.80 $\pm$ 19.5550	7.9833
Percentage of total intake of protein from	Cereals	55.00 $\pm$ 26.2678	10.7238
	Pulses	7.80 $\pm$ 4.2426	1.7320
	Milk & Milk Products	17.40 $\pm$ 13.5351	5.5257
	Egg, Fish & Meat	8.60 $\pm$ 5.0990	2.0816
	Other Food	11.20 $\pm$ 8.2219	3.3565

*Source:* NSS Report No. 560 Nutritional Intake 2011-12.

**Table 7.8: Percentage of Total Adjusted Intake of Calorie and Protein Derived from Different Groups of Food Items for Households of Sikkim (Urban) 2011-12**

Category	Items	Mean $\pm$ S.D.	Standard Error
Percentage of total intake of calorie from	Cereals	51.60 $\pm$ 22.2261	9.0737
	Other Food	48.40 $\pm$ 23.1516	9.4516
Percentage of total intake of protein from	Cereals	47.40 $\pm$ 22.2979	9.1031
	Pulses	7.90 $\pm$ 5.0990	2.0816
	Milk & Milk Products	16.10 $\pm$ 12.8374	5.2408
	Egg, Fish & Meat	11.00 $\pm$ 8.0249	3.2761
	Other Food	17.60 $\pm$ 13.9283	5.6862

*Source:* NSS Report No. 560 Nutritional Intake 2011-12.

The above tables (7.7 & 7.8) reveal the percentage of total adjusted intake of Calorie and Protein derived from different groups of food items for households of Sikkim and a comparison amongst percentage of total intake of Calorie from cereals and other food, and percentage of total intake of Protein from cereals, pulses, milk & milk products, egg, fish & meat and other food in both rural and urban areas with their significant mean  $\pm$ S.D. and standard error. The percentage of total intake of Calorie from cereals is higher in rural areas compared to urban and the significant mean  $\pm$ S.D. are: rural 61.10 $\pm$ 26.2526, standard error calculated as 10.7175 and urban 51.60 $\pm$ 22.2261 and standard error calculated as 9.0737. The Calorie from Other Food intake is higher in urban area than rural and the significant mean  $\pm$ S.D. are: urban 48.40 $\pm$ 23.1516 and standard error calculated as 9.4516 and rural 38.80 $\pm$ 19.5550 and standard error calculated as 7.9833. The percentage of total intake of Protein from cereals, pulses, milk & milk products, egg, fish & meat and other food shows that Cereals contribute highest Protein in both rural and urban areas and their significant mean  $\pm$ S.D. are: rural 55.00 $\pm$ 26.2678, standard error calculated as 10.7238 and urban 47.40 $\pm$ 22.2979, standard error calculated as 9.1031. Other items having Protein content are

pulses, significant mean (rural 7.80±4.2426 and urban 7.90±5.0990), milk & milk products (rural-17.40±13.5351 and urban-16.10±12.8374), egg, fish & meat (rural-8.60±5.0990 and urban-11.00±8.0249) and Other Food (rural-11.20±8.2219 and urban-17.60±13.9283) respectively.

**Table 7.9: Percentage Break-Up of Calorie Intake over Different Food Groups and Average Intake of Calorie, Protein and Fat per Consumer Unit per Day for Households in Different Ranges of Calorie Intake (per consumer unit per day) in Sikkim (Rural) 2011-12**

Particulars		Mean ± S.D.	Standard Error
No. of consumer units per HHs		2.95±1.6260	.6638
Percentage of calorie for food group	Cereals	57.29±24.3967	9.9599
	Roots & Tubers	1.35±.6892	.2813
	Sugar & Honey	4.48±3.0331	1.2382
	Pulses, Nuts & Oilseeds	8.05±5.0990	2.0816
	Veg. & Fruits	2.15±1.0858	.4432
	Meat, Eggs & Fish	1.32±.7293	.2977
	Milk & Milk Products	6.80±4.6043	1.8797
	Oils & Fats	8.66±6.4187	2.6204
	Misc. Food etc.	9.90±6.4807	2.6457
	All	100.00±25.3456	10.3473
Average intake per consumer unit per day of	Calorie(Kcal)	2404±28.6007	11.6761
	Protein (gm)	60.90±23.6050	9.6367
	Fat (gm)	48.70±20.3174	8.2945

Source: NSS Report No. 560 Nutritional Intake 2011-12.

**Table 7.10: Percentage Break-Up of Calorie Intake over Different Food Groups and Average Intake of Calorie, Protein and Fat Per Consumer Unit Per Day for Households in Different Ranges of Calorie Intake (Per Consumer Unit Per Day) in Sikkim (Urban) 2011-12**

Particulars		Mean ± S.D.	Standard Error
No. of consumer units per HHs		2.78±1.3084	.5341
Percentage of calorie for food group	Cereals	50.06±19.4190	7.9278
	Roots & Tubers	1.50±.8371	.3540
	Sugar & Honey	4.85±3.0331	1.2382
	Pulses, Nuts & Oilseeds	8.10±5.9665	2.4358
	Veg. & Fruits	2.59±1.2649	.5164
	Meat, Eggs & Fish	1.62±1.0295	.4203
	Milk & Milk Products	8.86±6.4187	2.6204
	Oils & Fats	9.82±5.8309	2.3804
	Misc. Food etc.	12.60±6.3245	2.5819
	All	100.00±25.3456	10.3473
Average intake per consumer unit per day of	Calorie(Kcal)	2456±15.8113	6.4549
	Protein (gm)	63.50±23.4691	9.5812
	Fat (gm)	58.00±21.2037	8.6564

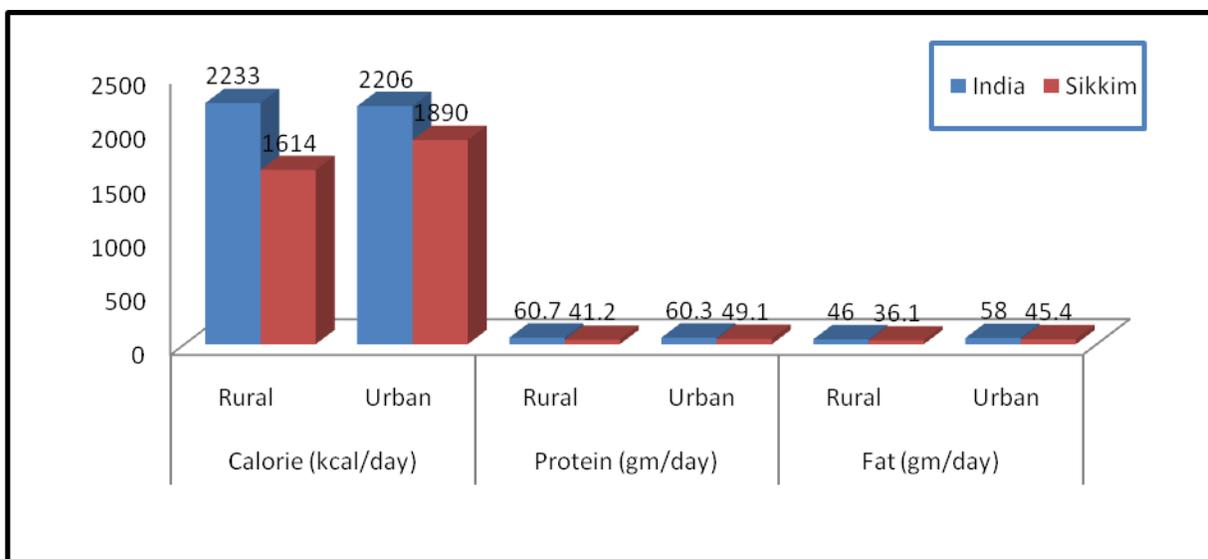
Source: NSS Report No. 560 Nutritional Intake 2011-12.

The tables (7.9 & 7.10) show the percentage break-up of Calorie intake over different food groups and average intake of calorie, protein and fat per consumer unit per day, separately for households in different ranges of Calorie intake (per consumer unit per day) with comparisons made among percentage of calorie for food groups (cereals, roots & tubers, sugar & honey, pulses, nuts & oilseeds, vegetables & fruits, meat, eggs & fish, milk & milk products, oils & fats, misc. food etc.) and average intake per consumer unit per day of Calorie (Kcal), Protein (gm) and Fat (gm) in rural and urban areas of Sikkim. The number of consumer units per HHs is higher in rural areas than urban and their significant mean  $\pm$ S.D. are: rural  $2.95\pm 1.6260$  and urban  $2.78\pm 1.3084$ , and standard errors are calculated as .6638 and .5341. The percentage of calorie for food group like cereals, the calorie content is higher than other food groups. The average intake of Calorie content per day per consumer is higher in rural than urban areas in the case of cereals and the significant mean  $\pm$ S.D. are: rural  $57.29\pm 24.3967$  and (urban  $50.06\pm 19.4190$  and standard errors calculated as 9.9599 and 7.9278. The significant mean  $\pm$ S.D. in other food group Roots & Tubers are: rural  $1.35\pm .6892$ , urban  $1.50\pm .8371$ , Sugar & Honey: rural  $4.48\pm 3.0331$ , urban  $4.85\pm 3.0331$ , pulses, nuts & oilseeds: rural  $8.05\pm 5.0990$ , urban  $8.10\pm 5.9665$ , vegetables & fruits: rural  $2.15\pm 1.0858$ , urban  $2.59\pm 1.2649$ , meat, eggs & fish: rural  $1.32\pm .7293$ , urban  $1.62\pm 1.0295$ , milk & milk Products; rural  $6.80\pm 4.6043$ , urban  $8.86\pm 6.4187$ , oils & fats: rural  $8.66\pm 6.4187$ , urban  $9.82\pm 5.8309$ , miscellaneous food: rural  $9.90\pm 6.4807$ : urban  $12.60\pm 6.3245$ . The average intake per consumer unit per day of Calorie (Kcal), Protein (gm) and Fat (gm) is higher in urban area than rural and their considerable mean  $\pm$ S.D. are: calorie (Kcal) rural  $2404\pm 28.6007$ , urban  $2456\pm 15.8113$ , Protein (gm), rural  $60.90\pm 23.6050$ , urban  $63.50\pm 23.4691$  and Fat (gm) rural  $48.70\pm 20.3174$ , urban  $58.00\pm 21.2037$  and their corresponding errors are calculated as: Calorie (Kcal) rural 11.6761, urban 6.4549, Protein (gm) rural 9.6367, urban 9.5812 and Fat (gm) rural 8.2945, urban 8.6564) respectively.

**Table 7.11: India & Sikkim: Per Capita Intake of Calorie, Protein and Fat (2011-12)**

Regions	Calorie (kcal/day)		Protein (gm/day)		Fat (gm/day)	
	Rural	Urban	Rural	Urban	Rural	Urban
India	2233	2206	60.7	60.3	46.0	58.0
Sikkim	1614	1890	41.20	49.10	36.10	45.40

Source: NSS Report No. 560 Nutritional Intake 2011-12.



**Figure 7.5:** India & Sikkim: per capita intake of Calorie, Protein and Fat

The figure 7.5 shows the per capita intake of Calorie, Protein and Fat derived from different groups of food items for rural and urban households of India and Sikkim. It is found from the above data that in Sikkim per capita intake of Calorie, Protein and Fat in both households either in rural or in urban is low compared to national intake. The Calorie (Kcal/day) intake of India rural is 2,233 and urban 2,206 in India, but in Sikkim it is only 1,614 in rural and 1,890 in urban areas. Likewise, Sikkim has low per capita intake of Protein and fat as compared to India in both rural and urban areas.

### **Role of Public Distribution System in Food Security**

Public distribution system (PDS) provides food grains at reasonable prices and is one of the imperative rudiments of the Government's Food Security system. It has been considered as a mechanism for ensuring availability of necessary food commodities at affordable prices to the citizens of the country. Moreover, it has also become an important plan for poverty eradication and run under the joint venture of the Central as well as State Governments. The main task of Central Government is responsibility for purchasing/obtaining, storage, transportation and mass allocation at subsidized prices of definite essential items such as rice, wheat, sugar and imported edible oils. The State Governments control their distribution to the consumers through a set-up of Fair Price Shops at different places.

### **Ensuring Food Security**

In view of the increasing poverty and higher incidence of hunger (absence of two meals a day) as perceived by the households in the region (NER), ensuring food security becomes a challenging task. There are two aspects of achieving this objective: one, to ensure adequate supply of food and two, to help households to have enough income to buy adequate food (Dubey & Kharपुरi; 2003).

### ***Public Distribution of Food at Subsidized Prices***

The Department of Food and Public Distribution is responsible for the management of the food economy of the nation. It undertakes various activities such as procurement of food grains, building up and maintenance of food stocks, their storage movement and delivery to the distributing agencies. A close watch is kept on production and efforts are made to ensure their adequate availability at reasonable prices in different parts of the country (Sharma; 2005).

### ***Expansion and Coverage of Major Food Security Initiatives: At a Glance***

Public Distribution System has been considered as the most important food based safety net introduced by the government of India. The basic objects of the PDS in India is to provide essential consumer goods at cheap and subsidized price to the consumers so as to insulate them from the impact of rising prices of these commodities and maintain the minimum nutritional status of our population. In addition to food grains, PDS has been used in India for the distribution of edible oils, sugar, coal, kerosene and cloth. The most important item covered under PDS in India have been rice, wheat, sugar and kerosene. Together these four items have accounted for 86 percent of the PDS sale: pulses, which constitute an important source of protein for the poor, have a share of less than 0.2 percent in total PDS sale. PDS in India covers the whole population as no means of direct targeting are employed. PDS distributes commodities worth more than Rs 30,000 crores annually to about 160 million families and is perhaps the largest network of its kind in the world. The Central Issue Price (CIP) fixed by the government remained unaltered till 1997, then a dual pricing structure was introduced under the Targeted Public Distribution System (TPDS), in which the issue price for families below the poverty line (APL) were fixed at 50 percent of economic cost. For making the PDS system more efficient, the government reduced the issue price of APL families by 70 percent during (Kurukshetra Journal; 2012).

### **History of the Public Distribution System**

- During 1964 FCI set up a solitary central agency for procurement, storage, transportation and distribution of food commodities viz, rice, wheat, sugar edible oils, kerosene and coal.
- Period between 1964 – 1978 drought of 1965/67 and 1972/73 provided strong movement for the expansion of PDS.
- Within the periods of 1978 – 1991 Food grain distribution through PDS falls considerably to 14MT in 1994 stock accumulate. Between 1991 and 1994 PDS process doubles. The poor are priced out. Sales drop. Stocks build up. In this period because global prices are temporarily high, export has taken place at the cost of nutrition in India.
- Targeting introduced in 1997.

- For Above Poverty Line (APL) prices of different commodities were increased by 85 % (wheat) and 61% (rice) and BPL prices by 66% and 62% respectively during 1998 – 2001.

To make the public Distribution System more effective and ‘poor oriented’ the Targeted Public Distribution System (TPDS) was introduced in the year 1997. The schemes under the system have been introduced to ensure availability of food grains to the poor at affordable prices. It is an attempt of the government to guarantee at least a minimum quantity of food grains at specially subsidized prices to people living below the poverty line (Achievement-FCS&CA-2016).

The central and state governments along with joint venture dedicated to implement this Public Distribution System (PDS) for the greatest help of the beneficiaries. The Rural Management and Development Department of the state has formed Social Audit-cum-Vigilance Committees in each Gram Panchayat Unit and also has given power to watch over the efficiency, the transparency and the accountability of the Public Distribution System in the state.

In Sikkim the Department of Food, Civil Supplies and Consumer Affairs, Government of Sikkim deals with the procurement and distribution of essential commodities like rice, sugar, wheat (atta), kerosene oil and petroleum mainly through Fair Price Shops.

According to verdict of Supreme Court of India on 17.11.2004 the following agenda had been passed in order to implements the following schemes:

1. Sampoorn Grameen Rozgar Yojana
2. Mid Day meal scheme
3. Antyodaya Anna Yojana.

Among them the 3<sup>rd</sup> is imperative and it is mainly for poor families:

This scheme is meant for the poorest of the poor. A person allowed to benefit under this scheme is issued a red card. The red card holders are entitled to obtain grain and rice from the dealer through Public Distribution System (PDS) at a highly subsidized rate like Rs. 2 per kg of wheat and Rs.3 per kg for rice.

The Public Distribution System (PDS) mainly focus on the poor in an effort to transform the macro-level self-sufficiency in the food grains into micro-level i.e. make sure the availability of food for the poor. The work of TPDS is a lot of responsibility on the state government in identifying and issuing special cards to those belonging to below the poverty line and confirm that the food grains provided by the centre to the states are actually taken from the go-downs of FCI, transported to the shops and from there distributed to the actual card holders. Along with other states, TPDS was also introduced in Sikkim in order to distribute food items to the poor families through fair price shops.

Sikkim State Cooperative Supply and Marketing Federation Ltd. (SIMFED) under the policy of State Government has been delivering consumer goods to the rural primary cooperatives. The Department had also provided services of three utility Vehicles to SIMFED for smooth delivery of consumer goods and the vehicle on return from the rural cooperatives shall carry back marketable surplus of the members for onward marketing. All the overhead cost incurred by SIMFED has been reimbursed by the Department under the scheme. The State Government, under its policy, has been supporting SIMFED in its role to provide all consumer goods on F.O.R. from society's go-downs in the State on wholesale rate basis and for this purpose SIMFED is maintaining a central go-down at Rangpo Regulated Market yard/Jorethang/Mangan for dispatching consignments to various destinations on prepaid demand basis (Sikkim; 15 Triumphant Years of Democracy (1994-2009)).

**Targeted Public Distribution System (TPDS) and Antodaya Anna Yojana (AAY):  
(Seventh Report of the Commissioners to the Supreme Court)**

The Public Distribution System (PDS) is considered as one of the oldest food subsidy programmers in the country. The British Government Rationing was introduced in 1939 and the basic structure for the PDS was flattened up in 1942. Since then, many changes have been seen in this programme along with the most recent change being the prologue of the Targeted Public Distribution System (TPDS) in 1997, having made a difference between households below the poverty line and above poverty line and provided for a major amount of the subsidy to be transferred only to those households who fall below the poverty line (BPL). Food grains are also given to those families of Above Poverty Line (APL) but the subsidy is very low as compared to that for the BPL families.

Under the Targeted Public Distribution System (TPDS) introduced in 1997, the Government of Sikkim made an attempt to provide rice at highly subsidized rates to the poor families. The task was carried out under the supervision of the respective District Collectors in order to identify 43,450 BPL families in the state. The state government under this scheme started issuing 35 kg of rice per family at Rs. 4 per kg per month since the commencement of the programme.

Different programmes have been introduced to uplift the poor families. The programmes/schemes being implemented by the state government up to December 2015 are as below:

**1. *Below Poverty Line***

Under this scheme, in the case of Sikkim, 26,914 families were fully benefited after getting highly subsidized rate of rice at Rs. 2 per kg. The beneficiaries were allowed to get 35 kg of rice per month. From April 2002, the department was issuing this quantity and for this, the state was allotted 942 MT of rice under this scheme every month.

## 2. *Mukhya Mantri Antodaya Annadan Yojana*

Through this scheme, the poorest among the BPL families have been further identified for the Antodaya Annadan Yojana Scheme. Under this scheme a poor family is allowed to acquire 35 kg of rice per family per month at Rs. 3 per kg. The state government of Sikkim has renamed this scheme as Mukhya Mantri Antodaya Annadan Yojana from 23<sup>rd</sup> August, 2003 and under this scheme 9.914 beneficiaries are allotted with 35 kg of rice free of cost. The financial cost of 3.46 per kg is being burdened by the state government. Under this scheme 347 MT (Metric Tons) of rice was distributed every month.

## 3. *Mukhya Mantri Khadya Surakshya Abhiyan (MMKSA)*

The instruction of central government was to provide subsidized rice to 43,450 people who are living below the poverty line under the TPDS scheme in the state. The state government introduced scheme called ‘Mukhya Mantri Khadya Surakshya Abhiyan’ and around 26,000 economically marginal families’ and indigenous tribes are further provided rice at the subsidized rate of Rs.4 per kg. In this scheme the department purchases rice at Rs.830 per quintal and issues it at rate of Rs.370 per quintal. The subsidy of Rs.4.60 per kg is being borne by the state government.

The State Government under this scheme provided 35 kg of rice to marginal and economically backward families at a subsidized rate of Rs. 2/- per kg. These beneficiaries were marginal BPL families who had been left out in the BPL list. 872.3 MT of rice was allocated under this scheme every month (Achievement-FCS&CA-2016).

## 4. *Antodaya Annadan Yojana*

Under this scheme of the central government, rice is being issued at Rs.3 per kg to 6,600 very poor beneficiaries selected from the BPL list. The 578 MT of rice was being allocated by the Central Government under the scheme of AAY out of which 347 MT of rice was distributed to MMAAY scheme and the remaining 231 MT of rice was distributed to 6,600 families under this scheme. As per this scheme the beneficiaries were allotted 35 kg of rice free of cost every month.

According to the revised notification of government of Sikkim under Food and Civil Supplies and Consumer affairs Department, dated 30<sup>th</sup> July, 2013:

“In order to provide food security to priority households, the Government is pleased to revise and notify the rate of subsidized rice to be provided under the Public Distribution System as below:

1. All households previously under *Mukhya Mantri Antodaya Annadan Yojana* (MMAAY) and *Expanded Antodaya Annadan Yojana* (EAAY) will henceforth come under *Antodaya Annadan Yojana* (AAY) and will be entitled to 35 kg of rice free of cost per month per household. Further, households having more than 6 (six) members will be entitled additional 15 kgs of rice free of cost per month.

2. All households previously under the Below Poverty Line (BPL) scheme and *Mukhya Mantri Khadya Suraksha Abhiyan* (NMKSA) both will come under *Mukhya Mantri Khadya Suraksha Abhiyan* (NMKSA) and will be entitled to 35 kg of rice per household per month at the rate of Rs.2 per kg. Further, households having more than 6 (six) members will be entitled additional 15 kg of rice at Rs. 2 per kg per month. The above rates will be effective from 1<sup>st</sup> August, 2013” (Sikkim Express- 03/08/2013).

The Government of India allocated the following category of rice per month to the State of Sikkim up to December 2015. The allocation of rice to BPL families was 9,420.00 qtls., to AAY families 5,780.00 qtls, and rice to APL families 19,200.00 qtls (Achievement-FCS&CA-2016).

**Table 7.12: Departmental Distribution of Allocated Rice and Wheat**

Sl. No	Schemes	Qty. in qtls	CIP(Central Issue Price) in Rs. per qtls	Consumer price per kg in Rs.	Subsidy per qtl	Subsidy Amt. per month
1.	Rice AAY	5780.00	300/-	Free	Rs.335/-	Rs.1936300.00
2.	Rice MMKSA from BPL	9420.00	565/-	2.00	Rs.452/-	Rs.4257840.00
3.	Rice MMKSA from APL	8723.00	830/-	2.00	Rs.700/-	Rs.6106100.00
4.	Rice APL	10477.00	830/-	9.00	nil	nil
	Total	34400.00				12300240.00
5.	Wheat	2450.00	6.10/-	8.92 (Atta)	nil	nil

Source: FCS& CA, 2016.

The department of Food Civil Supplies and Consumer Affairs, Government of Sikkim has taken the responsibility to distribute the allocated rice and wheat to the poor families. The Central Government allocated the quantity of rice and wheat through different schemes to the state. The state government distributed the allocated commodities and ensured its reach to the beneficiaries. According to above schemes AAY has got 5,780.00 quintals of rice and the central issue price was Rs.3, but beneficiaries were getting free of cost. Actually subsidy per quintals was Rs.335 and the total subsidy amount per month was Rs.19,36,300.00. Similarly, rice under MMKSA (BPL) was granted 9,420.00 quintals of rice and the central issue price was Rs.565 per quintals but consumer price was only Rs.2.00. Likewise, subsidy per quintal was Rs. 452 and grand subsidy amount per month was Rs.42,57,840.00. Rice under MMKSA (APL) allocated 8723.00 quintals and central issue price was Rs.830 per quintal. The consumers were getting Rs.2 per kg of rice and subsidy per quintal Rs.700 and the total subsidy amount per month came around Rs.61,06,100.00. Rice for APL category allocated 10,477.00 quintals and central issue price was Rs.830 per quintal. The APL consumers had to pay higher price of rice i.e. Rs.9.00 per kg as compared to other categories and there were no

subsidy. The second commodity i.e. wheat which got 2,450.00 quintals and central issue price was Rs.6.10 per quintal. The consumer price was Rs.8.92 and there were no any subsidy.

#### **5. *Annapurna Scheme***

Under the Annapurna Scheme, since November 2000 the destitute senior citizens above the age of 65 years who have no one to support them and are eligible for National Old Age Pension. They are provided 10 kg of rice free of cost.

Since April 2000 beneficiaries have been provided rice under this scheme and total numbers of 2,500 beneficiaries have been covered. A Ration Card has been provided free of cost to these beneficiaries which was different from others in the state of Sikkim.

#### **6. *Welfare Institutions/Destitute Homes***

Inmates/residents of Welfare Institutions are provided free meals of rice at the rate of Rs. 4 per kg and the concerned department has been constantly distributing the rice immediately after receiving central allocations.

Moreover, the state of Sikkim is provided 391 MTs of levy sugar per month and 245 MTs of whole wheat. There are 1,414 approved Fair Price Shops located in different areas of the state and their main functions is distribution of PDS and other commodities at fair prices to the end consumers.

Under this scheme various welfare institutions, orphanages, monastic schools are provided with free meals from the Food Department. They are provided with 5 kg of rice per inmate per month at Rs. 4 per kg and the Central Government allocates 11.39 Mt of rice under this scheme per month. In the state 32 welfare institutions with 2,278 beneficiaries are covered under this scheme (Achievement-FCS&CA-2016).

#### **7. *Whole wheat***

The Government of India allocates 245 MT of whole wheat to the state. For the convenience of the public it is ground into whole meal atta and distributed to ration card holders at the scale of 1 kg per individual at Rs. 8.92 per kg per month through Fair Price Shops and other designated shops. As the quantity is not sufficient for all the ration card holders and moreover all the ration card holders do not prefer 'atta' to rice, the department allocate whole meal "atta" only in those Fair Price Shops where there is a demand for "atta" as the shelf life of "atta" is short (Achievement-FCS&CA-2016).

#### **8. *Sugar***

After the deregulation of sugar by Government of India, the state had to lift sugar from the open market at market price duly calling for tender/quotations. The State procures 182 MT of sugar per month and makes sugar available to beneficiaries selected under AAY, MMAAY, MMKSA & BPL schemes of Department. Sugar was made available at Rs. 13.50 per kg at the

scale of 500 grams per individual or 2.50 kg per family whichever is lesser per month from the Fair Price Shops. The State lifts the allotted quota by engaging an agent directly from various sugar mills of Uttar Pradesh which quotes the lowest price. It is then transported by road to Siliguri and further transported to different Food go-downs in the State of Sikkim (Achievement-FCS&CA-2016).

To ensure safe storage and effective distribution of food grains, the department has established many new food go-downs at Chungthang, Pakyong, Ravangla, Chongrang and Dentam.

For the implementation of different schemes and policies, the Food Civil Supplies and Consumer Affairs Department, Government of Sikkim operates a total of 27 Food godowns in the State which are under supervision of the District Food and Civil Supply Official. From these godowns essential commodities such as rice, sugar, salt and 'atta' are distributed through Fair Price Shops registered with the Food & Civil Supplies Department. There are two FCI godowns each at Jorethang (South) and Rangpo (East) Sikkim. 27 Food Godowns are located in different places within the four districts of Sikkim viz. Chungthang, Dikchu, Mangan (North) Gangtok, Pakyong, Ranipool, Rhenock, Rongli, Singtam, Rangpo, Makha (East) Namchi, Jorethang, Ravangla, Temi, Yangang, Namthang, Melli, Bermoik, (South) and Dentam, Gyalshing, Kaluk, Legship, Sombaria, Soreng, Thingling, Chongrong (West). There are sub-godowns in Lachung and Lachen.

### **Fair Price Shops**

Under the Food Civil Supplies and Consumer Affairs Department a number of Fair Price Shops are registered in order to distribute essential commodities like rice, sugar, wheat (atta) etc. which are procured by the Department. These Shops are directly under the control of the Department of Food and Civil Supplies and they are required to distribute essential items as per the prerogative scale and price which are already fixed and communicated by the Department. A number of Cooperative Societies are also registered in the same Department for providing essential commodities to the people.

As against the existing 35 Multi-Purpose Cooperative Society (MPCS), the department under the State policy is required to establish one MPCS in each GPU. The state has established 166 MPCS in the State and provided Government equity participation of Rs.30, 000/- and Financial assistance of Rs.47, 000 to each GPU MPCS (Sikkim; 15 Triumphant Years of Democracy (1994-2009).

The department has issued license to 1,538 shops including Cooperative Societies to run as Fair Price Shops all over the state. Of the total Fair Price Shops, 152 are inactive and as of 20<sup>th</sup> July 2016, there was a total of 1,409 Fair Price Shops which were operational in the state (Achievement-FCS&CA-2016).

### **Integrated Child Development Services (ICDS)**

Integrated Child Development Services (ICDS): the ICDS Scheme is one of the centrally sponsored schemes that was launched in 1975 with an aim to develop the nutritional and health position of children who falls below the age of six years and include the pregnant as well as lactating mothers. This scheme is fully implemented in Sikkim.

### **Mid Day Meal Scheme**

Mid Day Meal Scheme is one of the successful programmes launched on 15<sup>th</sup> August 1995. Within this scheme food grains are provided free of cost at the rate of 100 gram per child per school day and cooked hot meal is served with a minimum content 300 calories and 8-12 gram of protein each day of school for a minimum of 200 days and total of 3 kg per student per month covers around 9-11 months in a year. This scheme includes students (class v) of Government primary schools or primary schools aided by Government and the primary schools by local bodies. In drought affected places, the mid-day meal is distributed during the summer vacations also. Of late, this scheme has been revised and it is extended up to junior high school .i.e. up to VIII standard. All Government junior high schools in Sikkim have been benefitted by this scheme.

### **Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)**

The Central Government launched this new programme in 2005. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is considered as the first ever law internationally that guarantees wage employment at an unprecedented scale. The main aim is to reach livelihood security of households particularly in rural areas of the country by providing at least one hundred days of guaranteed wage to the adult members who volunteer to do unskilled manual work.

### **National Food Security Act (NFSA)**

The National Food Security Act, 2013 was enforced by an act of Parliament after receiving the assent of the President on the 10<sup>th</sup> September, 2013. The Act provides coverage of up to 75 % of the rural population and up to 50% of the urban population for receiving subsidized food grains under Targeted Public Distribution System (TPDS), thus covering about two thirds of the population (Achievement-FCS&CA-2016).

Earlier while implementing NFSA, there were chiefly three types of ration cards issued by State Governments such as APL, BPL and Antyodaya (AAY) ration cards which are distinguished by distinct colours decided by concerned State Govt. According to NFSA 2013, APL and BPL groups have re-categorized into two: Priority and Non-Priority. Thus NFSA prioritizes household's needs taking into account not only their income but other socio-economic disproportion in the society.

## **Priority Categories**

**Priority House Hold (PHH):** A large section of ration card holders comes under this category. In order to eradicate poverty, National Food Security Act (NFSA) claims right to collect food grains at subsidized prices by persons falling in eligible household that is Priority House Holds (PHH) under Targeted Public Distribution System (TPDS). In this sector every person falling under priority households, shall be allowed to receive five (5) kg of food grains per person per month at subsidized prices from the ration shops not exceeding Rs. 3 per kg of rice, Rs. 2 per kg of wheat and Rupee 1 per kg for coarse grains for a period which is fixed by the Central Government and above price may be fixed from time to time by the Central Government.

**1. Antyodaya Anna Yojana (AAY) Ration Card:** It is basically for the poor people that Antyodya Anna Yojana has been preserved. It is projected that 5 percent of the people who are unable to get two meals a day on a sub-standard basis throughout the year. The person who belongs to this category and whose purchasing power is so low that they are unable to buy food grains round the year, even at BPL rates. About 5 crore people or around 1 crore families makes the target group of Antyodya Anna Yojana. On 1<sup>st</sup> March 2001 AAY scheme was introduced in the State. This scheme reflects the pledge of the Government of India to ensure security for all paving the way for a hunger free India in the coming next five years and to transform and improve the distribution system so as to provide supply to the poorest of the poor in rural and urban areas. Under this scheme (AAY) households provide 35 kg of food grain per household per month. Wheat and rice are being issued at the range of 15 kg and 20 kg per family per month at Rs. 2 and Rs. 3 per kg respectively.

### **2. Annapurna Yojna (AY) Ration Card**

Annapurna Yojna (AY) Ration Card is considered as a special type of ration card issued only to those elderly poor people whose age is above 65 years. They are provided 10 kgs of foodgrain on a monthly basis by the government.

### **3. State Priority Ration Card (SPHH)**

State priority cards are one of the special card that is issued only to a member who needs treatment due to serious illness but it comes directly to non-priority household ration card. State priority card holder is ineligible to obtain articles from ration shops. Providing this type of ration card is the sole responsibility of concerned state and purely depends on ruling State Govt. and its policies.

## **Non-Priority Categories (NPHH)**

The households that remain after populating and selecting priority list will go to Non-Priority category. Non-Priority Households (NPHH) are not eligible to acquire subsidized food grains under NFSA system. As per the NFSA, 25 % of the rural population and 50 % of urban

population will move away from the ambit of receiving subsidized food grains under Targeted Public Distribution System (TPDS). They may possess a ration card but no subsidized food grains. In contrary the priority ration card (PHH) holders remain eligible to acquire subsidized food grain and thereby become benefitted through the scheme.

**Table 7.13: The quantity allotted by the Ministry under NFSA from January 2016**

Allocation Category	Rice	Wheat	Total	Central Issue Price Rice/kg	Central Issue Price Wheat/kg	Consumer Issue Price /kg	Scale of Issue
AAY	577.50	0.00	577.50	Rs.3.00	Rs.2.00	Rs.3.00	35 kg/family
Priority	1,614.17	0.00	1,614.17	Rs.3.00	Rs.2.00	Rs.3.00	5 kg/member
Total	2,191.67	302.24	2,493.91				
Tide over	1,200.00	302.24	1,502.24	Rs.8.30	Rs.6.10	Rice Rs.11.00 & Wheat Rs.10.90 /kg	Rice 8.05 & wheat 1.74 kg/ individual

Source: FSC& CA, 2016.

The Food, Civil Supplies and Consumer Affairs Department implemented the National Food Security Act (NFSA) from the month of January 2016. As per the government report at present the beneficiaries under NFSA (Rice) AAY = 16,500 households, PHH = 3,22,834 individuals and OPHH is 1,46,899 individuals. Distributions of food grains to these families are done through 1,409 Fair Price Shops within the four districts of Sikkim.

## Price of Essential Commodities

### Rice

**Table 7.14: Wholesale and Retail price of Rice under NFSA**

Sl. No	Commodity/Scheme	Wholesale rate per qtl	Retail sale per kg	Scale
1.	Rice AAY	Rs. 114.00	Rs.3.00	35kg/Family
2.	Rice PHH	Rs.114.00	Rs.3.00	5 kg/Family
3.	Rice OPHH	Rs.914.00	Rs.11.00	8.05kg/Individual

Source: FSC& CA, 2016.

From the above table it is understood that under NFSA, the schemes like AAY, PHH and OPHH have fixed different wholesale and retail price for rice for the beneficiaries. For the AAY scheme wholesale price of rice was fixed at Rs.114 per qtl, retail price at Rs. 3.00 per kg and a scale of 35 kg per family per month. Similarly, under PHH scheme wholesale price of rice was fixed at Rs.114 per qtl., retail price at Rs. 3.00 per kg and a scale of 5 kg per family per month and under PHH scheme wholesale price of rice at Rs.914 per qtl., retail price at Rs. 11.00 per kg and a scale of 8.05 kg per individual per month.

### ***Wheat***

Wheat is one of the important essential items distributed by the state government which is allocated by the Government of India. However in Sikkim, the allocated wheat is ground to make 'Atta' (wheat flour) and then distributed. Wheat allotted from the Ministry up to December 2015 was 2,450.00 qtl and the same have been allotted to: a) M/s Rangeet Associates Pvt. Ltd. at 1,800.00 qtl per month and b) M/s Kailash Flour Mills Ltd. at 650.00 qtl per month. The whole wheat allotted to the above two mills are distributed by the Department in the form of atta after grinding as per the direction of the Department. The CIP (Central Issue Price) of wheat is Rs.610.00 per qtl and the retail sale rate of Atta is Rs. 8.92 per kg (Achievement-FCS&CA-2016).

The revised allocation of wheat under NFSA from the month of January 2016 is 3,022.40 qtl and the same is allotted to the above mentioned mills.

### ***Sugar***

Sugar is considered as an essential commodity distributed by the department of Food Civil Supplies and Consumer Affairs, Government of Sikkim. The total amount of sugar distributed from July 2013 to May 2015 was 1,820.00 qtl. Total AAY beneficiaries till 31<sup>st</sup> December 2015 was 16,514 households (family) and MMKSA beneficiaries was 51,837 households (family). Grand total beneficiaries of both AAY and MMKSA are 68,351 beneficiaries (households).

After deregulation of sugar w.e.f. April 2013-14, under the new system the state governments are required to procure sugar from open markets for the Targeted Public Distribution System. The Government of India had constituted a Committee headed by Dr. C. Rangarajan, Chairman, Economic Advisory Council to the Prime Minister to look into all aspects related to regulation in the sugar sector. As per recommendation of the Committee, the Central Government had decided to remove the levy obligation on sugar mills and the regulated release mechanism. The state government accepted the mechanism and approved to provide sugar to 3,62,260 beneficiaries under Public Distribution System at the price of Rs. 13.50 per kg by purchasing from the open market at the factory price of Rs.32.00 per kg. The difference between the purchase price and issue price was Rs. 18.50 per kg which was borne by the Government of India and the remaining Rs.7.53 per kg was borne by the State Government. This was in the year October 2014 (Achievement-FCS&CA-2016).

Scale of sugar distribution is 2.5 kg per month per family up to December 2015 and the scale has been refixed at 2.4 kg per family per month from January 2016 due to increase of Ration Cards from 1,54,992 to 1,60,604. The subsidized sugar is provided to all the ration card holders irrespective of their category (Achievement-FCS&CA-2016).

**Table 7.15: Scheme wise Rate and Scale of Essential Commodities till 31<sup>st</sup> December, 2015**

Sl. No.	Schemes	Rate of Rice	Scale
1.	Antodaya Anna Yojana (AAY)	Free	35 kg/household/month
2.	Below Poverty Line (BPL)	2/kg	35 kg/household/month
3.	Mukhya Mantri Khadya Suraksha (MMKS)	2/kg	35 kg/household/month
4.	Above Poverty Line (APL)	9/kg	2kg/person

*Source:* FSC& CA, 2016.

According to old schemes such as Antodaya Anna Yojana (AAY), Below Poverty Line (BPL), Mukhya Mantri Khadya Suraksha (MMKS) and Above Poverty Line (APL) till 31<sup>st</sup> December, 2015, price of rice was different for different schemes. Those beneficiaries who fall under Antodaya Anna Yojana (AAY) scheme were getting 35 kg per household per month free of cost rice. But schemes like Below Poverty Line (BPL) and Mukhya Mantri Khadya Suraksha (MMKS), beneficiaries had to pay Rs. 2 per kg and the quantity was confined to 35 kg per household per, month only. However, if the beneficiaries required more than 35 kg of rice, then they had to pay more. Those belonging to Above Poverty Line (APL) category had to pay Rs.9 per kg of rice and were allowed to acquire only 2 kg per person per month.

**Table 7.16: Scheme wise Rate and Scale of Essential Commodities from 1<sup>st</sup> January 2016**

Sl. No.	Scheme/Commodities	Rate in Rs.	Scale
1.	Antodaya Anna Yojana (AAY)	3/kg	35 kg/households/month
2.	Priority Households (PHH)	3/kg	5kgs/households/month
3.	Other Priority Households (OPH)	11/kg	8.053 kg/person/month
4.	Whole Meal Atta	10.90/kg	1.713kg/person/month (In lieu of rice entitlement)
5.	Sugar	27.14/kg	2.4kg/household/month
6.	Kerosene Oil	15.25 to 16.20/litre	1.25litre/person/month (Rural area) 1.00ltr/person/month (Urban area)

*Source:* FSC& CA, 2016.

As per revised schemes such as Antodaya Anna Yojana (AAY), Priority Households (PHH) and Other Priority Households (OPH), the rate and scale of commodities are different compared to older schemes. The Antodaya Anna Yojana (AAY) beneficiaries are getting Rs. 3.00 per kg of rice and are entitled for 35 kg per household per month. Similarly, Priority Households (PHH) beneficiaries are getting Rs. 3.00 per kg of rice, but they are only enjoying 5 kg per household per month. Likewise, Other Priority Households (OPH) categories had to pay little more i.e. Rs. 11.00 per kg and were entitled to receive only 8.053 kg per person per month. Moreover, the rate and scale were set different for three commodities like Whole Meal Atta (rate Rs.10.90/kg & scale 1.713kgs/person/month (in lieu of rice entitlement), Sugar (rate Rs. 27.14/kg & scale-2.4kgs/household/month) and Kerosene Oil (rate Rs.15.25 to

Rs.16.20/litre & scale- 1.25ltre/person/month (Rural area) and 1.00ltr/person/month (Urban area) applicable for all beneficiaries.

**Table 7.17: Latest Policy Master of the Food Civil Supplies and Consumer Affairs Department (2016)**

Schemes	Rice		Wheat		Sugar		Kerosene	
	Quantity Allocated (Kg)	Price (Rs.) per Kg	Quantity Allocated (Kg)	Price (Rs.) per Kg	Quantity Allocated (Kg)	Price (Rs.) per Kg	Quantity Allocated (litre)	Price (Rs.) per litre
AAY	35 kg per card	3.00	-		2.40 per card	27.14	Rural: 1.25 per unit Urban:1.00 per unit	16.85 to 17.00 per litre
PHH	5 kg per unit	3.00	-		2.40 per card	27.14	Rural: 1.25 per unit Urban:1.00 per unit	16.85 to 17.00 per litre
OPHH (G)	8.053 kg per unit	11.00	1.738kg per unit	10.90	2.40 per card	27.14	Rural: 1.25 per unit Urban:1.00 per unit	16.85 to 17.00 per litre
OPHH(S)	8.053 kg per unit	11.00	1.738kg per unit	10.90	2.40 per card	27.14	Rural: 1.25 per unit Urban:1.00 per unit	16.85 to 17.00 per litre
NPH		-	-		2.40 per card	27.14	Rural: 1.25 per unit Urban:1.00 per unit	16.85 to 17.00 per litre

Source: FSC& CA, 2016.

The Food Civil Supplies and Consumer Affairs Department, Government of Sikkim has recently developed a master policy in order to cover all schemes as well as provide essential commodities to the beneficiaries as per the subsidized rates. The schemes include AAY, PHH, OPH and NPH, but the OPH is further divided into OPHH (General) and OPHH (Special). In these schemes the basic commodities such as rice, wheat, sugar and kerosene are covered. As per the different schemes beneficiaries are allotted rice, wheat, sugar and kerosene at different rates. Under the AAY scheme the quantity of rice allotted was 35 kg per card at the rate of Rs.3.00 per kg , sugar 2.40 kg per card at the rate of Rs. 27.14 and kerosene for Rural: 1.25 per unit & for Urban:1.00 per unit at the rate of Rs. 16.85 to17.00 per litre. Similarly, under PHH scheme quantity of rice allotted was 5 kg per card at the rate of Rs.3.00 per kg , sugar 2.40 kg per card at the rate of Rs. 27.14 per kg and kerosene for Rural: 1.25 per unit & for Urban:1.00 per unit at the rate of Rs. 16.85 to17.00 per litre. Likewise, OPHH (General) and OPHH (Special) were allotted 8.053 kg per unit of rice at the rate of Rs.11.00 per kg, wheat 1.738 kg per unit at the rate of Rs. 10.90. Sugar and kerosene rates and scales were same for

all beneficiaries. The NPH beneficiaries are getting only sugar and kerosene at same rate and scale as other beneficiaries were getting.

The total number of beneficiaries as on 1<sup>st</sup> January, 2016 is as under:

- i) AAY -- 16,500 households
- ii) PHH – 3,22,834 individuals against the target of 3,24,081
- iii) OPH – 1,19,240+25,007 (left out) OPH (General) +2,652 OPHH

Over the time these data base have undergone changes due to the detection of sizeable number of duplicate beneficiaries. The duplication detected is because of duplicate entries of family members or because of double establishments. The figure as on 11<sup>th</sup> May 2016 is as under:-

- i) AAY – 16,509 households against 16,500
- ii) PHH – 3,24,814 individuals against 3,24,081
- iii) OPHH (General) -- 1,19,726 individuals
- iv) OPHH (Special) -- 2,652

The changes are due to ongoing process of deleting duplicate entries and replacing them with new entries of genuine left out beneficiaries (Achievement-FCS&CA-2016).

### **National Food Security Bill**

National Food Security Bill stated that there should be homogeneous benefits to 75 percent of the population in rural areas and 50 percent in the urban areas as entitled for 5 kg of food grain per person per month.

It had further stated that priority households may be allowed to receive 7 kg food grains per person per month at variable prices according to essential commodities not exceeding Rs. 3/2/1 per kg for rice, wheat, coarse grains correspondingly. The general households may be allowed to get not less than 3 kg of food grains per person at prices not 50 percent of Minimum Support Price.

The standing committee on food, consumer affairs and public distribution submitted their report to Lok Sabha speaker Meira Kumar, further suggested that state governments may be given the provision to expand coverage beyond the stipulations from their own resources. According to the committee report, there should be a single category system of inclusion with uniform entitlement of 5 kg per person per month and distribution of food grains to states according to 2011 population estimates which possibly will be revised in every 10 years gap.

Vilas Muttemwar, chairman of committee described the National Food Security Bill as “revolutionary” and he further said that “Considering the current levels of production and procurement of food grain, the committee agrees to the proposed coverage of 75 percent population in rural areas and 50 percent in urban areas to be identified as a uniform entitlement at the 5 kg per person per month under the bill. Nearly 83 crore population of the country will be covered”.

The Food Security Bill was introduced in the Lok Sabha in December 2011 which was then handed over to the standing committee in January 2012. The original bill had planned to cover 75 percent of rural population (at least 46 percent belonging to priority households) and up to 50 percent of the urban population (with at least 28 percent belonging to priority households) under the Targeted Public Distribution System (TPDS).

After the extensive discussions in the parliament session finally the Food Security Bill was passed on 27<sup>th</sup> August 2013, hoping it may feed the mouth of every poor families of the country.

### ***Salient Features of the National Food Security Bill***

Food Security Bill brings more benefits for the poor people of the country. The following features have been taken into consideration:-

- A beneficiary can get rice at Rs.3/kg, wheat at Rs.2/kg and coarse cereals at Rs.1/kg.
- The scheme offers a homogeneous monthly entitlement of 5 kg grains for up to 75 per cent of the rural population and up to 50 per cent of the urban population.
- The entitlement of Antodaya Anna Yojana households - the poorest of the poor will, however, continue at 35 kg per month.
- The right cannot be applicable if there is a war, flood, drought, fire, cyclone or earthquake affecting supplies.
- The prices of the grains will continue the same for the period of three year after that it may change. The government can in future look at schemes of cash transfers or food coupons to beneficiaries in place of the grain entitlement.
- Pregnant women and lactating mothers, in addition being entitled to nutritious meals as per the prescribed nutritional norms, will also receive at least Rs.6,000, as one of the maternity benefits.
- Children in the age group between 6 months to 14 years will be entitled to take home ration or hot cooked food as per prescribed nutritional norms.
- Not less than 3 kg of essential grain per person per month for general household at prices not exceeding half the Minimum Support Price (MSP) for wheat and coarse grains and not exceeding half the derived MSP of rice.
- At least one free meal every day for the destitute.
- Affordable meals at comity kitchens for the homeless people.
- Two free meals a day for up to three months for the disaster victim.

### **Reform of PDS**

The need of the hour is PDS reforms to ensure that public distribution functions the way it is intended. Technology based reforms are suggested.

The different types of reforms undertaken by different states are:

- Adhaar Linked and Digitized Ration Cards: This allows online entry and verification of beneficiary data. It also enables online tracking of monthly entitlements and off-take of food grains by beneficiaries.
- Computerized Fair Price Shops: Fair Price Shops automated by installing 'Point of Sale' device to swap the ration card. It authenticates the beneficiaries and records the quantity of subsidized grains given to a family.
- Direct Benefit Transfer (DBT): Under the Direct Benefit Transfer scheme, cash is transferred to the beneficiaries account in lieu of food grains subsidy component. They will be free to buy food grains from anywhere in the market. For taking up this model, pre-requisites for the States/UTs would be to complete digitization of beneficiary data and seed Adhaar and bank account details of beneficiaries.
- Use of GPS technology: Use of Global Positioning System (GPS) technology to track the movement of trucks carrying food grains from state depots to FPS which can help to prevent diversion.
- SMS-based monitoring: Allows monitoring by citizens so they can register their mobile numbers and send/receive SMS alerts during dispatch and arrival of TPDS commodities.
- Use of web-based citizens' portal: Public Grievance Redressal Machineries, such as a toll-free number for call centres to register complaints or suggestions ([www.clearies.com](http://www.clearies.com)).

As compared to old reforms of PDS system the new are very much digitized and attached with the beneficiaries.

### **Livelihood Security**

The perception of people towards livelihood security indicates that 88.72 percent people are concerned with livelihood matter whereas 11.28 percent people are less bothered.

According to observations, people of Sikkim cannot sustain their family members if the Government stops the import of food grains. The state of Sikkim cannot produce essential commodities as per the demand of food grains due to the following reasons:-

- i) Hilly region/rugged topography
- ii) Water scarcity
- iii) Infertility of soil
- iv) Constraints of land
- v) Less production in agricultural field

vi) Growing population

vii) Frequent landslides during rainy season, etc.

The agricultural sector plays a crucial role as source of livelihood activities and it also provides direct admittance to food. The primary source of food supply is a combination of aspects like home production, open market, Fair Price Shop, Public Distribution System etc. Accordingly, connection between food production and food security depends on the food stocks available at the household level.

**Table 7.18: Sources of Food Items**

Sl. No	Sources of Food Items	Percentage Mean $\pm$ S.D.	Standard Error
1.	Own farm Production	20.29 $\pm$ 13.0690	5.3354
2.	Food purchased from market	30.66 $\pm$ 18.1769	7.4206
3.	Supply from relatives/friends	1.07 $\pm$ .8941	.3650
4.	Government ration	26.09 $\pm$ 13.3865	5.4650
5.	Fair Price shop	17.65 $\pm$ 10.8258	4.4196
6.	Open market	1.89 $\pm$ 1.2096	2.4938
7.	Storage at home	2.35 $\pm$ 1.9241	.7855
	Total	100.00 $\pm$ 25.3456	10.3473

*Source:* Field Survey 2015-16.

The table 7.18 shows the sources of food items in the study area and also a comparative data on variables like own farm production, food purchased from market, supply from relatives/friends, Government ration, Fair Price shop, open market and storage at home and their significant mean  $\pm$ S.D. and standard error. The highest percentage is observed in food purchased from market which shows the significant mean  $\pm$ S.D. is 30.66 $\pm$ 18.1769 and standard error is calculated as 7.4206. Government ration comes under second position which has significant mean  $\pm$ S.D. of 26.09 $\pm$ 13.3865 and standard error is calculated 5.4650. The own farm production holds third position among other sources of food items and its significant mean  $\pm$ S.D.is 20.29 $\pm$ 13.0690 and standard error is calculated as 5.3354. People also depend on Fair Price shop for food items and the considerable mean  $\pm$ S.D.is 17.65 $\pm$ 10.8258 and standard error is calculated as 4.4196. The remaining sources such as open market, supply from relatives/friends and storage at home are less compared to other sources. Only 20 percent of food items can be hardly produced in the fields and remaining 80 percent requirement depends on other sources.

## **Food Habits**

Food habits of people in different parts of the world can be impacted by environmental conditions. According to Vidal de la Blache, “among the connections that tie man to a certain environment, one of the most tenacious is the food supply; clothing and tools are more subject to modification than the dietary regime, which experience, has shown to be best suited to human needs in a given climate” (Hussain, 2004).

The physical environment of a region must be taken into account by its inhabitants in deciding to produce particular foods suitable to the climate and soil. Basically, environment plays a crucial role to determine the food habits of human kind in any region of the world. Food habits are strongly influenced by cultural traditions, derived from events and conditions in the physical milieu. People in many folk societies believed that everything in nature has a distinctive characteristic, based on its looks and natural properties. Consequently, certain foods are desired or avoided in response to perceive the beneficial or harmful natural characteristics.

Food habits and dietary customs are inevitably affected by the availability of indigenous products, but people do not simply eat what is available in their particular environment. Food habits are strongly influenced by cultural traditions, derived from events and conditions in the physical environment (Hussain; 2004).

The food habits of people vary from location to location, depending upon proximity of sea, land, hill, desert, etc. People are conditioned over a time depending upon geographical, climatic and social condition as well as their innate tendency to satisfy the needs and requirement based on availability of local resources, its proximity, accessibility and adequate availability of items in extreme seasons. The North-East Region of India is no exception as it is dominated by the tribal population, and agriculture for the production of food grains in the region is highly dependent upon the custom, tradition, culture and food habit of the tribal people. Despite diversity in food habits among different communities, rice and wheat provide the staple diet for most of the people in the region, though pulses, vegetables, fruits, fish, meat, egg and milk are also taken by them to some extent along with the rice (Datta & Pradhan; 2006).

Sikkim has its own unique dietary culture with specific cuisine and food recipes. Like anywhere else in the world, food habits here have evolved as the result of traditional wisdom and empirical experiences of generations. Today in many parts of the world these traditional foods have entered commercial production, and their recipes have become popular among people of different ethnic origin. In the Sikkim Himalayas traditional foods are an integral part of the dietary culture of the various ethnic groups of people consisting of the Nepalese, Bhutias and Lepchas. Rice is the staple food. Meat and dairy products are also consumed

depending on availability. Besides these, various traditional fermented foods and beverages, which constitute about 20 percent of the basic diet for centuries are prepared and consumed.

The dietary culture of this region is mostly reflected in the pattern of food production. Depending on the altitudinal variation finger millet, wheat, buckwheat, barley, vegetable, potato, soybeans, etc. are grown. Some of the common traditional cuisine that are integral to the dietary culture of Sikkim are *momo*, *thukpa*, *kinema*, *gundruk & sinki soup*, *chhurpi*, *mesu*, *tama*, *kalo dal*, *sidra ko achar*, *selroti*, *shimi ko achar*, *pakku*, *kodo ko roti*, *phapar ko roti*, *silam ko achar*, *phulaurah*, *chambray*, *ti ko alu*, *sishnu soup*, *mohi*, *dahi*, *jaanr/chaang*, *kodo ko jaanr*, *bhaate jaaanr*, *makai ko jaanr*, *gahun ko jaanr*, *jahun ko jaanr*, *simal tarul ko jaanr*, *kodo ko jaanr* and *raksi*.

Sikkim has a blend of culture and traditions of Nepal, India, Bhutan and Tibet. So, does the cuisine of this state. The bizarre combination of various cuisines has resulted into one specific cuisine, which is now called as cuisine of Sikkim. Today, Sikkim boasts of its own dietary culture that comprise of different food habits and some special recipes. These recipes and habits emerged with the traditional wisdom and experiments of generations. The traditional food of Sikkim, is gaining popularity among the masses. In the present day, Sikkim cuisine has entered the kitchens of the world ([www.bharatonline.com](http://www.bharatonline.com)).

Food culture of Sikkim is directly related to the pattern of food production in the State. It has evolved as a result of traditional wisdom and experiences of generations over a period of time. It has been based on agro-climatic conditions suitable for cultivation of different crop species such as cereals, pulses, oilseeds, fruits, vegetables, spices and availability of wild edible plants, ethnic, regional, and cultural practices. Traditional foods have an important bearing in the dietary habits of the people of Sikkim. (Tamang, 2005:1-2 & Subba, 2008).

### **Consumption of Rice**

Rice is the staple food of Sikkim. It is seasonal and most important cereal crop of the South district next to maize. It is cultivated in the lower altitude especially in the river valleys of Teesta and Rangit. Besides, it is also cultivated in the gentle slope with the help of terrace farming.

In South district maximum paddy cultivation has been seen in lower areas. The production of paddy is not very large in volume and it is mostly consumed by farmers themselves. Sometimes due to economic problems, villagers sell the paddy/rice in villages as well as in local markets in limited quantity. Most farmers store some of the produce in order to maintain food security.

**Table 7.19: Average Monthly Purchase of Rice From the Market/Household (in kgs)**

Sl. No.	Rice purchased from the market (in Kg/month)	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below 15	2.33 $\pm$ 1.6456	.6718
2.	15-30	11.04 $\pm$ 8.9442	3.6514
3.	30-45	13.58 $\pm$ 10.9178	4.4572
4.	45-60	48.41 $\pm$ 20.1494	8.2259
5.	Above 60	24.64 $\pm$ 15.2315	6.2182
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.19 represents the Average Monthly Food items (Rice) purchased from the market per household in the study area with significant mean  $\pm$ S.D. and standard error. For most of the households, monthly rice purchased from the market ranges between 45-60 kg with significant mean  $\pm$ S.D. 48.41 $\pm$ 20.1494 and standard error is calculated as 8.2259. The households purchasing rice above 60 kg per month hold the second place with mean  $\pm$ S.D. of 24.64 $\pm$ 15.2315 and its corresponding error is 6.2182. The third position is occupied by households purchasing 30-45 kg of rice from the market for the family members and the significant mean  $\pm$ S.D. is 13.58 $\pm$ 10.9178 and its corresponding error calculated as 4.4572.

**Table 7.20: Consumption of Rice/Day/Family**

Sl.No.	Consumption of rice in gm/day	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below ¼kg (250 gm)	7.21 $\pm$ 5.5497	2.2656
2.	½ kg (500 gm) - ¾ kg(750 gm)	8.14 $\pm$ 5.9665	2.4358
3.	¾kg (750 gm) – 1kg (1000gm)	19.54 $\pm$ 15.6588	6.3972
4.	1kg (1000gm) - 2 kg (2000gm)	47.28 $\pm$ 22.6450	9.2448
5.	2+ kg (above 2000gm)	17.83 $\pm$ 13.7113	5.5976
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.20 reveals the average consumption of rice (gm) per day per family with significant mean  $\pm$ S.D. and standard error. The highest number of households is found in the category of average consumption rate between 1kg (1000gm) to 2kg (2000gm) and the corresponding mean  $\pm$ S.D. is 47.28 $\pm$ 22.6450 and standard error is calculated as 9.2448. The second highest number of families is found to have consumption of rice between ¾kg (750 gm) to 1kg (1000gm) with considerable mean  $\pm$ S.D. 19.54 $\pm$ 15.6588 and its corresponding error is calculated as 6.3972. Families with consumption rate of 2kg+ (above 2000gm) come third having significant mean  $\pm$ S.D. of 17.83 $\pm$ 13.7113 and standard error is calculated as 5.5976.

**Table 7.21: Percentage of Families Able to Feed Themselves if Allotment of Rice is Withdrawn**

Sl. No	Response of villagers	Percentage
1.	Yes	36.26
2.	No	63.74
	Total	100.00

Source: Field Survey 2015-16.

The above data makes the perception of people clear towards rice. If allotted rice is withdrawn by the government there will be problems of feeding for 63.74 % of the sample families. However, 36.26 % say that they will not be affected.

### Consumption of Maize

Maize is considered as one of the important crops grown in almost all parts of study areas. As for South district, maize is a dominant crop in the entire district.

**Table 7.22: Average Production of Maize (in kg)**

Sl. No.	Production in kg	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below 50	8.03 $\pm$ 6.4187	2.6204
2.	50-100	19.09 $\pm$ 13.9857	5.7096
3.	100-150	29.76 $\pm$ 16.7690	6.8459
4.	150-200	26.08 $\pm$ 13.7113	5.5976
5.	Above 200	17.04 $\pm$ 12.9460	5.2852
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.22 shows the average production of maize (kg) by the households in the study area with the significant mean  $\pm$ S.D. and standard error. Most of the households produce between 100-150 kg and has significant mean  $\pm$ S.D. 29.76 $\pm$ 16.7690 and standard error is calculated as 6.8459. The second position is occupied by households producing 150-200 kg with considerable mean  $\pm$ S.D. is 26.08 $\pm$ 13.7113 and its corresponding error as 5.5976. A significant number of households produce 50 kg to 100kg while some others produce more than 200kg. There are few households that produce below 50 kg.

**Table 7.23: Consumption Status of Maize**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	87.63
2.	Quantity Sold	12.37
	Total	100.00

Source: Field Survey 2015-16.

Maize is one of the chief cereal crops cultivated in Sikkim. It is grown by every farming family. As far as the consumption of maize is concerned, 87.63 percent is self-consumed. Sometimes people sell maize if produced in surplus or during the time of emergencies.

### Consumption of Wheat

Wheat is the third important cereal crop and the most important rabi crop in the South district. Wheat is cultivated as part of mix cropping with mustard in the low altitude in dry area and maize in higher altitude with cool weather conditions. It is sown in October, November and harvested in March-April. It is observed that the cultivation of wheat is done in lesser degree in the study area.

**Table 7.24: Average Monthly Food Items (Wheat-Maida/Atta) Purchased from the Market/Household (in kg)**

Sl. No.	Wheat (Maida/Atta) purchased from the market in kg/month	Percentage
1.	1-2	2.95
2.	2-3	17.03
3.	3-4	65.44
4.	4-5	14.58
	Total	100.00

Source: Field Survey 2015-16.

The table 7.24 shows the average monthly food items (wheat- in kgs) purchased from the market per household in the study area. The data indicates that maximum number of households purchase between 3-4 kg of wheat from market per month followed by the households with monthly purchase of 2-3 kg and 4-5 kg of wheat.

**Table 7.25: Consumption of Wheat (in gm)/Day/Family**

Sl. No.	Consumption of Wheat (Maida/Atta) gm/day	Percentage
1.	Below 250 gm	78.17
2.	½ kg (500 gm) - ¾kg (750 gm)	12.71
3.	¾kg (750 gm) – 1kg (1000 gm)	7.46
4.	1kg (1000 gm) – 2kg (2000 gm)	1.66
5.	2+ kg (above 2000 gm)	0.00
	Total	100.00

Source: Field Survey 2015-16.

The table 7.25 illustrates the average consumption of wheat (gm) per day per family. The data indicates the highest average consumption of wheat per family is below 250gm.

### Consumption of Millet

Very less cultivation of millet has been seen in the study areas. The production of millet ranges from 20 kg to 200 kg. Millet is consumed by the villagers themselves in order to make local alcohol and other dishes.

### Consumption of Buckwheat

**Table 7.26: Consumption Status of Buckwheat**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	33.33
2.	Quantity Sold	66.67
Total		100.00

Source: Field Survey 2015-16.

Buckwheat is grown widely in Sikkim in the marginal farmlands as a subsidiary crop. As per the table 7.26, the quantity sold is higher than consumed. Only one-third of the total produce is consumed by the growers while two-thirds are sold in the market.

### Consumption of Pulses

A variety of pulses are grown in Sikkim. Pulses are one of the important food crops which supplement income as well as dietary protein. It contains 24 percent protein and considerable amount of phosphoric acid. South district is one of the important areas of the state for the production of pulses.

**Table 7.27: Average Production of Pulses (in kg)**

Sl. No	Production in kg	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below 5	18.01 $\pm$ 13.9570	5.6979
2.	5-10	19.13 $\pm$ 14.3666	5.8651
3.	10-15	25.38 $\pm$ 17.7426	7.2433
4.	15-20	22.69 $\pm$ 17.9777	7.3393
5.	Above 20	14.79 $\pm$ 11.5758	4.7258
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

**Table 7.28: Average Monthly Purchase of Pulse From the Market/Household (in kg)**

Sl. No.	Pulses purchased from the market in kg/month	Percentage
1.	1-2	8.48
2.	2-3	67.15
3.	3-4	21.36
4.	4-5	3.01
	Total	100.00

Source: Field Survey 2015-16.

**Table 7.29: Consumption of Pulses (in gm)/Day/Family**

Sl. No.	Consumption of pulses in gm/day	Percentage
1.	Below 250 gm	71.49
2.	½ kg (500 gm) - ¾kg (750 gm)	19.45
3.	¾ kg (750 gm) – 1kg (1000 gm)	9.06
4.	1kg (1000 gm) – 2kg (2000 gm)	0.00
5.	2+ kg (above 2000 gm)	0.00
	Total	100.00

Source: Field Survey 2015-16.

**Table 7.30: Consumption Status of Pulses**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	45.99
2.	Quantity Sold	54.01
	Total	100.00

Source: Field Survey 2015-16.

The table 7.30 reveals the consumption status of pulses. As per the above data it is found that selling of pulses is higher than consumed.

### Consumption of Oilseeds

Sikkim grows mustard, rye and a variety of oilseeds in small quantities. The production of oilseeds in the state is insufficient.

**Table 7.31: Average Production of Oilseeds (in kg)**

Sl. No	Production in kg	Percentage
1.	Below 5	30.09
2.	5-10	54.24
3.	10-15	9.41
4.	Above 15	6.26
	Total	100.00

Source: Field Survey 2015-16.

**Table 7.32: Consumption Status of Oilseeds**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	99.99
2.	Quantity Sold	0.01
	Total	100.00

Source: Field Survey 2015-16.

The table 7.32 shows the average consumption status of oilseeds. The data indicates that almost all oilseeds are consumed. The average purchase of oilseed/mustard oil from the market is 5 litres per family per month.

### Consumption of Vegetables: Beans

**Table 7.33: Average Production of Beans (in kg)**

Sl. No	Production in kg	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below 5	31.02 $\pm$ 19.2249	7.8485
2.	5-10	39.09 $\pm$ 21.4289	8.7483
3.	10-15	8.13 $\pm$ 6.8121	2.7810
4.	15-20	14.71 $\pm$ 11.4017	4.6547
5.	Above 20	7.05 $\pm$ 5.9329	2.4221
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

**Table 7.34: Average Monthly Purchase of Beans from the Market/Household (in kg)**

Sl. No.	Beans purchased from the market in kgs/month	Percentage
1.	1-2	21.19
2.	2-3	61.18
3.	3-4	17.63
	Total	100.00

Source: Field Survey 2015-16.

**Table 7.35: Consumption of Beans (in gm)/day/family**

Sl. No.	Consumption of Beans in gm/day	Percentage
1.	Below 250 gm	52.08
2.	½kg (500 gm) - ¾kg (750 gm)	41.47
3.	¾kg (750 gm) – 1kg (1000 gm)	6.45
4.	1kg (1000 gm) – 2kg (2000 gm)	0.00
5.	2+ kg(above 2000 gm)	0.00
	Total	100.00

Source: Field Survey 2015-16.

**Table 7.36: Consumption Status of Beans**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	36.81
2.	Quantity Sold	63.19
	Total	100.00

Source: Field Survey 2015-16.

The table 7.36 shows the average consumption status of beans. The data indicate that selling of beans is higher than consumed.

### Chilies

**Table 7.37: Consumption Status of Chilies**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	24.73
2.	Quantity Sold	75.27
	Total	100.00

Source: Field Survey 2015-16.

The above table 7.37 demonstrates the average consumption status of Chilies. The data indicate that the selling of chilies is higher than what gets consumed. Production of chilies in the village ranges from 2 kgs and above. The market value of chilies depends on season as well as its time of production. The early produced chillies fetch the farmers Rs. 400 per kg whereas as the season progresses the price decreases to as low as 100 Rs. per Kg.

### Brinjal, Tomato and Pumkin

The production of tomato and brinjal has been seen in different places of south district as well in study areas. The production ranges from 2 kgs to 50 kgs.

**Table 7.38: Consumption Status of Brinjal, Tomato and Pumkin**

Sl. No.	Consumption status	Percentage
1.	Self-Consumed	39.89
2.	Quantity Sold	60.11
	Total	100.00

Source: Field Survey 2015-16

The table 7.38 represents average consumption status of brinjal, tomato and pumkin. The data indicate that selling of brinjal, tomato and pumkin is higher than consumed. The remaining quantity of vegetables is consumed by the producers themselves.

### Other Vegetables (Seasonal Vegetables)

**Table 7.39: Average Monthly Other Vegetables Purchased from the Market/Household (in kg)**

Sl. No.	Other vegetables purchased from the market in kgs/month	Percentage
1.	Below 3	6.78
2.	3-9	73.45
3.	6-9	14.11
4.	Above 9	5.66
	Total	100.00

Source: Field Survey 2015-16.

The table 7.39 illustrates the average monthly other vegetables purchased from the market per household in the study area. The data indicates that the highest monthly purchase of other vegetables from the market is in the range of 3-9 kg. The second highest purchase of other vegetables ranges between 6-9 kg.

**Table 7.40: Consumption of Other Vegetables (Seasonal)/Day/Family**

Sl. No.	Consumption of Other Vegetables (seasonal) in gm/day	Percentage
1.	Below 250 gm	36.33
2.	½kg (500 gm) - ¾kg (750 gm)	32.11
3.	¾ kg (750 gm) – 1kg (1000 gm)	21.64
4.	1kg (1000 gm) – 2kg (2000 gm)	9.92
5.	2+kg (above 2000 gm)	0.00
	Total	100.00

Source: Field Survey 2015-16.

The table 7.40 illustrates the average consumption per day per family of other vegetables (seasonal) which indicates the highest average consumption of other vegetables (seasonal) per family is below 250 gm and second highest consumption of other vegetables is in the range of ½g (500 gm) - ¾kg (750 gm). Some families consume up to 1kg of other seasonal vegetables per day.

### Consumption of Fruits

As far as the consumption of fruit is concerned it is predominantly used during the following occasions - at the time of festivals, family rituals, death ceremonies, ill-health conditions, as nutritional supplements for children, during marriage ceremonies etc. The monthly purchase of

fruits from the markets ranges between 1 kg to 5kgs. Therefore, the consumption of fruits is found to be occasional in the study areas.

### Meat Consumption

Animal derived foods are the most resource intensive foods. Animal protein foods are at the top of the food chain in relation to the resources. In many developing nations, it is expected that global meat consumption will continue to rise. It has been suggested that if meat consumption patterns continue along the same path, then the consumption rates will be 72 percent higher than 2000 levels in the year 2030. Demand for meat is growing rapidly in developing countries, particularly India, China and Brazil ([www.ncbi.nlm](http://www.ncbi.nlm)). The world average meat consumption stands at 41.90 kg per person per year ([chartsbin.com](http://chartsbin.com)>view).

Meat plays a vital role for food security in tribal communities in particular and other communities in general. Actually meat covers approximately 20 percent of the food. During the time of festivals meat consumption gets doubled. In Sikkim most of the people consumes meat during festivals, while some consume occasionally and during the weekends.

**Table 7.41: Average Monthly Meat Purchased from the Market/Other Places (in kgs)**

Sl. No.	Meat purchased from the market/other places in kgs/month	Percentage Mean $\pm$ S.D.	Standard Error
1.	Below 4	24.87 $\pm$ 16.7809	6.8507
2.	4-6	68.13 $\pm$ 22.7859	9.3023
3.	6-8	5.00 $\pm$ 2.8816	1.1764
4.	8-10	1.09 $\pm$ .8898	.3632
5.	Above 10	0.61 $\pm$ .2160	.0882
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.41 indicates the average monthly meat purchased from the market/household (in kg) per household in the study area along with the significant mean  $\pm$ S.D. and standard error. For most of the households the highest monthly purchase of meat from the market/other places is 4-6 kg and it has significant mean  $\pm$ S.D.68.13 $\pm$ 22.7859 and standard error is calculated as 9.3023. The second highest purchase of meat ranges between 2-4 kg and the corresponding mean  $\pm$ S.D. 24.87 $\pm$ 16.7809 and the standard error is 6.8507.

**Table 7.42: Average Meat Consumption/Days in A Week/Household**

Sl. No.	Response of villagers	Percentage Mean $\pm$ S.D.	Standard Error
1.	1 day	25.66 $\pm$ 15.7353	6.4239
2.	2 days	43.47 $\pm$ 17.6295	7.1972
3.	3 days	21.81 $\pm$ 14.7918	6.0387
4.	4 days	3.96 $\pm$ 2.1213	.8660
5.	More than 4 days	5.10 $\pm$ 3.4641	1.4142
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.42 indicates the average meat consumption per day in a week per household and its significant mean  $\pm$ S.D. and standard error. As per above data, it is found that the highest average consumption of meat per household is 2 days and the corresponding mean  $\pm$ S.D. 43.47 $\pm$ 17.6295 and standard error is calculated as 7.1972. There are many families that consume meat once in a week, while some consume meat three days a week. It has also been noticed that some families, though very few in number, consume meat even four or more days in a week.

**Table 7.43: Consumption of Meat (in gm)/Day/Family**

Sl. No.	Consumption of Meat in gm/day	Percentage
1.	Below 250 gm	21.69
2.	½kg (500 gm) - ¾kg (750 gm)	66.41
3.	¾kg (750 gm) – 1kg (1000 gm)	11.90
4.	1kg (1000 gm) – 2kg (2000 gm)	0.00
5.	2+kg (above 2000 gm)	0.00
	Total	100.00

Source: Field Survey 2015-16.

The table 7.43 demonstrates the average consumption of meat (gm) per day per family. As per above data, most of the families are found to consume ½ kg (500 gm) - ¾ kg (750 gm) of meat in a day.

### Consumption of Eggs

Average consumption of eggs in surveyed areas ranges between 2-4 pieces per day per family, but not on regular basis.

## Consumption of Milk

**Table 7.44: Average Home Production of Milk Per Household/Day**

Sl. No.	Response of villagers	Percentage Mean $\pm$ S.D.	Standard Error
1.	1 litre	29.66 $\pm$ 15.3883	6.2822
2.	2 litres	51.02 $\pm$ 15.2970	6.2450
3.	3 litres	8.27 $\pm$ 5.9665	2.4358
4.	4 litres	6.08 $\pm$ 4.6043	1.8797
5.	More than 4 litres	4.96 $\pm$ 3.0331	1.2382
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The table 7.44 depicts the average home production of milk per household per day in the study area with significant mean  $\pm$ S.D. and standard error. Most of the households produce 2 litres of milk with significant mean  $\pm$ S.D. 51.02 $\pm$ 15.2970 and standard error calculated as 6.2450. Very few families produce 3 litres, 4 litres and more than 4 litres per day.

**Table 7.45: Daily Average of Milk Purchased and Consumed Per Household/Day**

Sl. No.	Responses of villagers	Percentage
1.	1 litre	87.54
2.	2 litres	12.46
3.	3 litres	0.00
4.	4 litres	0.00
5.	More than 4 litres	0.00
	Total	100.00

Source: Field Survey 2015-16

The above table indicates that the purchase of 1 litre contributes maximum. Less number of people purchase and consume 2 litres of milk.

## Consumption of Butter

**Table 7.46: Average Monthly Butter (Ghee) Purchased from the Market/Household (in kg)**

Sl. No.	Butter (Ghee) purchased from the market/other places in kg/month	Percentage
1.	1	87.79
2.	2	12.21
	Total	100.00

Source: Field Survey 2015-16.

The table 7.46 indicates the average monthly butter (ghee) purchased from the market/other places per household in the study area. Maximum (87.79) households purchase 1 kg butter (ghee) from the market/other places. Some households purchase up to 2 kg butter. Villages people consume butter (ghee) according to the availability, festivals, health, death rituals, during the time of worship, and arrival of guests etc.

## Meals

**Table 7.47: Three Items in a Meal - Rice, Dal and Vegetables Every Day**

Sl. No.	Response of villagers	Percentage
1.	Yes (three items in a meal)	19.59
2.	No (three items in a meal)	31.82
3.	Only either two (dal or vegetables)	48.59
4.	Do not know	0.00
	Total	100.00

Source: Field Survey 2015-16.

As per the above data it is clear that only 19.59 percent respondents consume three items during the meal. The responses under no category are slightly higher (31.82 %) whereas the responses under only either two (dal or vegetables) category contributes maximum (48.59).

## Food (Meal Time)

The people of Sikkim are basically rural, and generally take two heavy meals and two light refreshments. Unlike in the other parts of the country, people of Sikkim in the rural area prefer to eat four meals a day: Morning meal (before going to morning field-work), Mid day meal or lunch (before going for the day's field-work), Afternoon refreshment and Evening dinner. Food culture not only depends on different communities living in Sikkim but also on economic status of the people and availability of food crops especially seasonal vegetables and fruits in different season in a year. It also changes with the people, space and time (Subba;2008)

### 1. Morning Light Meals

In the rural village of Sikkim the morning starts with tea or alcoholic beverage with dry-fried whole maize or soybean or beaten rice/maize or boiled potato or colocasia or any seasonal foods, and proceed for morning work of fodder/fuel-wood collection or agricultural works such as ploughing, field preparation, manuring, sowing, transplanting, weeding, harvesting, storing etc. Tea is taken with sugar or salt, with or without milk, or with a pinch of black pepper or ginger paste (Subba; 2008). Now a days people take sometimes biscuits, beaten rice etc. along with tea in the morning (6-8 am).

### 2. Mid-Day Meals (Lunch)

After finishing the morning work the rural people may come for lunch at home or the lunch is served in the field depending on the nature of work. *Bhat-dal-tarkari-achar* (rice-legume soup-curry-pickle) is the basic of the Sikkimese meal corresponding to cooked rice, *dal* or vegetable mixed with potato curry, meat or milk product - *mohi* and various kinds of pickle with hot chilly (Tamang, 2005:2-3 & Subba; 2008). The rice is very often substituted by *Makai ko Bhat - Dhenro, Hariyo Makai, Kodo ko roti, Phaper ko roti, Gahun ko roti* etc. The legume soup-curry is often substituted with seasonal vegetable curry or meat curry or *mohi* (Subba; 2008). However, people do not regularly have rice+vegetables/dal-achar, sometimes they partake dal + vegetables, otherwise they are satisfied with vegetable curry along with rice (9-11 am).

### 3. Afternoon Refreshment

In the afternoon, the rural people take light refreshment with tea or alcoholic beverages. The refreshments may be of seasonal root or tuber crops (boiled cassava, potato, colocasia, greater yams, sweet potato, Iskus-chayote root or fruit etc.), dry fried maize or soybean, *phapar ko roti, kodo ko roti, gahun ko roti, chewra* (beaten rice), *murai, champa* (roasted and powdered maize, wheat, barley, gram etc.)(Subba;2008). This is not common and compulsory in villages. The nature of refreshments generally between 2 – 5 pm is based on the type of work and physical exert.

### 4. Evening Meals (Dinner)

In the evening the rural people take tea or alcoholic beverages *tongba* - fermented millet beer put in bamboo or wooden cans (*Chang/Jaar/Bhati ko Jaanr*) before dinner. The dinner (6-8 pm) is also composed of the basic *Bhat-dal-tarkari-achar* as mentioned above. The rural people mostly eat cooked maize as staple food such as *Dheroh* (boiled maize rice). Rice is slowly being replaced by *roti or chapaati* (wheat-based baked bread), even in the rural areas. (Tamang, 2005:2-3 & Subba; 2008). This change of food is also observed by the researcher in the study area. But now a days

younger generation is not interested in *Dhero and Makai Ko chamal*, but are fond of rice-vegetables-dal- achar etc.

**Table 7.48: Change in Food Habits over Last 12 Months**

Sl. No.	Response of villagers	Percentage
1.	Yes	24.60
2.	No	75.40
	Total	100.00

Source: Field Survey 2015-16.

The above data makes it clear that the perception of people towards change of food habits in a village is less i.e. 24.60 percent. People who have not changed their food habits constitute 75.40 percent. However, people change their food habits based on time and situations. Those who have changed their food habits are found to consume chapatis, momo, thukpa etc. as a replacement of the standard meal of rice-dal-curry.

**Table 7.49: Afforded to have Balanced Meals over Last 12 Months**

Sl. No.	Response of villagers	Percentage
1.	Often true	16.69
2.	Sometimes true	29.44
3.	Never true	50.87
4.	Refused	3.00
	Total	100.00

Source: Field Survey 2015-16.

The above data is the response of villagers towards balanced meals. The highest response is of never true which covers almost 50.87 percent. The second highest response comes under sometimes true i.e. 29.44 percent. The next highest response comes as often true with 16.69 percent. However, 3.00 percent of the villagers refused to respond.

**Table 7.50: Not Enough Money to Purchase Food**

Sl.No.	Response of villagers	Percentage
1.	Yes	56.42
2.	No	38.29
3.	Do not know	4.29
4.	Refused	1.01
	Total	100.00

Source: Field Survey 2015-16

People who do not have enough money to purchase food at any time have been seen at village level in higher proportion with 56.42 percent. More than 38 percent of the respondents have said that they are able to purchase food for their family. A few refused to respond (1.1 percent).

**Table 7.51: Households having Problems in Satisfying Food Needs in Last 12 Months**

Sl. No.	Response of villagers	Percentage
1.	Never	16.87
2.	Seldom	39.69
3.	Sometimes	43.44
4.	Always	0.00
	Total	100.00

*Source:* Field Survey 2015-16.

The table 7.51 indicates the households having problems in satisfying the food needs during last 12 months. Majority of the respondents (43.44 percent) have said that they faced problems sometimes. People seldom having problems in satisfying the food needs constitute 39.69 percent. Nearly 17 percent respondents do not have problems in satisfying their food needs.

**Table 7.52: Food Brought Did Not Last and Did Not Have Money to Purchase**

Sl. No.	Response of villagers	Percentage
1.	Often true	25.79
2.	Sometimes true	41.35
3.	Never true	29.13
4.	Refused to answer	3.73
	Total	100.00

*Source:* Field Survey 2015-16.

The table 7.52 indicates the percentage of villagers who expressed their opinions on 'food brought did not last and did not have money to purchase'. The highest response was 'sometimes' true (41.35 percent). Second comes, the response 'never true' at 29.13 percent. The response 'often true' contributes 25.79 percent. Some villagers refused to respond.

**Table 7.53: Family Income Spent in Buying of Food**

Sl. No.	Response of villagers	Percentage
1.	Less than 1/3	8.63
2.	1/3 only	21.28
3.	More than 1/3	48.18
4.	Do not know	11.91
	Total	100.00

*Source:* Field Survey 2015-16.

In the table 7.53 it is observed that the highest percentage of villagers spent more than 1/3 of their budget in buying food (48.18 percent). The second highest response comes under 1/3 only (21.28 percent). People who do not know about their budget spent in food contribute 11.91 percent.

All the villagers are very much conscious about the rise in price of essential food items which does affect family's intake of food. If the price of commodities suddenly increase then people suffer and as a result they are unable to manage the monthly and yearly expenses too. Villagers/people get worried for not being able to purchase their next meal.

**Table 7.54: Family Members Remain Hungry Sometimes Being Unable to Buy Food**

Sl. No.	Response of villagers	Percentage Mean $\pm$ S.D.	Standard Error
1.	Yes	1.46 $\pm$ 1.0583	.4320
2.	No	95.22 $\pm$ 20.5231	8.3785
3.	Once in a year	0.00 $\pm$ .0000	.0000
4.	Sometimes	2.97 $\pm$ 1.4240	.5813
5.	Do not know	1.35 $\pm$ .9633	.3932
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16

The table 7.54 demonstrates that the family members remain hungry sometimes because they are unable to buy food. The data suggest that the highest percentage of villagers do not remain hungry with considerable mean  $\pm$ S.D. 95.22 $\pm$ 20.5231 and standard error calculated as 8.3785. The villagers sometimes remain hungry because of not being able to buy food and its corresponding mean  $\pm$ S.D. 2.97 $\pm$ 1.4240 and standard error is .5813. The people who do not experience any starvation in their life have a significant mean  $\pm$ S.D. 1.35 $\pm$ .9633 and standard error as .3932. Very few people in the villages have experienced acute hunger in their life.

**Table 7.55: Sleep without Food at Night**

Experience of sleeping without having food	Percentage
Yes	1.06
No	98.94
Total	100.00

Source: Field survey 2015-16.

Some of the elderly people as well as the farmer's family members had experiences of starvation during night time in their earlier days due to unavailability as well as lack of purchasing power of food. In village areas still some people are found to be sleeping without having food.

**Table 7.56: Main Reasons for Food Shortage in a Household**

Sl. No.	Response of villagers	Percentage Mean $\pm$ S.D.	Standard Error
1.	Low agricultural production	52.31 $\pm$ 23.4264	9.5638
2.	Inadequate supply (due to heavy rainfall roads remain blocked)	5.46 $\pm$ 3.8987	1.5916
3.	Lack of purchasing power	29.84 $\pm$ 16.2480	6.6332
4.	Storage problems	11.33 $\pm$ 9.0553	3.6968
5.	Large family	1.06 $\pm$ .6723	.2744
	Total	100.00 $\pm$ 25.3456	10.3473

Source: Field Survey 2015-16.

The above data indicate the perception of people on food shortage in a household. The food shortage seems to be higher due to low agricultural production with significant mean $\pm$  S.D. 52.31 $\pm$ 23.4264 and the corresponding error calculated as 9.5638. The next strong reason is indicated as lack of purchasing power with significant mean $\pm$  S.D. 29.84 $\pm$ 16.2480 and the standard error calculated as 6.6332. Storage problems come next, but to a lesser extent with considerable mean $\pm$  S.D. 11.33 $\pm$ 9.0553 and the standard error calculated as 3.6968. Sometimes, inadequate supply of food due to heavy rainfall and road block could be the reason for food shortage in a household with significant mean $\pm$  S.D. 5.46 $\pm$ 3.8987 and standard error as 1.5916. Hunger situation occurs more in monsoon during long periods of rainfall. Large family has less percentage compared to others with the significant mean $\pm$  S.D. 1.06 $\pm$ .6723 and its corresponding error is .2744. Food is made available for every family member in a household, if they have enough purchasing power. People depend mostly on markets for the purchase of essential commodities. Basically in the hill areas of Sikkim landslide is the major problem during rainy season i.e. June to September. As such production and supply of food grains is not adequate during this period.

**Table 7.57: Young Generations Involved in Agriculture Sector**

Sl. No	Response of villagers	Percentage
1.	Yes	9.91
2.	No	90.09
	Total	100.00

Source: Field Survey 2015-16.

According to respondents, high percentages of youths are not interested in agricultural activities. Some of the plausible reasons on why younger generations are not indulged in agricultural activities are indicated as follows:

1. Water scarcity
2. Rugged topography

3. More interested in obtaining educational degrees for better life and prospects
4. They are nowadays educated and do not want to spend their life in agricultural field
5. Everyone is interested to work in offices or in other field rather than agricultural field.
6. Agricultural production is not satisfactory

### **Population Growth and Food Production**

According to Malthus theory there is reciprocal relationship between population growth and other demographic changes on one hand and socio-economic changes on the other.

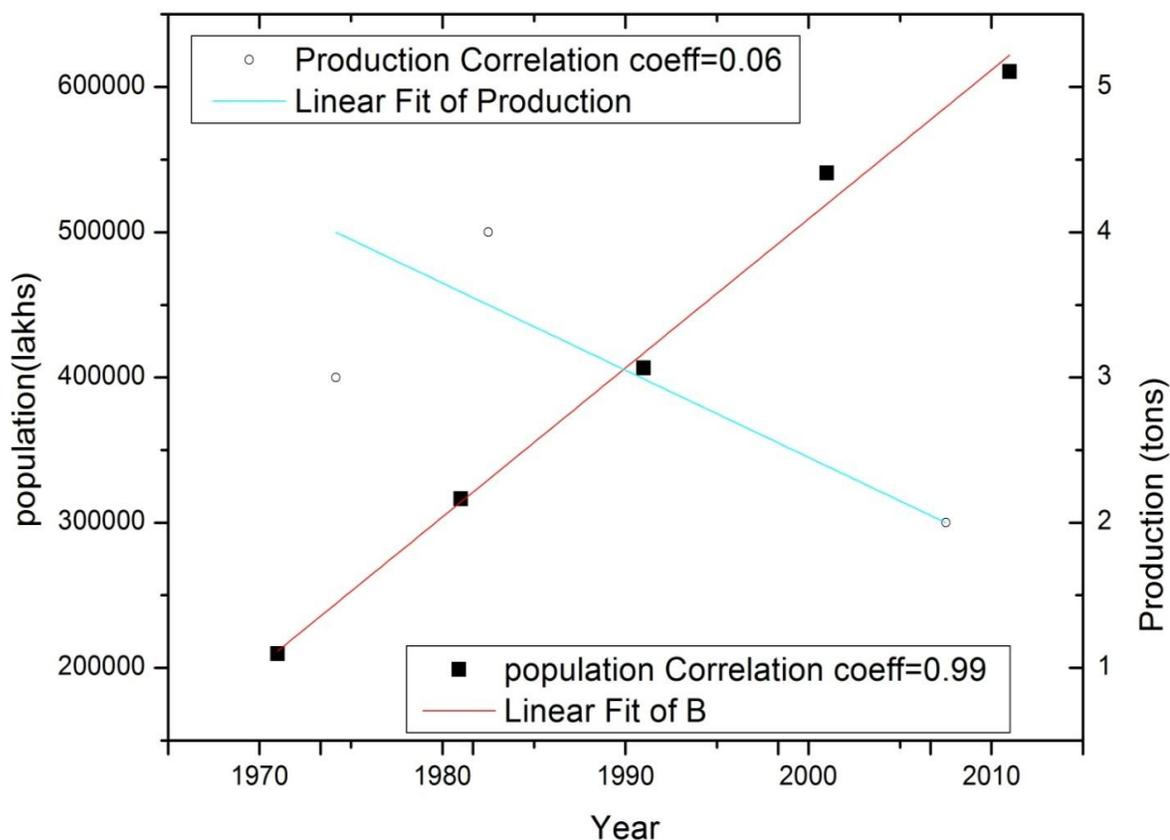
While developing his principle he assumed two postulates: first, that food is necessary for the existence of man; second that the passion between the two sexes is necessary and will remain nearly in this present stage. Having assumed these two postulates, he asserted that the power of population to reproduce is indefinitely greater than the power in the earth to produce subsistence for man. Further he said that, population, if goes uncontrolled, increases in a geometrical ratio (1,2,4,8,16,32,64,128,...) on the other hand, subsistence increases only in an arithmetic ratio (1,2,3,4,5,6,7,8,...). Malthus measured the unit of time in which a population could double, if it were not checked by lack of subsistence, to be about 25 years (Chandna, 2014).

Further widening of the gap between population and subsistence will increase man's propensity to push upon the means of subsistence. As a result, society gets divided into two sections of people i.e. the rich (haves) and the poor (have nots). Moreover, the increasing gap between the population and resources shall ultimately lead to the point where gloom and poverty shall become unavoidable. The following tables show the concept of Malthus theory with respect to population growth and production of food grains in Sikkim. While population increases in lakhs, production is increasing in thousands metric tons only. Thus there is always a gap between two aspects and it is for this reason we are unable to say that we are food secured.

**Table 7.58: Total Population and Production of Food Grains in Sikkim (1971 to 2011)**

Year	Total Population	Year	Production of Food grain (MT)
1971	2,09,843	1975-76	47,550
1981	3,16,385	1980-81	53,990
1991	4,06,457	1990-91	83,410
2001	5,40,851	2000-01	1,03,211
2011	6,10,577	2010-2011	1,03,410

Source: Census of India (1981-2011) and FS & AD, 2010-11 & Gazetteer of Sikkim.



**Figure 7.6: Population Growth and Production of Food grain of Sikkim (1971 to 2011)**

As per above figure, it is found that, the correlation coefficient of population growth is 99 percent, but the production correlation coefficient is only 0.06 i.e. 6 percent. Hence, a very poor correlation has been observed between the two variables. Therefore, people of Sikkim depend on other states for different commodities.

As per the above figure it is clearly seen that population growth is higher than production, therefore the lack of subsistence or food security.

Growth rate of population has outweighed the growth of food grain production and has transformed Sikkim from food surplus state to a food deficient state (Chakrabarti; 2012).

Sikkim like any other mountainous area is a food-deficit State. The food grains produced in the state can feed its population only for three and half months, therefore food grains have to be brought from other states for feeding its population for seven and half months every year. Yet about 89 percent of the people living in the rural areas are directly or indirectly dependent on agriculture, horticulture and livestock rearing, as they have no other options for earning their livelihood. In Sikkim, mixed farming is the only means of livelihood for food and nutritional security of the people who depend on agriculture production, diversification of the food basket, availability of low cost and environmentally safe food products, and equitable distribution and management. It involves efforts to generate purchasing power for physical and economical access to food by all people at all times (Subba; 2008).

In the study areas it is found that there are three categories of food scarcity i.e. low, medium and high. The low food scarcity has been seen in the months of January, August, September, October, November and December. Medium food scarcity has been found in the months of February, June and July but high scarcity of food has been seen in the months i.e. March and April. The analysis suggests that every month there is some scarcity of food in Sikkim.

## References

- Baby, K. 2012. "Food Security and Public Distribution System; Issues and Concerns," *Kurukshetra*' Ministry of Rural Development, Vol. 60 No.5 (March):22-23.
- Chandna, R.C. 2014. *Geography of Population; Concepts Determinations and Patterns*. New Delhi: Kalyani Publishers: 531-532.
- Chakrabarti, A. 2012. "Food Security in Sikkim: A Critical Review" In *Politics, Society and Development* edited by M.Yasin and D.P. Chhetri. Delhi: Kalpaz Publications: 214.
- Choudhury, Maitreeye. 2004. "State of Agriculture in Sikkim" In *The Himalayan Miscellany*, Vol.15. CHS, University of North Bengal: 25-34

- Datta, P.C. and Pradhan, B.C. 2006. "Nutrition and Food Insecurity –A Problem of New Millennium" In *Agriculture Food Security Nutrition and North –East India*, North-East India: 263.
- De, K. U. 2006. "Food Security and the Related Issues-some Reflections on the State of Tripura" In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 154, Delhi: Mittal Publication: 154.
- Dhar, B. 2006. "An Aspect of Food Security on the High Altitude Region of the Eastern Himalayas-A Case Study on the Thingbu-pas of Arunachal Pradesh," In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 169-70, Delhi :Mittal Publication:169-70.
- Dubey,A and Kharपुरi,O. 2003. "Hunger and Poverty in North-eastern States: Implications for Food Security," In *Towards A Food Secure India*, edited by S.Mahendra Dev, K.P. Kannan and Nira Ramachandran, 165, New Delhi: Institute for Human Development: 165.
- GoI (Government of India). 1981-2011. *Census of India (1981-2011)*. GoI.
- GoS (Government of Sikkim). 2009. *Sikkim; 15 Triumphant Years of Democracy (1994-2009); A Call to Action*. Gangtok Sikkim: Department of Information and Public Relations, GoS: 110-111.
- 2011. *Annual Progress Report 2010-2011*. Krishi Bhawan , Tadong, Gangtok: Development of Food Security and Agriculture, GoS.
- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS.
- 2016. *Achievement-23 Years of Ensuring Food Security*. Department of Food & Civil Supplies & Consumer Affairs, GoS: 12-42.
- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS.
- Husain, Majid.2004. *Human Geography*. New Delhi: Rawat Publications: 225-226.
- Kalita, et.al. 2006. "Food and Nurtition Security"- An Overview," In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 237, Delhi: Mittal Publication: 237.

NSSO (National Sample Survey Office), 2014. *Nutritional Intake in India, 2011-12*, Report No. 560, NSS 68<sup>th</sup> Round, October, 2014. New India: National Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India.

Radha, V. 2009. *Women and Rural Households Food Security*. New Delhi: Serials Publications:116.

Sharma, A. 2005. *Environmental Studies*. Delhi: Surjeet publications.

Singh, R.K.P. et.al. 2006. "Food and Nutritional Security in the North-Eastern States-An Analysis" In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 129, Mittal Publication.

Subba, J.R. 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House: 86-129

Sukhatme. 1987. "Economics of Nutrition", *Indian Journal of Agricultural Economics*, Vol.32, No.3.

Swaminathan, M. S. 2001. "Food Security and Sustainable Development," *Current Science*, Vol.81, No.8. , 25<sup>th</sup> October.

Tiwari, R. C. 2010. *Geography of India*. Allahabad, India: Prayag Pustuk Bhawan: 266-269.

Tulachen, Pradeep M. 2001. "Mountain Agriculture in the Hindukush-Himalaya; A Regional Comparative Analysis" In *Mountain Research Development*, ICIMOD, Vol. 21, No. 3.

Vyas, Vijay S. 2005. *Food Security in Asian Countries in the Context of Millennium Goals* (ed.), New Delhi: Academic Foundation:30.

World Health Organisation (WHO) .1985. "Energy and Protein Requirements", In *Report of a Joint FAO/WHO/UNI/ Expert Consultation*, Geneva : Technical Report Series No.724.

### **Newspapers**

*Sikkim Express* (Local Paper). 2009. "Chief Minister's Independence Day Message to the People of Sikkim," *Sikkim Express*, 18<sup>th</sup> August.

*Sikkim Express* (Local Paper). 2010. "DESME tags 21,618 BPL households; Food & Civil Supplies Distribution rice to 43,428 BPL families," *Sikkim Express*; 11th May.

*Sikkim Express* (Local Paper). 2010. "Distribute, Procure, Store and Sow," *Sikkim Express*, (17.09.2010- Local Paper).17<sup>th</sup> September.

*Sikkim Express* (Local Paper). 2013. "Secretary- Department of Food Civil Supplies & Consumer Affairs," *Sikkim Express*; 3<sup>rd</sup> August.

**Web Link**

[www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html-date](http://www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html-date) (Accessed on March 28, 2015).

[www.bharatonline.com/sikkim-tours/heritage-tour.html](http://www.bharatonline.com/sikkim-tours/heritage-tour.html) (Accessed on March 28, 2015).

[14.139.206.50>jspui>handle](http://14.139.206.50>jspui>handle) (Accessed on September 24, 2016).

[https:// www.clearies.com>public-distribtuion](https://www.clearies.com>public-distribtuion) (Accessed on January 02, 2018).

[www.ncbi.nlm.gov](http://www.ncbi.nlm.gov) (Accessed on January 08, 2018).

[chartsbin.com>view/12730](http://chartsbin.com>view/12730) (Accessed on January 08, 2018).

[www.foodandenvironment.com](http://www.foodandenvironment.com) (Accessed on January 20, 2018).

[www.fao.org](http://www.fao.org) (Accessed on January 27, 2018).

[www.ncbi.nlm.nih.gov>articles](http://www.ncbi.nlm.nih.gov>articles) (Accessed on January 27, 2018).

# Chapter 8

## Major Findings, Conclusion and Suggestions

### Major Findings

Despite adversities, agriculture is the main occupation of the inhabitants in the mountain state of Sikkim and it forms the basis of the socio-cultural pattern of the territory. Basically, land and water are the two important aspects of natural resources which contribute considerably to agriculture of Sikkim. Food crops, usually grown in valleys, terraces and hill slopes, supplemented by some animal products satisfy the basic energy intake of the inhabitants.

The habitable areas in Sikkim extend from 300 to 2100 m, but the actual settlement has been confined only below 1800 m amsl. According to 2011 census more than 75 percent of people live in rural areas. Due to the absence of any sizeable flat land the distribution of population is sparse throughout the state.

Agricultural development in the districts as well as the state gained momentum immediately after the merger of Sikkim with India. The state's economy is largely agrarian, based on the terraced farming of rice and the cultivation of crops such as maize, millet, buckwheat, wheat, barley, pulses, oilseeds, potato, ginger, oranges, tea and cardamom.

Sikkim occupies only 0.2 percent of geographical area of the country. But most of the land is unfit for agricultural use due to rocky precipitous slopes, rugged topography etc. The department of Agriculture and Horticulture has prepared a month-wise calendar for the cultivation, transplanting, harvesting etc. of different crops in Sikkim. Similarly, different communities of Sikkim – Bhutia, Lepcha and Nepali have also prepared the month-wise calendar according to their tradition, culture and religious aspects in relation to agricultural activities.

The agro-economics of the entire state is determined by physiographic conditions and socio-cultural compounds. The state has been divided into four districts according to administrative convenience and regional location i.e. East, West, North and South. The South district has 148 Revenue Blocks, 452 villages, 47 Gram Panchayat Units and 271 Panchayat wards. For the purpose of research only 15 Gram Panchayat Units (GPUs) were randomly selected on the basis of agro-climatic zones. Altogether there were 8,975 households in the 15 GPUs under

study, out of which 1,500 households were sampled. To reach the target of above 15 percent, 100 households from each GPU were selected by random sampling method. The selection of GPUs was done as follows: Set I - 300m to 900m (Namphing, Legship, Rong-Bul, Tarku, Turung-Mamring), Set II - 900m to 1500m (Sadam-Suntaley, Tinik Chisopani, Namthang-Maneydara-Assangthang-Wok-Omchu,) and Set III - 1500m to 2100m (Borong-Phamthang, Barfung-Zarong, Paiyong, Tinkitam-Rayong and Perbing-Dovan).

The agricultural activities for livelihood in study areas are mainly categorized into three groups - mainly subsistence, mainly commercial and no agricultural activity. The highest number of Sikkim's farmers depends on mainly subsistence which covers around 96 percent of the households, while a handful (3.4 percent) are progressive farmers, in the sense they prefer commercial farming over traditional agriculture. Some of the households i.e. 0.33 percent in villages are not involved in agricultural activity due to small size of family, water scarcity, old age, etc and are involved in other non-farm activities.

The food chain system of the state is mainly dependent upon crop and animal production which is largely based on fixed farming. Under the land-locked situations prevailing in most parts of the state, field crop production occupies the primary position and agriculture and livestock play supplementary and subsidiary roles. Moreover, cattle supply the farm power by means of bullocks which are the backbone of agricultural operations where mechanization of farm power is not feasible due to topographical features. The animals under this system thus have a multi-functional utility and their products such as milk, meat and eggs are by and large utilised domestically and surplus if any is sold in the neighbourhood or in nearby market. Cattle, goats, pigs and poultry, especially chicken which are reared in the mid and lower hills by the settled farming community come under the subsidiary system.

Agriculture along with livestock is the single largest source of employment in the state. Over 80 percent of the farmers in the state own livestock and earn supplementary incomes from them. The four main livestock – cattle, goat, pig and poultry are main economic support to the villagers. As for the number of livestock available in selected GPUs i.e. poultry has the highest number, cattle comes second, goat third and pig, last. Many problems have come up in the state due to high population growth, limitation of land and increasing unemployment. Revamping of the farming systems by incorporating science and technology interventions is imminent. Livestock development has enormous potential in bringing about a favourable change in the rural economy of the marginal farmers.

The main agricultural and horticultural crops grown in the district within the elevation of 300m to 2100m are – maize, ginger, paddy, barley, buckwheat, mustard, pulses, cardamom, orange and vegetables. On the whole, eight different crops such as maize, rice, wheat, finger-millet, barley, buckwheat, pulses and oilseeds are taken into consideration in the state. The

crops found in study areas are maize, rice, ginger, paddy, barley, buckwheat, mustard, pulses, cardamom, orange and vegetables. Some of the crops are grown in very limited areas. As for availability of crops, maize and ginger constitutes nearly 50 percent. Maize is the main crop followed by rice, wheat, pulses, potato and vegetables that are predominantly grown in hill terraces. Few cash crops such as ginger, cardamom, tea, orange etc. play an important role in the economy of the district.

The predominant crops of Set I GPUs are rice, maize, pulses, ginger, wheat, mustard, potato, cabbage, cauliflower, millet, beans, soybean, buckwheat, orange, cardamom and vegetables.

In Set II (900m -1500m) the main crops of five GPUs are rice, maize, pulses, ginger, wheat, mustard, millet, soybean, buckwheat and vegetables.

In Set III (1500m- 2100m) the main crops of five GPUs are rice, maize, pulses, ginger, wheat, mustard, millet, soybean, buckwheat, wheat and vegetables.

Crop combinations in the study area according to field survey are: paddy-pulses-vegetables, paddy-vegetables-fallow, paddy-ginger, maize-pulses-vegetables, maize-soybean-vegetables, maize-buckwheat-vegetables, paddy+pulses, paddy+pulses+vegetables, maize+pulses+vegetables and maize+ginger. But maize-buckwheat-vegetables show fewer practises in comparison to other types of cropping.

Farmers still use traditional equipments in agricultural field. Though the power tiller is distributed to the progressive farmers by the Agriculture Department, Government of Sikkim, it has remained only as a trial and error tool. Power tiller's success in a hill state like Sikkim is yet to be proven. Moreover, the choice of crop is mostly local consumption oriented and system of cultivation is established in low input, capital, yield and technology because still primitive form of agriculture is most dominant in the district.

After 2003, Sikkim government suddenly banned the use of chemical fertilizers in the agricultural field and instead encouraged organic farming only. In 2016, Sikkim was declared as the first fully organic state in India. After banning of chemical fertilizers, villagers started using different types of organic fertilizers such as cow dung, goat manure, pig manure, poultry manure, leaves collected from vicinity jungle, compost, and sometimes organic fertilizers provided by Agriculture and Horticulture Department.

Sikkim's agriculture has been developing fast over the last decades. It started to happen after the introduction of better farming techniques and better irrigation facilities which help increase agriculture production. The government has encouraged organic farming in the state with a view to produce eco-friendly crops, vegetables and fruits. In order to improve more in

organic farming the state government has started training and awareness programmes for farmers on EM composting training, methods for preparing organic manures, negative impacts of chemical fertilizers etc. and further to create awareness levels to the farming community and improve their organic practices and many more innovative programme for the long term benefit of the rural farmers.

The state is fully focused for the betterment of people of Sikkim in general and poor people/rural people in particular. The state authorities have initiated lots of schemes for the people so that they can be benefited and improve the quality and quantity of different food items as well as improve the purchasing power of people. To uplift the lot of BPL people relief is given from time to time by distribution of milk cow, pig, cardamom sapling, ginger, turmeric, HYV of seeds, organic manure, green house scheme, water tank, poly pipe, power tiller machine, different farmer trainings etc.

In the month of June, 2018 as per the 14<sup>th</sup> Finance Commission 2017-18, state government has opened organic stalls at Singtam highway side, by providing stalls for vendors worth Rs. 4,63,650. After the declaration of organic state, initiatives have been taken to set up many organic stalls in different places of Sikkim. The main target of government is to open at least one or two organic stall in the main town of every district.

Though maize is never a part of the staple food item, it is taken as substitute food sometimes in absence of rice in Sikkim. Its production still contributes over 70 percent of the total food grains production in Sikkim. The production of maize in South district has always been at the top among all crops but it cannot fulfil the requirement of food. The productivity of maize has been increasing. Within a period of five years it has increased by 4.9 percent from 2000-01 to 2005-06, likewise from the years of 2005-06 to 2010-11 increased by 4.8 percent, and again by 9.5 percent from 2010-11 to 2015-16.

Horticultural crops such as large cardamom, ginger and mandarin orange are the main cash crops which support the ecology and agro-climatic conditions of Sikkim. Horticulture is now one of the chief economic activities of the people of Sikkim. Large cardamom, ginger and turmeric are the principal spice crops, while mandarin orange, guava, mango, banana and so on are the principal fruits grown in the state. The department of Horticulture is deeply involved in motivating and providing technical guidance to local farmers. Sikkim is also famous for flowers. The scheme of Horticulture Mission for North East and Himalayan States (HMNEH) stands as a backbone of horticulture development in Sikkim and through it there has been a considerable enhancement in funding and amendment in pattern of assistance.

Agriculture pattern has been changing slowly in Sikkim with the progress of concepts and agricultural technology. Agricultural pattern has transformed itself from shifting to subsistence

and in the recent past has oriented itself towards commercial production, the reasons being the cultivation of off-season vegetables for generating good income.

The South district of Sikkim stood 1<sup>st</sup> in the state in vegetables production. The officials of Horticultural Department, Government of Sikkim, have adopted many schemes sponsored by central government in 2007, such as 'Vegetable Initiative' at the national level under the Rashtriya Krishi Vikas Yojana. The state has been benefited from another centrally sponsored scheme particularly the Horticulture Mission for North-East and Himalayan states – which was launched during 2001-02 under the Technology Mission for North-East for integrated development of horticulture. Sikkim government initiated an action plan especially in Gangtok, East district and Namchi, the South district headquarter, for practicing the vegetable initiative scheme.

At the present scenario, demographic and economic expansions have challenged the limits of economic, social and ecological sustainability, giving rise to questions about food security at a global level.

Population growth and food security are directly linked with food supply, food habits, health and nutrition. Population growth always wants for basic needs of food and shelter. If the requirements are fulfilled then there is no question of any effect on people's health and nutrition; otherwise the consequences will be counterproductive as far as health conditions, nutrition intensity and the quality of life are concerned. Food supply relies on the domestic food grains production and import quantity. Food production in the mountains depends on land available for cultivation, feasibility for cultivation of different crops and different facilities that would benefit the farmers. Rapidly increasing population juxtaposes reduction in total size of arable land which indicates a serious problem.

Sikkim faces food deficit due to unfavourable agro-climatic conditions, physical features etc. The state obtains food grains to the tune of 45,849 tons of rice and 636 tons of wheat annually under different Centrally Sponsored and State programme from FCI and distribute to the consumers through PDS (Subba, 2008). Economic Survey 2006-07 stated that Sikkim continues to remain a highly food deficit State. The deficits are seen more remarkably in oilseeds and pulses production.

According to HDR, 2001 maize cannot be considered as staple food in Sikkim, even though its production has steadily increased since 1980-81, and contributes over 50 percent of the foodgrains production in the state. But the share of rice, the main food item in the traditional diet, in total food production, has increased only by 20.7 percent. As Sikkim has been declared a food deficit state, there is no indication of marketing food grains outside the state.

Besides maize and paddy, various other cereals crops also grown in Sikkim. Though the contribution to other cereals in agriculture production is only 0.33 percent, they generate income and are important sources of food. Expenditure on cereals occupies the highest position in household budgets. Frequency of pulse consumption is little higher than the frequency of consumption of meat and fruits for the sample rural households.

According to Socio-Economic Survey 2006, the state is allotted 34,400 quintals of rice every month under APL and BPL scheme and 2,450 quintals of wheat. The annual requirement of food grains to tide over the scarcity of food in Sikkim in the past decade can be understood from the fact that during 2007 the government of Sikkim demanded 5000 metric tons of rice as buffer stock. The government of Sikkim also accepted in 2009 that there is shortfall of 18,254 tons of fruits and vegetables, 2,050 metric tons of beef per annum, pork per annum 380 metric tons and 135.24 lakhs eggs per annum.

In 2009 two schemes were announced by the state, namely, Mukhya Mantri Poustha Ahaar Yojana – monthly free distribution of 4 kg of mixed pulses to BPL families and Mukhya Mantri Jeevan Rakshyak Kosh. In India the per capita Calorie (Kcal/day) intake of rural population is 2233 and urban population is 2206, but in Sikkim it is 1614 for rural and 1890 only for urban population as per 2011-12 data. Sikkim has low per capita intake of Protein and fat as compared to India in both rural and urban areas.

There is a deficit of nearly 72,000 MT (food grain) 12500 MT (pulses) and 3500 MT (oilseeds) respectively. Rice is the staple food even though sometimes *Makai ko Chamal* substitutes rice. The highest average consumption of rice per family is between 1kg (1000gm) - 2kg (2000gm). As per data on family size, the average number of persons in a family is five. Family size always affects the rate of food consumption. The requirement of rice per member per family is 300 grams per day = (1500gm/5 members= 300gm) but the per capita availability of rice in the state is 158 gms/day, which is far below the National average of 417 gm during 2001-02.

If the per capita consumption of rice per day is 300 grams, then state needs 65,942 tons of rice per annum. The domestic production of rice as per 2015-16 report is only 19,690 tons. In other words, there is shortfall of 46,252 tons of rice per annum. It is clear that only 22.99 percent is contributed by domestic production while remaining 77.01 percent is imported from other states. Needless to say the state is food deficit and insecure. In the survey areas the people were seen to take chapattis, momo (meat or vegetable dumplings) and other items from wheat (maida/atta), though not frequently. The monthly consumption of wheat on an average is 3-4 kg. If the average family size is five persons, then per year need amounts to 5,935 tons, but the state produces very small quantity of wheat, about 350 tons only (2015-16). Therefore, there is a shortage of 5,585 tons of wheat per annum in the state. Clearly, 94.43 percent of wheat

requirement depends on other states and only 5.57 percent comes from home production. Overall it is seen that there is foodgrains deficit in Sikkim. The state arranges to distribute very low cost rice to the BPL families. If allotted rice is withdrawn by the government there will be problems of feeding for as much as 63.74 % of households in the surveyed area. However, 36.26 % would not get affected if food subsidy is withdrawn. Still, the situation seems to be alarming as far as food security is concerned.

In the case of vegetables production and consumption, per capita per day scenario in Sikkim is very interesting and impressive one. As per field report per capita consumption is around 250 grams per day, but according to recent data (2015-16) prepared by Horticulture department it is stated that per capita consumption is 280 grams. The state's own production of vegetable is 80,976 tons while domestic requirement is 61,546 tons. It gives the positive indication in state that there is about 19,430 tons of surpluses in vegetable production. That answers the question why Sikkim government has banned the import of inorganic vegetables from outside state. Actually it is for the betterment of Sikkim's people.

To make sure about storage and proper distribution of foodgrains many new food godowns have come up at Chungthang, Pakyong, Ravangla, Chongrang and Dentam. For the implementation of different schemes and policies, the Food & Civil Supplies and Consumer Affairs Department, Government of Sikkim operates a total of 27 Food Godowns in the State which are under supervision of the District Food and Civil Supply Officials. From these Godowns essential commodities such as rice, sugar, salt and 'atta' (wheat flour) are distributed through Fair Price Shops registered with the Food & Civil Supplies Department. Again, department has issued license to 1,538 shops including Cooperative Societies to run as Fair Price Shops all over the state.

The increasing gap between the population and resources shall ultimately lead to the point where gloom and poverty shall become unavoidable. The concept of Malthus theory applies in Sikkim with respect to population growth and production of food grains, where population increases in lakhs but the production is increasing in thousands of tons only. Thus there is always a gap between two aspects and it is for this reason that the state is food insecure.

## Conclusion

Physical environment and human economic activities are very closely linked. From the beginning human being is conscious about insecurity in terms of food and shelter. Human being always tries to make relation with physical environment in order to sustain life. People living in mountain environment have to work harder to maintain this relation. Mountain agricultural environment is not very conducive for bountiful production, particularly food grain production, and often cannot meet the food requirements of mountain households.

The main spotlight of this dissertation is on i) Agro-economic environment and ii) Food security in Sikkim. In order to understand the aforementioned aspects and different stages of agriculture development in Sikkim in general and South district in particular, studies have been made on people tilling the agriculture field, adopting traditional as well as modern methods, practicing different cropping patterns, off season vegetables cultivation, adopting new concept on horticulture i.e. organic farming, rearing of animals, development plan for agriculture improvement and policy instruments for making cultivation environmental friendly – all that would make the state more food secure.

Agricultural economics is that branch of knowledge which takes into account agriculture and economics together. The study of agricultural economics is of recent origin. Agricultural economics is a social science which teaches how to maximize production, yields outputs and returns from agricultural activities. Following the thumb rules of agro-economics, most of the farmers now follow the mixed farming system i.e. Agriculture+Horticulture+Animal Husbandry. In Sikkim too, mixed farming like raising Crops+Animals+Trees together is being practiced.

The agro-economic activities which are now being adopted by the farmers can make the socio-economic environment healthier and stronger. Environment can be either natural or manmade; generally the latter one is more active in the case of agro-economic milieu. Almost every system in agriculture is essentially formed of mixed farming with arable cultivation of cereals and tubers, livestock-rearing and intensive use of forests. The rugged topography offers very little of its land for cultivation (estimated as only 11.13%. However some data indicate 15.36 % as the total operated area in the state). According to the 2015-16 progress report of Food Security & Agriculture Development Department, Government of Sikkim, if horticulture and agriculture are combined together (total land 73,612.8 ha+69,423 ha=1,43,035.8 ha), 20.15 % operated land is estimated to have been dedicated to agriculture+horticulture as whole. As per 2015-16 data agriculture+horticulture land use cover in South district is estimated to be around 41,790 hectares or about 5.89 percent of the total geographical area.

The habitable region in Sikkim extends up to 2100m, which constitutes about 23.9% of the total geographical area; settlements are mainly limited to the area lying below 1800m and are generally clustered in the southern part of the state. The average slope of the study area is 39 degrees. The sloping lands are three to four times less capable in meeting the food requirements of calorie and protein because it can hardly sustain three to four persons per ha per annum against the sustainability of nine to ten persons in a plain land.

More than 65% of the population of Sikkim is engaged in agricultural activities. Land plays vital role where the socio-economic development is limited particularly when economy is largely based on agriculture. More than 70 percent of the rural population depends on agriculture and other allied sectors in order to secure their economic, food and nutritional aspects.

Sikkim is known as '*Renjong*' or '*Denzong*' or 'the valley of rice'. There are two main rivers i.e. Teesta and Rangit which drain the state from north to south, forming wide valleys in the lower parts of Sikkim. However rice cultivation is possible only in the irrigated and terraced lands. It can be grown in the areas which have altitude ranging from 300 to 1700 metres. For centuries most of cultivable land as well as cardamom plantations were under the controls of Bhutia *kazis* (landlords and aristocrats), which continues even today.

In the past there were land reform demands consisting of three points: abolition of landlordism, introduction of responsible government and Sikkim's accession to India. A set of land reforms and land ceiling were implemented after the abolition of monarchy and Sikkim's annexation with India. Regarding ceiling on agricultural land some of the important points that were decided are: single adult person can hold up to six and half acres of land, two adult family members can hold twelve and half acres, and families having more than five members can hold twenty and half acres of land. For the religious institutions (monastery estates) the ceiling is much higher, ranging between twenty to sixty acres of land. But the ceiling is not properly maintained in the case of Lepcha and Bhutia land; as such their land cannot be purchased by other communities except the tribal communities. So agriculture is not fostering due to unequal distribution of land. In Sikkim, the all India land ceiling of 12 acres, which is blanket ceiling irrespective of topographical variations, is difficult to implement. The *Kazis* in Sikkim still hold considerable amount of land, some reportedly have 1500 acres of land even today.

For the first time detail land utilization statistics of Sikkim was published in 1995-96 by the Department of Agriculture, Government of Sikkim. The land holdings in Sikkim are large, medium and small/marginal. The large land holdings, mostly owned by the Bhutia landlords are few in number. In the South district maximum land holdings are in marginal category. As per primary and secondary data, marginal land holders constitute 67.03 percent which is

obviously much more than the other categories combined together. In South district about 68.33 percent of households are located in dry, rain-deficient area. Consequently, much of the land holdings in the district are dry land. Community-wise distribution of households shows that the Rai community owns most of the dry land holdings due to major share in population (Socio-economic Report 2006).

The number of workers in rural areas of South district is much higher than in urban areas. A large number of workers in the district are marginal. The female marginal workers are more in number (13,826) than male workers (10,029), 15.92 percent more than male marginal workers. The male workers are mostly main workers but the female workers have less time for outdoor activities. Among the selected GPUs, Barfung-Zarung and Namphing GPU has the highest main worker. Animal Husbandry helps to supplement income and food for the farming households in the forms of dairy, poultry, goatery and piggery. Dairy is the main income source in upper GPUs (1500 - 2100 metres amsl), poultry in middle (between 900 to 1500 metres amsl) and again dairy in lower GPUs (300-900 metres amsl). Though self consumption is often found to be the main reason for rearing of livestock, in some households poultry farming is done in small/medium scale on commercial basis. Average income and expenditure of farmers/villagers fall within the range of Rs. 30,000-40,000 per annum.

Workers remain involved in agricultural activities between 6 months to 9 months. Agricultural land remains uncultivated (fallow) for more than 3 months in a year due to scarcity of water, lack of proper irrigational facilities and lack of man power. Earlier, to fulfil the shortage of labourers, the farmers used to practice '*Parma System*' (exchange of agricultural labourers) from one family to other family during the time of sowing and harvesting. However, '*Parma System*' has slowly disappeared due to decrease in the number of family members, individual involvements in various other vocations, and the onset of compulsory education policies of the government.

The annual growth of Gross State Domestic Product of Sikkim at current prices in 2014-15 accounted by agriculture is 13.35 percent. Sikkim's Gross Domestic Product was estimated at US dollar 1.57 billion in 2014.

Mainly two types of cropping seasons have been found i.e. kharif season and rabi season, but recently a sort of agricultural revolution has occurred in the form of off-season vegetables which has changed the horticulture scenario in Sikkim. In 2016, Sikkim has been declared as the first fully organic state in India. Nowadays the farmers are using only organic manures in their agriculture field. As a corollary to the government of Sikkim announcement of November, 2017, vegetables grown inorganically outside the state have been banned in Sikkim after 31<sup>st</sup> March, 2018. The Government of Sikkim has made it compulsory to grow only organic vegetables in the state, so that people of Sikkim can have access to hygienic and

healthy vegetables in order to protect themselves as well as horticultural crops from various diseases. Access and availability of healthy and hygienic crops and vegetables is one of the essential elements under food security. Moreover, horticulture is nowadays gaining popularity for domestic consumption as well as marketability.

Maize is the main crop in Sikkim, and also in the study areas, followed by rice, pulses, potato, ginger, vegetables etc. Maize is one of the staple as well as substitute foods of rural people in the state. Though rice is the primary staple food, sometimes *makai ko chamal* (maize granules) is consumed as substitute of rice. As for cash crops, ginger is a good income source for small and marginal farmers that can be grown up to an altitude of 1500m above mean sea level. However, it was observed during field survey that some of the farmers have of late reduced the cultivation of ginger due to low market price. Farmers are still found to rely on traditional crops more than modern or HYV crops.

The farmers in the study area often get frustrated due to low rainfall/lack of irrigational facilities and crops destruction by wild animals. From the villagers' point of view they are food insecure due to low production, scarcity of water, crop destruction by wild animals, soil erosion, land fragmentation, rugged topography etc. They spend more than 1/3 of their budget to procure their food items. The main reasons for shortage of food in a household is low agricultural production, lack of proper storage, shortage of food at the time of landslides and lack of purchasing power.

The sources of food grains in the households are domestic production, purchased from market and government ration. Food shortage becomes acute when low agricultural production is coupled with lack of purchasing power that constitutes around 81.97 percent. It is obvious that most of the people have to depend on market for food grains.

The percentage of population living below poverty line in Sikkim in the year 2006 was 19.33. But by the year 2011-12 it came down to 8.19. Even then Sikkim had higher percentage of population below poverty line during 2011-12 compared to states like Goa (5.09 %), Kerala (7.05%) and Himachal Pradesh (8.06 %) respectively.

In order to bring relief to high percentage of people living below poverty line the National Food Security Act (NFSA), 2013 suggests coverage of up to 75% of the rural population and up to 50% of the urban population for receiving subsidized food grains under Targeted Public Distribution System (TPDS).

The correlation coefficient of population growth is 99 percent, but the production correlation coefficient is only 0.06. Hence, a very poor correlation has been observed between the two

variables. Therefore, people of Sikkim depend on imports from other states for different commodities.

Despite considerable annual investment in agricultural sector new recommended technologies have not reached to the majority of farmers. The deficit of the above could be linked to the meagre number of young people unwilling to enter the field of agriculture.

Sikkim needs immediate measures to transform agriculture by developing in-house measures and investing more on research and development by the government to bridge the deficit that exists and if not worked upon immediately may lead to a more broadened state.

It is interesting to note that the concerned department for agricultural development in Sikkim is called Department of Food Security and Agriculture Development. The message is clear that this tiny Himalayan state with a population of less than 7,00,000 strives to make its inhabitants food secure by re-vamping agro-economic activities.

## Suggestions

- Due to lack of storage facilities, farmers have to sell the ripened horticultural products and cardamom at low cost at throw away prices. As a medium for the purchase of the products and the platform for storage, co-operative societies have to be encouraged. In addition, a farmer centric, minimum support price for the horticultural products and cardamom have to be fixed by the government as a support measure to the farmers.
- A comprehensive in-depth research must be undertaken in every cluster and block levels for generating a rationale based protocol that guides the farmers for cultivating crops according to soil, climate, elevation, slope etc. of a particular region. A mission oriented popularization of high yielding, improved and locally suitable varieties of crops are need of the hour.
- Scientific based cultivation of appropriate and naturally growing crops, simultaneously with traditional methods of practice are desirable.
- Measures for the improvement of indigeneous varieties of seed crops is required.
- Strict adherence to pre and post harvest management practices appears essential for food security.
- Reforms are required to strengthen research and implementation of extension programmes for farmer's participation.
- Requirement to encourage the practice of mixed farming system to avoid failure of particular crop. For example, cultivation of maize and soybean together will help the farmers benefit. Though maize does not offer high dividend to the farmers, selling soybean may act as a compensation. Similarly, new cropping pattern like ginger + maize, pea+oilseed, ginger+ pulses and turmeric cultivation can help the farmers benefit.
- In hilly area, like south district, an approach on conservation of soil is very crucial for the treatment of catchments and watershed areas. Setting up of a micro-economic unit may boost the economic conditions of the farmers and also solve problems of soil erosion.
- Lack of irrigation facility is an immense problem in the district. The agricultural practice in the district is mostly rainfed. This problem may be solved to a certain extent by practicing roof water harvesting. The excess rains during rainy season can be collected in the tank for future use and also for the recharging of the ground water. Roof rain water harvesting should be made mandatory for every household in the villages.
- Water shade and catchments area development approach is one of the essential soil water conservation practices for sustainable agricultural development in hilly area. This approach can be successfully actualized on a holistic basis only if there is the participation of various stakeholders that include, farmers, local bodies and planners.

- Setting up regulated market with facilities in terms of infrastructure, market information and transport will help farmers obtain suitable price for their produced commodities. In every panchayat ward the rate chart of vegetables and other essential items should be displayed for the general awareness of the villagers.
- Financial input institutions in agricultural sector is essential in every district. Proper policy and planning for procurement of inputs, sales of products, proper and appropriate norms to get rid of middlemen, will enhance production and income as well as the agricultural development in the district.
- Inspiration and motivation to the farmers in the right direction and their participation will encourage them to implement the execution of various plans and policies of the state.
- The fertile land suitable for paddy cultivation should not be leased to different companies/pharmaceutical/factories.
- Implementation of schemes of animal husbandry should be done only after undertaking research in the field. Also, hands-on experience focussed on practical learning should be imparted to the villagers engaged in such activities.
- For raising the productivity of livestock, rearing of improved breeds and setting up of artificial insemination centres in all corners should be encouraged.
- Frequent livestock health check up becomes mandatory and most essential.
- It appears that there is some sort of regional specialisation in relation to livestock rearing for example, sheep and yak farming in the himalayan region, cattle, goat etc. in middle hills and poultry farming in the lower belt and this practice requires continuity.
- Improved varieties of grasses have to be introduced so that the problem of fodder and pasture gets reduced.
- Building buffer stocks is essential during the time of rainy season.
- Improving food distribution –building of proper Public Distribution System (PDS).
- Improving household food scarcity through:
  - a. Improving purchasing power.
  - b. Food for work programme (like MNGREGS).
  - c. Direct or Indirect food subsidy to all villagers.
- Food supplementation to properly address special needs of the susceptible groups through Integrated Child Development Services (ICDS), Mid-Day meals etc.
- Sun light or solar light plays crucial role in increasing crop production and positively influences poultry farming. Every living creature is a music lover and historically

music has been an integral part of our lives. Therefore, music may be experimented as an option to enhance milk production.

## Bibliography

### *Books*

- Agarwal, A.N. 1986. *Indian Agriculture; Problems, Progress and Prospects*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Basu, Debashis et.al. 2006. *Agricultural Food Security, Nutrition and Health in North East India*. New Delhi: Mittal Publication.
- Bhattacharya, Pranab Kumar. 1984. *Aspect of Cultural History of Sikkim*. Calcutta: K.P. Bagchi and Company.
- Bhatt S.C. and Gopal K. Bhargava. 2005. *Land and People of Indian States and Union Territories: Sikkim*. Vol. 34, Delhi: Kalpaz Publications.
- Chandna, R.C. 2014. *Geography of Population; Concepts Determinations and Patterns*. New Delhi: Kalyani Publishers.
- Chauhan, D.S. 1953. *Agricultural Economics*. Agra, India: Printed at the Modern Press.
- Choudhury, Maitreyee. 2006. *Sikkim: Geographical Perspectives*. New Delhi: Mittal Publications.
- Coelho, V.H. 1970. *Sikkim and Bhutan*, Indian Council for Cultural Relations. New Delhi: Vikas Publications.
- Das, B.S. 1996. *The Sikkim Saga*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dasgupta, Manas. 2002. *Sikkim: Problems and Prospects of Development*. New Delhi: Indus Publishing.
- Debnath, J.C. 2009. *Economic History and Development of Sikkim*. Delhi: Abhijeet Publications.
- Dev, Mahendra S., Kannan, K.P. and Ramachandran, Nira. 2003. *Towards A Food Secure India; Issues and Policies* (edited.). New Delhi: Institute for Human Development.
- Dhamala, Ranju, R., Rai, C.D., Dutta, M.S. and Ghatak, Sanchita. 1993. *People of India, Sikkim* Vol. 39, (edited.). Calcutta: Anthropological Survey of India, Seagull books.
- Dhar, P.K. 2005. *Indian Economy; Its Growing Dimensions*. New Delhi: Kalyani Publishers.
- Dorji, N.G.2010. *A to Z Sikkim 2009-10*. Tadong, Gangtok: Ghising Torrent International Pvt.Ltd.
- Drummond, Evan H. and Goodwin, John W. 2004. *Agricultural Economics (eds.)*. Delhi: Pearson Education.

Gaunle, Gopal. 2002. *Sikkim Rajtantra Dekhi Prajatantra Sammah* (in Nepali). Namchi, South Sikkim: Nirman Prakshan, Gumpa Ghurpise.

GoI (Government of India). 1981-2011. *Census of India* (1981-2011). GoI.

GoS (Government of Sikkim). 1978. *Land Reform Report F 16 (16) LL/1978*. Gangtok Sikkim: Department of Law and Legislative, GoS.

-----1996. *Land Utilisation Statistics of Sikkim*. Bhutia, Kunga Gyatso. Tadong, Sikkim: Department of Agriculture, Gos.

-----2001. *Sikkim: Genuine Commitments Unique Achievements*. Gangtok Sikkim: Department of Information and Public Relation, GoS.

-----2001. *Sikkim Human Development Report*. Mahendra P. Lama (ed.). Delhi: Social Science Press, GoS.

-----2014. *Sikkim Human Development Report 2014*. Available at [www.sikkim.gov.in>stateportal](http://www.sikkim.gov.in/stateportal)>Link (Accessed on August 08, 2015).

-----2002. *Sikkim: A Statistical Profile 2002*. Gangtok Sikkim: Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

-----2003. *The Glory of New Sikkim*. Mahendra P. Lama (ed.). Gangtok Sikkim: Department of Information and Public Relation, Printed at Kwality Stores Sikkim, GoS.

-----2004. *Sikkim Study Series, Geography & Environment*. Mahendra P. Lama (ed.), Volume-I, Department of Information and Public Relation, GoS.

-----2005. *Thirty Years of Sikkim Takes Stock of three Decades Statehood*. Gangtok Sikkim: Department of Information and Public Relations, GoS.

-----2005. *Trainer's Manual*. Gangtok Sikkim: Department of Agriculture and Horticulture, GoS.

-----2005. *Sikkim: A Statistical Profile 2004-05*. Gangtok Sikkim: Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

-----2006. *Training Manual Horticultural Crops 2005-06*. Gangtok Sikkim: Department of Horticulture and Cash Crops Development, GoS.

-----*Strategic Research and Extension Plan of South District*. South Sikkim: Department of Food Security and Agriculture Development, GoS.

-----2007. *Economic Survey 2006-2007*. Gangtok Sikkim: Department of Directorate of Economics, Statistics, Monitoring and Evaluation (DESME), GoS.

- 2009. *Sikkim; 15 Triumphant Years of Democracy (1994-2009); A Call to Action*. Gangtok Sikkim: Department of Information and Public Relations, GoS.
- 2011. *Annual Progress Report 2010-2011*. Krishi Bhawan , Tadong, Gangtok: Development of Food Security and Agriculture, GoS.
- 2011. *Annual Progress Report 2010-11*. South Sikkim: Department of Horticulture & Cash Crops, GoS.
- 2013. *Annual Progress Report 2012-13*. South Sikkim: Department of Horticulture & Cash Crops, GoS.
- 2016. *Annual Progress Report 2015-16*. South Sikkim: Department of Horticulture & Cash Crops, GoS.
- 2011. *Village Development Action Plan; A Plan For Realizing of A Poverty Free Sikkim*. Gangtok Sikkim: Department of Rural Management and Development, GoS.
- 2012. *Report on 19<sup>th</sup> Livestock Census*. Krishi Bhawan, Gangtok: Department of Animal Husbandry Livestock, Fisheries and Veterinary Services, GoS.
- 2013. *Gazetteer of Sikkim*. S. Kharel, and J.W. Bhutia, (eds.). Gangtok Sikkim: Department of Home, GoS.
- 2013. *Sikkim: A Statistical Journal 2013(Draft)*. Gangtok Sikkim: Department of Economics, Statistics, Monitoring & Evaluation (DESME), GoS.
- 2014. *Hand Book on Agriculture Sikkim 2013-14*. Gangtok Sikkim: Department of Food Security and Agriculture Development and compiled by Agriculture Census & EARAS Unit, GoS.
- 2016. *State of Environment Report Sikkim (Draft) 2016 ENVIS Sikkim*. Gangtok Sikkim: Department of Forest Department, GoS.
- 2012. *Inventory and GIS Mapping of Landslides in North, East, West and South Sikkim and Its Mitigation*. Gangtok Sikkim: Department of Management Authority, Land Revenue & Disaster Management and Sikkim State Disaster, GoS.
- 2016. *Achievement-23 Years of Ensuring Food Security*. Department of Food & Civil Supplies & Consumer Affairs, GoS.
- Gorer, Geoffrey. 2005. *Himalayan Village: An account of the Lepchas of Sikkim*. (Second Edition), Varanasi, India: Pilgrims Publishing.

- Gupta, Manas Das. 1992. *Sikkim: Problems and Prospects of Development*. New Delhi: Indus Publishing Company.
- Handbook of Agriculture*. 1987. New Delhi: ICAR, Printed at Rachna Printers Pvt. Ltd.
- Husain, Majid. 2004. *Human Geography*. New Delhi: Rawat Publications.
- Jhingan, M.L. 2003. *The Economics of Development and Planning*. New Delhi: Vrinda Publications Pvt. Ltd.
- Joshi, P.C. 1976. *Land Reforms in India*. Delhi: Allied Publishers Ltd.
- Khan, Nizamuddin. 2001. *An Introduction to Physical Geography*. New Delhi: Concept Publishing Company.
- Lekhi, R.K. and Singh Joginder. 2001. *Agricultural Economies*. Ludhiana, India: Kalyani Publishers.
- Mahmood, A. 1998. *Statistical Methods in Geographical Studies*. New Delhi: Rajesh Publications.
- NSSO (National Sample Survey Office), 2014. *Nutritional Intake in India, 2011-12*, Report No. 560, NSS 68<sup>th</sup> Round, October, 2014. New India: National Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India.
- Radha, V. 2009. *Women and Rural Households Food Security*. New Delhi: Serials Publications.
- Sharma, A. 2005. *Environmental Studies*. Delhi: Surjeet publications.
- Shrestha, R.S. 2005. *Sikkim: Three Decades towards Democracy Evolution of the Legislative System*. Gangtok: Sikkim Legislative Assembly Secretariat.
- Saxena, N.C. et.al. 2008. *Right to Food* (eds.). New Delhi: Human Rights Law Networks.
- Sikkim A to Z (2009-10) 2010. Tadong, Gangtok: Ghising Torrent International Pvt.Ltd.
- Singh, Jasbir and Dhillion, S.S. 2006. *Agricultural Geography*. New Delhi: Tata McGraw, Hill Publishing Company Limited.
- Singh, Katar and Shishodia, Anil. 2016. *Rural Development; Principals, Policies, and Management*. New Delhi: SAGE Publications India Pvt Ltd.
- Subba, J.R. 1984. *Agriculture in the Hills of Sikkim*. Gangtok, Sikkim: Sikkim Science Society.
- 2008. *History, Culture and Customs of Sikkim*. New Delhi: Gyan Publishing House.

- Subba, J.R. and Upadhyaya, R.C. 1995. *Vegetable Crops of the Himalayan Region*. Gangtok: Akhil Sikkim Limbu Chumlung Association.
- Subba, T.B. 1989. *Dynamics of a Hill Society: The Nepalis in Darjeeling and Sikkim*. New Delhi: Mittal Publications.
- Tiwari, R. C. 2010. *Geography of India*. Allahabad, India: Prayag Pustuk Bhawan.
- Swaminathan, M. 1990. *Handbook of Food and Nutrition*. Bangalore: Bangalore Printing and Publishing Co. Ltd.
- Vyas, Vijay S. 2005. *Food Security in Asian Countries in the Context of Millennium Goals* (ed.), New Delhi: Academic Foundation.
- Yasin, M. and Chhetri, D.P. 2012. *Politics, Society and Development* (ed.), Delhi: Kalpaz Publications.

#### ***Articles (Published)***

- A. De waal and J. Tumushade. 2003. "Report on Northern Associates on RCSA (*Regional Center for Southern Africa*) food strategic option." Available at: <http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf> (Accessed on July 28, 2007).
- Baby, K. 2012. "Food Security and Public Distribution System; Issues and Concerns," *Kurukshetra*' Ministry of Rural Development, Vol. 60 No.5 (March):22-23.
- Boot, Debi Prasad. 1988. "Agricultural Land Use and Land Holding Pattern in Sikkim: Some Observations," *Sikkim Through periodical Articles, Reports, Seminar proceedings etc.* Vol.2, CHS: 57-63
- Bouis, Howarth and Hunt, Joseph. 1999. "Linking Food and Nutrition Security: Past Lessons and Future Opportunities," In *Asian Development Review: Studies of Asian and Pacific Economic Issues*, Vol. 17, No. 12. edited by Jungsoo Lee.
- Chakrabarti, A. 2012. "Food Security in Sikkim: A Critical Review" In *Politics, Society and Development* edited by M.Yasin and D.P. Chhetri. Delhi: Kalpaz Publications: 214.
- Choudhuri, Buddhadeb. 1984. "Migration and Agrarian Relations: A study on Darjeeling District" paper presented at seminar on Land Relations and Land Reforms in the Plains and Valleys of North-East India, NEICSSR Shillong, 17<sup>th</sup> -18<sup>th</sup> April.

Choudhury , Maitreyee. 1998. “An outline of the physical geography of Sikkim,” In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.

-----2004. “State of Agriculture in Sikkim” In *The Himalayan Miscellany*, Vol.15. CHS, University of North Bengal: 25-34

Datta, P.C. and Pradhan, B.C. 2006. “Nutrition and Food Insecurity –A Problem of New Millennium” In *Agriculture Food Security Nutrition and North –East India*, North-East India: 263.

Debnath, J.C. 1980. “Agriculture in Sikkim” In *North Bengal Review*, Vol.1, June.

De, K. U. 2006. “Food Security and the Related Issues-some Reflections on the State of Tripura” In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 154, Delhi: Mittal Publication.

Dhamala, R. Ranju and Bhowmick, D.J. 1985. “Land Reforms in Sikkim,” In *The Himalayas: Profiles of Modernization and Adaptation*, edited by S.K. Chaube. New Delhi: Sterling Publishers Pvt. Ltd.

Dhar, B. 2006. “An Aspect of Food Security on the High Altitude Region of the Eastern Himalayas-A Case Study on the Thingbu-pas of Arunachal Pradesh,” In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 169-70, Delhi :Mittal Publication.

Dubey,A and Kharपुरi,O. 2003. “Hunger and Poverty in North-eastern States: Implications for Food Security,” In *Towards A Food Secure India*, edited by S.Mahendra Dev, K.P. Kannan and Nira Ramachandran, 165, New Delhi: Institute for Human Development.

John Farrington and N.C.Saxena. “Food Security in India.” Available at: [www.org.UK/publications/working\\_papers/wp231/wp231-references.pdf](http://www.org.UK/publications/working_papers/wp231/wp231-references.pdf) (Accessed on July 28, 2007).

John Luke Gallup, Jefferey Sachs and Adrew D. Mellinger. 1998. Report on Northern Associates on ‘RCSA (*Regional Center for Southern Africa*) food strategic option.’ Available at: [http://www. Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf](http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf) (Accessed on July 28, 2007).

- Johan Van Rooyen and Howard Sigwele. 1999. "Report on Northern Associates on 'RCSA (Regional Center for Southern Africa) food strategic option.'" Available at: <http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf> (Accessed on July 28, 2007).
- Jordan, G. Arringe, Chavoj-Mejia and Rayes-Rayee, B.C. 2001. "Agricultural Research for Development in the Mexico Highlands," In *Journal of Mountain Research and Development*, Vol.21, No.1.
- J. Von Barun, P.Hazell, J. Homddinott and S. Babu .2003. "Report on Northern Associates on 'RCSA (Regional Center for Southern Africa) food strategic option.'" Available at: <http://www.Sarpn.org.za/documents/d0000507/RCSA-food/security.pdf> (Accessed on July 28, 2007).
- Kalita, et.al. 2006. "Food and Nutrition Security"- An Overview," In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 237, Delhi: Mittal Publication.
- Khawas , V. 2012. " Agriculture in the Sikkim Himalayas: A Geographical Note," In *Politics, Society and Development*, edited by Mohammad Yasin and Durga P. Chhetri, 192. Delhi: Kalpaz Publications.
- Mukhopadhyay, S.C. 1988. "A study in Planning Strategies for Resource Utilization and Development in the Sikkim Himalayas, Sikkim", Seminar paper presented at the Department of Geography, Calcutta University, 18-19 March.
- Pradhan, H.R.1998. 'Economic Structure of Sikkim,' In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.
- Sagar, Vidya. 2003. "Food Security Issues in a State of Large Agricultural Instability: The case of Rajasthan" In *Towards a food Secure India: Issues and Policies*, edited by S. Mahendra Dev , K.P. Kannan and Nira Ramachandran , New Delhi: Institute for Human Development.
- ..... 2005. "Food Security in India" in *Food Security in Asian Countries*, 30. New Delhi: Academic Foundation.
- Sarap, M. and Mahamallik. 2003. "Food Security System and Its Operation; A Study of Some Villages in the District of Kalahandi, Orissa" In *Towards a Food Secure India ; Issues and*

*Policies*, edited by S. Mahendra Dev, K.P. Kannan and Nira Ramachandran, New Delhi: Institute for Human Development.

Sikor, Thomas and Troong, Dao Minh. 2002. "Agricultural policy and Land use changes in a Black-Thai commune of Northern Vietnam," Vol. no. 3, 1952-1997, In *Journal of Mountain Research and Development*.

Singh, R.B. and Pandey. 2000. "Sikkim Himalaya: Geo-Ecological System, Socio-Economic Change and People's Perception" In *Sikkim: Society Polity Economy Environment*, edited by M.P. Lama, New Delhi: Indus Publishing Company.

Singh, R.K.P. et.al. 2006. "Food and Nutritional Security in the North-Eastern States-An Analysis" In *Agriculture Food Security Nutrition and Health in North East India*, edited by Debashis Basu, B.Francis Kulirani and B. Datta Ray, 129, Mittal Publication.

Som, T.K. 1988. "Agrarian situation in India" In *Journal of North-East India Council for Social Science Research*, Vol.12 no. 2.

Srivastava Nish. 2003. "The Paradox of Food Insecurity in a Food Surplus State; A case of Uttar Pradesh" In *Towards a food Secure India; Issues and Policies*, edited by S. Mahendra Dev, K.P. Kannan and Nira Ramachandran, New Delhi: Institute for Human Development.

Subba, J.R. 1998. "Vegetables crops in Sikkim," In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma, 399-412 Dehru Dun, India, Bishen Singh and Mahendra Pal Singh.

-----2009 "Indigeneous Knowledge on bio-resources management for livelihood of the people of Sikkim." In *Indian Journal of Traditional knowledge*, Vol.8 (1) January, 2009:56-64. Available at: [www.nopr.niscair.res.in](http://www.nopr.niscair.res.in) (Accessed on June 25, 2016).

Subba, T.B. 1989. "Agrarian Social Structure and Change in Sikkim," In *Social Change*, Vol.19, No.1, March.

Sukhatme. 1987. "Economics of Nutrition", *Indian Journal of Agricultural Economics*, Vol.32, No.3.

Swaminathan, M. S .1996. "Science and Technology for Sustainable Food Security," *Indian Journal of Agricultural Economics*, 51(1 and 2):60-75.

-----2001. "Food Security and Sustainable Development," *Current Science*, Vol.81, No.8. , 25<sup>th</sup> October.

Tulachen, Pradeep M. 2001. "Mountain Agriculture in the Hindukush-Himalaya; A Regional Comparative Analysis" In *Mountain Research Development*, ICIMOD, Vol. 21, No. 3.

Upadhyaya, R.C. 1998. In *Sikkim: Perspectives for Planning and Development*, edited by S.C. Rai, R.C. Sundriyal and E.Sharma. Dehra Dun, India: Bishen Singh Mahendra Pal Singh.

World Health Organisation (WHO) .1985. "Energy and Protein Requirements", In *Report of a Joint FAO/WHO/UNI/ Expert Consultation*, Geneva : Technical Report Series No.724.

### ***Newspapers***

*Sikkim Express* (Local Paper). 2009. "Chief Minister's Independence Day Message to the People of Sikkim," *Sikkim Express*, 18<sup>th</sup> August.

*Sikkim Express* (Local Paper). 2010. "DESME tags 21,618 BPL households; Food & Civil Supplies Distribution rice to 43,428 BPL families," *Sikkim Express*; 11th May.

*Sikkim Express* (Local Paper). 2010. "Distribute, Procure, Store and Sow," *Sikkim Express*, (17.09.2010- Local Paper).17<sup>th</sup> September.

*Sikkim Express* (Local Paper). 2013. "Secretary- Department of Food Civil Supplies & Consumer Affairs," *Sikkim Express*; 3<sup>rd</sup> August.

### ***Web Links***

[www.wikipedia.org/wiki/sikkim](http://www.wikipedia.org/wiki/sikkim) (Accessed on September 06,2010).

<http://www.envis.nic.in/soer/soer-sikkim/resources> (Accessed on November 26,2010).

<http://www.Unsystem.org/SCN/archives/scnnews04/ch.3-html> (Accessed on March 28, 2015).

[www.journalijdr.com](http://www.journalijdr.com) (Accessed on March 28, 2015).

<http://www.gcrio.org/CONSEQUENCES/VOI.2, NO.2/article.1.html> (Accessed on March 28, 2015).

[www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html-date](http://www.visitsikkim.com/food-&-drinks-visit-sikkim-india.html-date) (Accessed on March 28, 2015).

[www.bharatonline.com/sikkim-tours/heritage-tour.html](http://www.bharatonline.com/sikkim-tours/heritage-tour.html) (Accessed on March 28, 2015).

[foodsecuritycluster.net](http://foodsecuritycluster.net) (Accessed on March 28, 2015).

[shodhganga.inflibnet.ac.in](http://shodhganga.inflibnet.ac.in) (Accessed on May 18, 2015).

[www.fao.org/docrep](http://www.fao.org/docrep) (Accessed on May 18, 2015).

[en.m.wikipedia.org/wiki/Food-security](http://en.m.wikipedia.org/wiki/Food-security) (Accessed on June 09,2015).

[agricoop.nic.in](http://agricoop.nic.in) (Accessed on July 25,2015).

[Shodhganga.inflibnet.ac.in](http://Shodhganga.inflibnet.ac.in) (Accessed on August 08, 2015).

[www.sikkimforest.gov.in](http://www.sikkimforest.gov.in) (Accessed on February 20, 2016).

[www.sikkimsprings.org](http://www.sikkimsprings.org)-(Accessed on February 20, 2016).

[sikkim.nic.in>sws>sikk\\_geo](http://sikkim.nic.in>sws>sikk_geo) (Accessed on February 20, 2016).

[www.agricoop.nic.in](http://www.agricoop.nic.in) (Accessed on February 20, 2016).

[www.sikkimsprings.org>south\\_sikkim](http://www.sikkimsprings.org>south_sikkim) (Accessed on February 20, 2016).

[www.indiawater.org](http://www.indiawater.org)(Accessed on February 21, 2016).

[www.kvkeastsikkim.nic.in](http://www.kvkeastsikkim.nic.in) (Accessed on February 24, 2016).

[sikervis.nic.in](http://sikervis.nic.in) (Accessed on March 30, 2016).

[nfsm.gov.in>Tripura Workshop>Sikkim](http://nfsm.gov.in>Tripura Workshop>Sikkim) (Accessed on May 03, 2016).

[www.nopr.niscair.res.in](http://www.nopr.niscair.res.in) (Accessed on June 25, 2016).

[www.agriinfo.in](http://www.agriinfo.in) (Accessed on June 24, 2016).

[www.icarzcu3.gov.in](http://www.icarzcu3.gov.in) (Accessed on June 25, 2016).

[www.archive.india.gov.in](http://www.archive.india.gov.in) (Accessed on July 11, 2016).

[www.wikipedia.org>wiki>Plough](http://www.wikipedia.org>wiki>Plough) (Accessed on July 07, 2016).

[www.fao.org>docrep](http://www.fao.org>docrep) (Accessed on July 07, 2016).

[www.wikipedia.org](http://www.wikipedia.org) (Accessed on July 07, 2016).

<http://ec.europa.eu/agriculture/rural-area-economics> (Accessed on July 07, 2016).

<http://soilsmatter.wordpress.com> (Accessed on July 07, 2016).

<https://en.m.wikipedia.org>wiki>production> (Accessed on July 07,2016).

[www.visva-bharati.ac.in > AERC\\_DETAIL](http://www.visva-bharati.ac.in > AERC_DETAIL) (Accessed on July 16, 2016).

[Sikkim.ac.in>SWS>home\\_eco](http://Sikkim.ac.in>SWS>home_eco) (Accessed on July 27, 2016).

[www.fao.org/docrep/005/y4671e](http://www.fao.org/docrep/005/y4671e) (Accessed on September 23,2016).

[14.139.206.50>jspui>handle](http://14.139.206.50>jspui>handle) (Accessed on September 24, 2016).

[https:// www.clearies.com>public-distribtuion](https://www.clearies.com>public-distribtuion) (Accessed on January 02, 2018).

[www.ncbi.nlm.gov](http://www.ncbi.nlm.gov) (Accessed on January 08, 2018).

[chartsbin.com>view/12730](http://chartsbin.com>view/12730) (Accessed on January 08, 2018).

[www.foodandenvironment.com](http://www.foodandenvironment.com) (Accessed on January 20, 2018).

[www.fao.org](http://www.fao.org) (Accessed on January 27, 2018).

[www.ncbi.nlm.nih.gov>articles](http://www.ncbi.nlm.nih.gov>articles) (Accessed on January 27, 2018).

# Appendix

## INTREVIEW SCHEDULE FOR FARMERS (2015-16)

### 1. Preliminary Background

Respondent's Name.....

Age..... Sex: Male/Female Caste.....

Religion-(Hinduism /Buddhism /Christianity/Others)

Category-(ST/BL/SC/Central OBC/State OBC/GEN)

Education.....Marital status- Married/Single/ Widow/Divorcee

GPU.....Ward.....Block.....

### 2. Family Background-

Sl.No.	Name of Family Members	Sex	Age	Education	Relation with head
1					
2					
3					
4					
5					
6					

### 3. Land Use Pattern-

1. Do you have own land? Yes/No

If no, then-Tenants (Adhiya /Kuth);

Give details about

Adhiya/Kuth.....

If yes-

- i. Total land..... Area
- ii. Irrigated land..... Yes/No
- iii. Non-Irrigated land..... Yes/No
- iv. Culturable Waste..... Yes/No
- v. Cardamom..... Yes/No
- vi. Other ..... Yes/No

2. During the last agricultural year, did this household have any of the following:-

- i. Crops grown in this village
- ii. Crops grown in other places
- iii. Kitchen garden
- iv. Cropland rented from someone else
- v. Agricultural land left fallow

**4. Main crops-**

What are the Crops/Pulses/Vegetables/Fruits grown in your agricultural land? Specify the name.....  
.....  
.....

**5. Irrigation of Land-**

- i. What are the main irrigation means-  
Monsoon season  Streams  Roof rainwater harvesting   
Private well/tap  Dug out pond  Others

ii. Did Household have any irrigated land during the last agricultural year Yes/No  
If yes, how much land.....

- iii. Did you get any type of benefit from govt. and others sectors?  
a) RCC tank b)Plane sheet tank c) Rubber tank d) Poly pipe  
e) Dug out pond f) Others

**6. Economic Activity:**

- i. What is the household's main field of economic activity:  
Agricultural +Animal Husbandry  Services   
Others

- ii. What type of agricultural activity does household engage -  
Mainly subsistence   
Mainly commercial   
No agricultural activity

iii. Is your agricultural product sufficient to fulfill your requirement –Yes /No  
If no .....What is the reason for less production from your agricultural land.....

iv. How many months did you work in your agricultural farm in the last 12 months.....

v. In this household are you raising any cattle-Yes/No

Sl.No.	Type	Total No.
1.	Cow	
	a.In Milk	
	b.Drought	
2.	Ox	
3.	Goat/Sheep	
4.	Pig	
5.	Poultry	
6.	Others	

vi. What is the main reason for rearing of livestock –

Self consumption  For sale

Other purposes-specify.....

vii. What is your main reason for your involvement in agriculture activity?

.....

viii. Which crops/vegetables are sold maximum in the market per week.....

- How much (Kg) .....
- Per Kg Rs.....
- Per Mond (40Kg) Rs.....

ix. Why do you sell your agricultural crops/vegetables-

- a) Surplus b) To exchange of goods c) To earn money d) To save money for future

## 7. Income and Expenditure Information

i. What is your normal income per annum-

- a. below 10,000
- b. 10,000-20,000
- c. 20,000-30,000
- d. 30,000-40,000
- e. Above 40,000

- ii. What is your normal expenditure per annum-
  - a. below 10,000
  - b. 10,000-20,000
  - c. 20,000-30,000
  - d. 30,000-40,000
  - e. Above 40,000
  
- iii. Annual income from agriculture before MGNREGS programme:
  - a. below 10,000
  - b. 10,000-20,000
  - c. 20,000-30,000
  - d. 30,000-40,000
  - e. Above 40,000
  
- iv. Annual income from agriculture after MGNREGS programme:
  - a. below 10,000
  - b. 10, 000-20,000
  - c. 20, 000-30,000
  - d. 30, 000-40,000
  - e. above 40,000
  
- v. Annual expenditure of beneficiaries before MGNREGS programme:
  - a. below 10,000
  - b. 10,000-20,000
  - c. 20,000-30,000
  - d. 30,000-40,000
  - e. Above 40,000
  
- vi. Annual expenditure of beneficiaries after MGNREGS programme:
  - a. below 10,000
  - b. 10,000-20,000
  - c. 20,000-30,000
  - d. 30,000-40,000
  - e. Above 40,000
  
- vii. Do you find any impact on agricultural productivity after MGNREGS? Yes/No  
 If yes specify .....

**8. Cropping Pattern**

i. What is the normal cropping pattern of the fields-

- Paddy-pulses-vegetables
- Paddy-vegetables-fallow
- Paddy-ginger
- Maize-pulses-vegetables
- Maize-soybean-vegetables
- Maize-buckwheat-vegetables
- Paddy+pulses

- Paddy+pulses+vegetables
- Maize+pulses+vegetables
- Any others specify.....  
.....  
.....

ii. For how many months, does agricultural land remain uncultivated (fallow) in a year?  
a) 1 month b) 2months c) 3 months d) more than 3 months

iii. Do you have following type of cropping pattern-(mixed farming)

- Raising of crops +animals
- Raising of animals+trees
- Raising of crops+ animals+trees
- Raising of crops
- Rearing of animals

iv. Are you growing two or more crops at a time at your field(Inter-cropping) Yes/No

v. Do you practise seedlings of the crops after maturing of previous crops? Yes/No

vi. Do you grow the same crops on the same land(Monoculture) Yes/No

vii. Cropping pattern-

Season	Crops	Varieties	Cropping time	Area	Production (kg)
<b>A. Kharif(July to Oct.)</b>					
i.					
ii.					
iii.					
iv.					
v.					
vi.					
vii.					
<b>B.Rabi (Oct to March)</b>					
i.					
ii.					
iii.					
iv.					
vi.					
vii.					
<b>C. Off Season</b>					
i.					
ii.					
v i i	iii.				
i	iv.				
v.					
vi.					
vii.					

viii. Are you satisfied with your farm production? Yes?No  
 If No, give reasons.....

ix.What do you think about the present production of rice and maize in comparison to past years- Increasing /Decreasing  
 If decreasing give reasons.....

x. Had your agricultural land been taken by any of following:-

a) Construction of road-Yes/No,  
If yes, Area (how much).....

b) Taken by the Factories/Industries/Power line-Yes/No

If yes, Area (how much) .....

c) Landslides-Yes/No,  
If yes, Area (how much) .....

xi. Do you get any amount of insurance while crops are destroyed due to natural calamities etc? Yes/No

xii. Did you take agricultural loan from the banks /others institutions? Yes/No

If yes how much.....

xiii. Do you have Kisan Credit Card ( Kisan credit card is to provide affordable credit for farmers in India. It was started by the Govt. of India-RBI, NABARD)? Yes/ No

xiv. Is there any Farmer's club at your area? Yes/No

If yes, name them.....

xv. What is the function of Farmer's club?

.....  
.....

xvi. Is there sufficient number of agricultural labourers available during cropping/cultivation season? Yes/No

If no, give reasons.....

.....

xvii. What is the agricultural wage –

a) Working in field Rs.....

b) Ploughing Rs.....

xviii. Are you following-

Traditional way of farming? Yes/No

Modern way of farming? Yes/No

If yes, then what are the ways.....

.....

xix. What types of equipments and machinery do you use while cultivating the land-

a) Wooden plough(Halo)

b) Power tiller(Tiller machine)

c) Kata(Harrow)

d) Kodalo(Hoe)

e) Datey

f) others

xx.How many family members are engaged in your field?

- a) Male No.
- b) Female No.

xxi.What types of fertilizers do you use in your agricultural fields?

- a) Pesticides
- b) Insecticides
- c) Organic manure provided by govt.
- d) Manure of livestock prepare at home

xxii.Is there any change in the cultivation practices of different crops in the last few decades?

Yes/No. If yes, what types of major changes have been found.....

### 9. Food Sources/Storage-

- i. Own farm production
- ii. Purchased food from market
- iii. Supply from relatives/friends
- iv. Government ration
- v. Fair price shop
- vi. Open market
- vii.Storage at home

### 10. Food Consumption and Security-

Consumption Pattern (per surveyed family) - last 12 months

Items	Total production (kg)	Value (Rs/kg)	Self-consumed quantity from your farm produce	Quantity Sold	Quantity purchased from outside
Rice					
Maize					
Wheat					
Millet					
Buckwheat					
Pulses					
Beans					
Oilseed					
Potatoes					
Chilies					

Brinjal/Tomato/Pumkin					
Ghee/Butter					
Meat					
Eggs					
Fruits					
Others					

i. What is your staple food.....

ii. **Monthly Food items/commodities purchase from the market-**

Items	Monthly purchase food items from market(kg)	Per day consumption(kg) per family					
		¼()	¾()	½()	1()	2()	2 ()+
		kg	kg	kg	kg	kg	kg
Rice							
Maize							
Wheat(Maida/Atta)							
Millet							
Pulses							
Beans							
Oilseed							
Potatoes							
Chilies							
Brinjal/Tomato/Pumkin							
Other Vegetables							
Ghee/Butter							
Meat							
Eggs							
Fruits							
Others							

iii. Are your family members able to afford all three meals a day consisting of Rice, Dal and Vegetables?

- a) Yes      b) No      c) Only either two      d) Do not know

iv. Mention the time and items for your Meal.....

v. Are you afforded to eat balanced meals in the last 12 months?

- a) Often true      b) Sometimes true      c) Never true      d) Refused

- vi. Have your family members' change in food consumption pattern been observed over the past 12 months? Yes/No.  
If yes, what changes.....
  
- vii. In which month, your family members satisfy their hunger nicely?  
.....
  
- viii. Did you ever eat less than you needed because there wasn't enough money to purchase food?  
a) Yes b) No c) Don't know d) Refused
  
- ix. How often did the household have problems in satisfying the food needs last year?  
a) Never b) Seldom c) Sometimes d) Always
  
- x. The food brought by your family didn't last and you didn't have money to get more-  
a) Often true b) Sometimes true c) Never true d) Refused
  
- xi. What portion of your family income is spent in buying of food?  
a) Less than one third b) One third only c) More than one third  
b) Do not know
  
- xii. Has the rise in price of essential food items affected your family's intake of food grain – a) Yes b) No c) Do not know
  
- xiii. Do you have to worry as to how you will arrange money to purchase your family's next meal?  
a) Yes b) No c) Sometimes d) Do not know
  
- xiv. Does your family remain hungry sometimes being unable to afford to buy food? a) Yes b) No c) Once in a year d) Sometimes e) Do not know
  
- xv. Is your hunger more in monsoon during the long periods of rainfall?  
a) Yes b) No c) Do not know d) Does not arise
  
- xvi. What are the main reasons for food shortage in your household?  
a) Agricultural production is low b) Inadequate supply c) Lack of purchasing power d) Storage problems e) Bigger number of family members
  
- xvii. Do you think is there livelihood security? Yes/No
  
- xviii. How much litres of milk do you consume per day?

- a) Purchase- a) 1litre b) 2litre c) 3litres d) 4litres  
e) More than 5litres
- b) Home production- a) 1litre b) 2litre c) 3litres d) 4litres  
e) More than 5litres
- c) For how many days the households consumed meat during the last week?  
a) 1day b) 2days c) 3days d) 4days e) More than 4 days

- xix. Did your family get hundred days' employment under MGNREGS Act 2005-  
a) Yes b) No c) Do not know d) Does not arise
- xx. Is the Mid Day Meal supplied on all school days in your village school?  
a) Yes b) No c) Do not know d) Less than three days e) More than three days

- xxi. Does the ICDS centre supply food to the children of zero to three (0-3) years age group?  
a) Yes b) No c) Do not know
- xxii. Does the ration (fair price shop) shop remain open for all days a week?  
a) Yes b) No c) Do not know

- xxiii. Have you been allotted a BPL/AAY card-  
a) Yes b) No c) Do not know d) Does not arise

- xxiv. Are you allotted thirty five (35) kgs of rice /wheat under your BPL/AAY card?  
a) Yes b) No c) Do not know d) Does not arise

- xxv. Are you allotted kerosene and sugar under BPL/AAY card?  
a) Yes b) No c) Do not know d) Does not arise e) Sometimes

- xxvi. If BPL/AAY rice shall be withdrawn, will you be able to feed your family members?  
Yes/No, If Yes how.....

If no, then how to fulfill.....

- xxvii. Your family members are receiving any kind of scheme from Government?  
a) Old Age Pension
- b) Disable Pension(75% disable)
- c) Others

- xxviii. Now-a-days, young generations are interested in agricultural activities-  
Yes/No.

If No, give reason.....  
.....

**11. Plan and Policies of Government**

- i. What types of policies and programmes have been introduced by the government for the benefits of farmers?

.....  
.....  
.....

- ii. Do they who belong to marginal (land having below 1 ha) and small (land having between 1-2 ha) farmers' category also get the same type of benefits as others farmers? Yes/No

If no, give reasons.....  
.....

- iii. What is the Minimum Support Price for crops/vegetables given to you from the government?

.....  
.....