

MITIGATING CLIMATE CHANGE EFFECTS ON LIVELIHOOD  
THROUGH  
CO-OPERATIVES: BUILDING A CASE OF NEPAL

**A THESIS**

Submitted in Partial Fulfillment of the Requirement for the Degree of

**DOCTOR OF PHILOSOPHY IN ECONOMICS**

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## DECLARATION

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## ABSTRACT

Climate change is hitting hard the countries with poor and weak economies. Most developing countries and the poor have been most vulnerable as they depend on climate sensitive sectors like agriculture. The process of adaptation is always constrained by the institutional, social, economic, and political environment in which people must operate. The climate change has brought complexities and more challenges in the developing world including Nepal. These issues have made careful engagement of multiple decision makers in the development and implementation of adaptation strategies. The statement of the problem was devised as the extent of impacts of climate change in sustainable livelihood and response through cooperative movement including vulnerable groups like poor, marginalized, Dalit and excluded people. The purpose of the study was thus to assess the current trend of climate change, resulting impact on livelihood and impacts of co-operative movement towards sustainable life.

The literature review was carried out making the thematic review, theoretical review, and contemporary research studies. The review was concluded by making conceptual model of conceptual framework for the purpose of the study. This study was exploratory cum descriptive research based on qualitative and quantitative research approaches. The validity of this research was enhanced by the extensive and participatory nature of the investigations. The reliability of the study was ensured with multiple source of evidence, which leads to triangulation of data, the detailed, rich and thick descriptions of the researcher's own assumptions and position in the study, and ultimate conclusions.

The present study has devised a model for policy option in the field of mitigating climate change, and improvement of livelihood through micro cooperative movement. The study reflected about different emerging themes from the grounded settings. The livelihood setting demonstrated diversity in family composition, education as a lever for promoting employment, rising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement, declination of quality life and climate change. The impacts of climate change directly and indirectly threatened to livelihood. The assessment of climate change impacts illustrated about shift in season, weather change, variation in green coverage, declination in water sources, changing pattern of insect adaption, changing time of flowering and ripping fruits, declining crops production, over rainfall, drought, and people's feeling about climate change. The cooperative movement has also raised issues regarding the inclusion of the excluded groups in cooperatives, poverty alleviation versus cooperative movement, with, without and beyond cooperatives, and micro-cooperatives as an alternative platform of being together. It would be better if micro cooperative exists in future. The study concluded that micro/ primary cooperative may be the alternative platform for being together and the new approach for reaching the unreached.

The abstract of the thesis of Gyanendra Bahadur Karki for the Degree of Doctor of Philosophy in Economics was present on October 15, 2012.

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Abstract Approved by

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Gyanendra Bahadur Karki



## TABLE OF CONTENTS

## CONTENTS

## PAGES

|  |       |
|--|-------|
| ABSTRACT.....                          | i     |
| ACKNOWLEDGEMENT .....                  | iii   |
| TABLE OF CONTENTS.....                 | iv    |
| LIST OF TABLES .....                   | xii   |
| LIST OF FIGURES .....                  | xv    |
| ACRONYMS .....                         | xviii |
| CHAPTER I.....                         | 1     |
| INTRODUCTION.....                      | 1     |
| Background.....                        | 1     |
| Overview of Nepalese Economy .....     | 6     |
| Statement of the Problem .....         | 9     |
| Purpose of the Study.....              | 13    |
| Research Questions.....                | 13    |
| Rationale of the Study .....           | 13    |
| Scopes / Limitations of the Study..... | 14    |
| Delimitations of the Study .....       | 15    |
| Chapter Summary .....                  | 20    |

|  |    |
|--|----|
| CHAPTER II.....  | 21 |
| REVIEW OF LITERATURE.....  | 21 |
| Thematic Review .....  | 21 |
| Country Scenario .....   | 22 |
| Evolution of Atmosphere.....                                     | 30 |
| Composition of Atmospheric Gases .....                           | 33 |
| Historical Background of Climate Change.....                     | 35 |
| Status of Green House Gases.....                                 | 41 |
| Indicators of Human Fingerprint on Climate Change .....          | 56 |
| Global Impacts of Climate Change .....                           | 58 |
| Mitigating Climate Change: Learning from African Peninsula ..... | 61 |
| Impact of Climate Change in SAARC Countries .....                | 65 |
| Scenario of Climate Change .....                                 | 72 |
| Issues of Climate Change in Nepal.....                           | 74 |
| Contribution of GHGs Emission by Nepal.....                      | 75 |
| Climate Change Projections in Nepal.....                         | 77 |
| Climate Change Impacts on Livelihood .....                       | 78 |
| Hosting Cabinet Meeting at Kalapatthar .....                     | 80 |
| Co-operative Movement .....                                      | 81 |
| Problems and Challenges of Co-operative in Nepal.....            | 88 |

|  |     |
|--|-----|
| Trends of Institutionalization of Co-operatives.....           | 89  |
| Primary Co-operatives in Nepal .....                           | 95  |
| Theoretical Review .....                                       | 99  |
| Sustainable Livelihood Approach .....                          | 99  |
| Theories of Climate Change .....                               | 101 |
| First Theory: Anthropogenic Global Warming .....               | 102 |
| Second Theory: Bio-thermostat.....                             | 102 |
| Third Theory: Cloud Formation and Albedo .....                 | 104 |
| Fourth Theory: Human Forcing Besides the Greenhouse Gases..... | 105 |
| Fifth Theory: Ocean Currents.....                              | 106 |
| Sixth Theory: Planetary Motion .....                           | 106 |
| Seventh Theory: Solar Variability.....                         | 107 |
| Principles of Co-operative .....                               | 109 |
| Review of Contemporary Research Studies .....                  | 110 |
| Conceptual Framework.....                                      | 114 |
| Chapter Summary .....  | 117 |
| CHAPTER III .....  | 118 |
| RESEARCH METHODOLOGY .....                                     | 118 |
| Introduction .....   | 118 |
| Nature of the Research .....                                   | 118 |

|   |     |
|---|-----|
| Philosophical Approaches .....                        | 119 |
| Research Design .....                                 | 121 |
| Selection of Study Area .....                         | 123 |
| Sampling Criteria.....                                | 125 |
| Sampling and Sample Size .....                        | 125 |
| Methods of Data Collection.....                       | 127 |
| Observation .....                                     | 127 |
| Key Informant Interviews .....                        | 128 |
| Focus Group Discussion.....                           | 128 |
| Data Analysis.....                                    | 129 |
| The Validity of Quantitative Data .....               | 130 |
| Internal Validity .....                               | 130 |
| External Validity .....                               | 130 |
| The Reliability of the Findings .....                 | 131 |
| Chapter Summary .....                                 | 131 |
| CHAPTER IV .....                                      | 132 |
| ADAPTATION AND MITIGATION FOR SECURE LIVELIHOOD ..... | 132 |
| Nature and Composition of the Participants .....      | 132 |
| Education and Employment of the Households .....      | 135 |
| Status of Economic Conditions of the Family .....     | 137 |

|  |     |
|--|-----|
| Agro-economic Situation.....   | 145 |
| Cooperative Intervention for Livelihood Improvement .....                    | 152 |
| Response to Life Security and Quality of Life .....                          | 158 |
| Response to Climate Change with Respect to Livelihood .....                  | 161 |
| Chapter summary.....   | 163 |
| CHAPTER V .....  | 164 |
| CLIMATE CHANGE: THREAT TO EVERYWHERE.....                                    | 164 |
| Nature of Participants Responding Climate Change .....                       | 164 |
| The Sensation of Weather.....  | 167 |
| Trends of Green Coverage.....  | 176 |
| Availability of Water Sources .....  | 184 |
| Consequences in Insect Adaptation.....                                       | 195 |
| Trends of Livestock Farming and Uses of Chemical Fertilizer and Pesticides.. | 198 |
| Flowering and Fruiting in Plants .....                                       | 203 |
| Trends of Production of Crops .....  | 204 |
| Consequences of Disasters .....  | 209 |
| Pattern of Migration.....  | 210 |
| People's Experience about Impacts of Climate Change.....                     | 213 |
| Chapter Summary .....  | 214 |
| CHAPTER VI.....  | 215 |

|   |     |
|---|-----|
| COOPERATIVES: THE MEANS OF SUSTAINING LIVELIHOOD .....                            | 215 |
| Access of Excluded Communities in Cooperatives.....                               | 215 |
| Moving Ahead: From Group to Primary Cooperative Versus Micro Cooperative<br>..... | 219 |
| Primary Co-operative (Micro-cooperative) Management .....                         | 222 |
| Future Cooperative Model: Alternative Platform for Poverty Alleviation.....       | 227 |
| Beyond the Existing Cooperatives for Poverty Alleviation .....                    | 230 |
| Chapter Summary .....   | 231 |
| <b>CHAPTER VII</b> .....  | 232 |
| DISCUSSION AND NEW GROUNDED SETTINGS .....  | 232 |
| Diversity in Family Composition .....   | 232 |
| Education as a Lever for Promoting Employment .....                               | 233 |
| Rising Trends of Saving .....   | 234 |
| Crisis of Food Security and Agro- production .....                                | 235 |
| Co-operative Movement for Livelihood Improvement .....                            | 236 |
| Declination of Quality Life.....  | 237 |
| Climate Change: Thereat to Livelihood .....                                       | 237 |
| Shift in Season .....   | 238 |
| Weather Change: Rise and Fall .....   | 239 |
| Variation in Green Coverage .....   | 239 |
| Declining Water Sources .....   | 240 |

|  |     |
|--|-----|
| Changing Pattern of Insect Adaptation.....                         | 241 |
| Changing Pattern of Flowering and Ripening Fruits.....             | 242 |
| Declining Crops Production .....                                   | 242 |
| Over Rainfall and Drought .....                                    | 243 |
| People's Feeling of Climate Change .....                           | 243 |
| Including Excluded Groups in Cooperative .....                     | 244 |
| Poverty Alleviation versus Cooperatives .....                      | 245 |
| Without, With and Beyond the Cooperatives.....                     | 246 |
| Micro-Cooperatives: An Alternative Platform of Being Together..... | 247 |
| New Grounded Settings: The Knowledge Claim .....                   | 248 |
| Chapter Summary .....  | 250 |
| CHAPTER VIII .....   | 251 |
| SUMMARY, CONCLUSION AND IMPLICATIONS .....                         | 251 |
| Summary.....   | 251 |
| Conclusion .....   | 255 |
| Implications .....   | 259 |
| Philosophical Implications .....                                   | 260 |
| Implication to the Policy Makers .....                             | 260 |
| Implication to Development Partners .....                          | 262 |
| Implication to Community Workers.....                              | 262 |

|   |     |
|---|-----|
| Implication to Environment Managers .....   | 263 |
| Implication to Cooperative Management ..... | 263 |
| Implication to Agriculture Scientist .....  | 264 |
| ANNEXES .....                               | 281 |



## LIST OF TABLES

|            |   |     |
|------------|---|-----|
| Table 1.1  | Organization of the Study.....                                    | 18  |
| Table 2.1  | Contribution of Greenhouse Effects of GHGs .....                  | 42  |
| Table 2.2  | Seven Main Fossil Fuel Combustion Sources .....                   | 44  |
| Table 2.3  | Minimum Members for Registration of Primary Cooperative .....     | 94  |
| Table 2.4  | Number of Primary Cooperatives in Nepal .....                     | 96  |
| Table 2.5  | Number of Primary Co-operative of Woman in Nepal .....            | 98  |
| Table 3.1  | Study Area and Samples.....                                       | 126 |
| Table 4.1  | The Selection of Households Based on Economic Level.....          | 133 |
| Table 4.2  | The Selection of Households Based on Socio-economic Level.....    | 133 |
| Table 4.3  | The Status of Literacy Rate of Surveying Households.....          | 135 |
| Table 4.4  | The Status of Population and Employment of Households .....       | 136 |
| Table 4.5  | The Primary and Secondary Income Source of the Family .....       | 137 |
| Table 4.6  | The Trends of Economic Level of Households .....                  | 141 |
| Table 4.7  | The Status of Land Distribution of the Households .....           | 146 |
| Table 4.8  | The Enrollment in Co-operatives or Group .....                    | 153 |
| Table 4.9  | The Advantages of Co-operatives or Group.....                     | 155 |
| Table 4.10 | The Awareness about Impacts of Climate Change.....                | 162 |
| Table 5.1  | Age Specific Categorization of Male and Female Participants ..... | 166 |
| Table 5.2  | The Quantity of Heat Haze on the Sky.....                         | 171 |
| Table 5.3  | The Sensation of Warm in Summer .....                             | 174 |
| Table 5.4  | Reasons for Increasing the Green Coverage.....                    | 178 |
| Table 5.5  | The Quantity of Wild Animals & Birds around the Field .....       | 181 |

|            |   |     |
|------------|---|-----|
| Table 5.6  | The Wild Animals & Birds around the Field and Forests .....       | 182 |
| Table 5.7  | The Extinct Wild Animals & Birds around the Field and Forest .... | 183 |
| Table 5.8  | Quantity of Snow on Mountain .....                                | 186 |
| Table 5.9  | The Quantity of Monsoon.....                                      | 192 |
| Table 5.10 | The Depth of Ponds and Lakes with Comparing Past Years.....       | 193 |
| Table 5.11 | The Quantity of Water in Streams and Rivers.....                  | 194 |
| Table 5.12 | The Rate of Occurrence of Disease in Livestock and Human.....     | 200 |
| Table 5.13 | The Flowering and Fruiting Time of Plants .....                   | 203 |
| Table 5.14 | The Ripping Time of Fruits with Comparing to Past Years.....      | 204 |
| Table 5.15 | The Reasons for Increased Crop Production .....                   | 207 |
| Table 5.16 | The Alternative Sources of Income and Food against Deficit.....   | 208 |
| Table 5.17 | The Migration Pattern in Arun Valley.....                         | 210 |
| Table 5.18 | The Reasons for Migration in Arun Valley Area .....               | 211 |
| Table 5.19 | The Reasons for Migrating from Arun Valley Area.....              | 212 |
| Table 6.1  | The Dalit, Marginal and Excluded People in Co-operatives .....    | 216 |
| Table 6.2  | The Level of Benefits from Cooperatives by Excluded People .....  | 217 |
| Table 6.3  | The effective action plan through Co-operative Movement.....      | 218 |
| Table 6.4  | The Excluded People's Involvement in Co-operative Movement....    | 229 |
| Table 6.5  | Response towards Primary Co-operative .....                       | 220 |
| Table 6.6  | Alternative Views for Groups rather than Cooperatives .....       | 221 |
| Table 6.7  | The Alternative Naming of the Primary Co-operative .....          | 222 |
| Table 6.8  | The Members for Registration of the Primary Co-operative.....     | 223 |
| Table 6.9  | The Opinion towards the Registration Office.....                  | 224 |
| Table 6.10 | Colonization of the Primary Co-operatives .....                   | 225 |

|            |  |     |
|------------|--|-----|
| Table 6.11 | The Size of Co-operative Organization .....              | 226 |
| Table 6.12 | The Merging and Resizing the Secondary Cooperatives..... | 227 |
| Table 6.13 | The Options for Poverty Alleviation Models .....         | 229 |

## LIST OF FIGURES

|             |   |     |
|-------------|---|-----|
| Figure 2.1  | Climatic Variations in Nepal .....                            | 25  |
| Figure 2.2  | Types of Forest in Nepal .....                                | 28  |
| Figure 2.3  | Composition of Earth's Atmosphere.....                        | 34  |
| Figure 2.4  | Terrestrial Carbon Cycle .....                                | 46  |
| Figure 2.5  | Aquatic Carbon Cycle .....                                    | 47  |
| Figure 2.6  | Ten Indicators of a Human Fingerprint on Climate Change ..... | 57  |
| Figure 2.7  | Conceptual Framework of the Study .....                       | 116 |
| Figure 3.1  | Research Design Frameworks .....                              | 122 |
| Figure 4.1  | Number of Family Members of Surveying.....                    | 134 |
| Figure 4.2  | The Status of Income and Expenditure of the Family .....      | 138 |
| Figure 4.3  | The more annual Expenditure than Income .....                 | 139 |
| Figure 4.4  | The annually Saving Status of Households .....                | 140 |
| Figure 4.5  | The Reasons for Good Economic Status .....                    | 142 |
| Figure 4.6  | The Reasons for Bad Economic Status of the Households .....   | 143 |
| Figure 4.7  | The Expectation of Households for Economic Improvement .....  | 144 |
| Figure 4.8  | The Yearly Food Production Status of Household.....           | 147 |
| Figure 4.9  | The Distance of Selling Market.....                           | 148 |
| Figure 4.10 | The Possibility of Additional.....                            | 149 |
| Figure 4.11 | The Irrigation Facility in Summer .....                       | 150 |
| Figure 4.12 | The Irrigation Facility in Winter .....                       | 151 |
| Figure 4.13 | The Available of Seeds, Fertilizer and Pesticide .....        | 152 |
| Figure 4.14 | The Nature of Co-operatives or Group.....                     | 154 |

|             |   |     |
|-------------|---|-----|
| Figure 4.15 | The Support from other Organizations to Co-operatives .....       | 156 |
| Figure 4.16 | The Distance of Supporting Organization from the Households ..... | 157 |
| Figure 4.17 | Categories of Supporting Organization to Co-operatives.....       | 158 |
| Figure 4.18 | The Future Plan for Secure Life .....                             | 159 |
| Figure 4.19 | The Skilled Human Resource and Occupation.....                    | 160 |
| Figure 4.20 | The Occupational Expectations Households .....                    | 161 |
| Figure 4.21 | The Precautions to be Applied against the Climate Change .....    | 163 |
| Figure 5.1  | Occupational Status of Participants .....                         | 165 |
| Figure 5.2  | The Sensation of Cold in Winter .....                             | 167 |
| Figure 5.3  | The Quantity of Fog and Precipitation in Winter .....             | 168 |
| Figure 5.4  | The State of Dewdrops Fall and Cold Waves in Winter .....         | 170 |
| Figure 5.5  | The Strength of Blow of Storm/ Cyclone.....                       | 173 |
| Figure 5.6  | The Duration of Dryness in the Interval of Thirty Years .....     | 175 |
| Figure 5.7  | Change in the Status of Green Coverage .....                      | 177 |
| Figure 5.8  | Reasons for Decreasing the Green Coverage .....                   | 179 |
| Figure 5.9  | The Occurrence of Fire in the Forest .....                        | 180 |
| Figure 5.10 | Fuel Used for Cooking Purpose.....                                | 184 |
| Figure 5.11 | Amount of Water in Sources .....                                  | 185 |
| Figure 5.12 | The Quantity of Snow & Frost Fall Pattern in Winter.....          | 188 |
| Figure 5.13 | Quantity of Rain Fall in Winter .....                             | 189 |
| Figure 5.14 | The Quantity of Hailstone Fall along with Rain.....               | 191 |
| Figure 5.15 | The Number of Mosquitoes in the Interval of Thirty Years.....     | 195 |
| Figure 5.16 | The Number of Pest in Harvests.....                               | 197 |
| Figure 5.17 | The Number of Livestock Keeping in the Interval of Thirty Years . | 198 |

|             |   |     |
|-------------|---|-----|
| Figure 5.18 | The Rate of Usage of the Chemical Fertilizer and Pesticides .....   | 201 |
| Figure 5.19 | The Quantity of Crop Production in the Interval of Thirty Years ... | 205 |
| Figure 5.20 | The Production of Crops due to the Change Pattern of Weather .....  | 206 |
| Figure 5.21 | The Occurrence of Draught, Flood and Landslide .....                | 209 |
| Figure 6.1  | The Ways to Extend the Co-operative Activities .....                | 230 |
| Figure 7.1  | The Ways to Extend the Co-operative Activities .....                | 249 |

## ACRONYMS

|                               |  |
|-------------------------------|--|
| ADB                           | Asian Development Bank                                       |
| ADPC                          | Asian Disaster Preparedness Centre                           |
| AEPC                          | Alternate Energy Promotion Centre                            |
| AGW                           | Anthropogenic Global Warming                                 |
| C <sub>2</sub> F <sub>6</sub> | Hexa-fluoroethane  |
| CA                            | Conservation Agriculture                                     |
| CDIAC                         | Carbon Dioxide Information Analysis Centre                   |
| CDM                           | Carbon Development Mechanism                                 |
| CEGIS                         | Centre for Environment and Geographical Information Services |
| CF <sub>4</sub>               | Tetrafluoromethane   |
| CFCs                          | Chlorofluorocarbons  |
| CH <sub>4</sub>               | Methane  |
| ClO                           | Chlorine Monoxide  |
| CO <sub>2</sub>               | Carbon Dioxide   |
| DFID                          | Department of International Development                      |
| DHM                           | Department of Hydrology and Meteorology                      |
| DNA                           | Designated National Authority                                |
| EVAN                          | Electric Vehicle Association of Nepal                        |
| FAO                           | Food and Agriculture Organization                            |
| GCISC                         | Global Change Impact Studies Centre                          |
| GCM                           | General Circulation Model                                    |
| GDP                           | Gross Domestic Product                                       |

|                                |  |
|--------------------------------|--|
| GEF                            | Global Environmental Fund                                |
| GHGs                           | Green House Gases  |
| GLOF                           | Glacial Lake Outburst Flood                              |
| GWP                            | Global Warming Potential                                 |
| H <sub>2</sub> CO <sub>3</sub> | Carbonic Acid  |
| HCCRC                          | Himalayan Climate Change Research Centre                 |
| HCFCs                          | Hydro-Chlorofluorocarbons                                |
| HDI                            | Human Development Index                                  |
| HFCs                           | Hydro-Fluorocarbons                                      |
| HICAP                          | Hillside Conservation Agriculture Project                |
| HIV/AIDS                       | Acquired Immunity Deficiency Syndrome                    |
| HPI                            | Human Poverty Index                                      |
| HRD                            | Human Resource Development HRD                           |
| ICIMOD                         | International Centre for Integrated Mountain Development |
| IMD                            | India meteorological Department                          |
| IPCC                           | Inter-governmental Panel on Climate Change               |
| ITMC                           | Indian Tropical Meteorological Centre                    |
| IWM                            | Institute of Water Modeling                              |
| LDCs                           | Least Developed Countries                                |
| MDGs                           | Millennium Development Goals                             |
| MICCA                          | Mitigation of Climate Change in Agriculture              |
| MoAC                           | Ministry of Agriculture and Cooperatives                 |
| MoEST                          | Ministry of Environment Science and Technology           |
| MoU                            | Memorandum of Understanding                              |



|                  |   |
|------------------|---|
| MTEF             | Medium Term Expenditure Framework                     |
| N <sub>2</sub> O | Nitrous Oxide   |
| NAPA             | National Adaptation Program of Action                 |
| NARC             | Nepal Agriculture Research Centre                     |
| NCDB             | National Co-operative Development Board               |
| NF <sub>3</sub>  | Nitrogen Tri-fluoride                                 |
| NOAA             | National Oceanic and Atmospheric Administration       |
| NWP              | Nepal Water Partnership                               |
| O <sub>3</sub>   | Ozone   |
| ODS              | Ozone Depleting Substances                            |
| OECD             | Organization of Economic Co-operation and Development |
| PFCs             | Per-fluorocarbons                                     |
| PPB              | Parts Per Billion                                     |
| PPM              | Parts Per Million                                     |
| PPT              | Parts Per Trillion                                    |
| RCS              | Registration of a Cooperative Society                 |
| REDD             | Reduce Emissions from Deforestation and Degradation   |
| ROAP             | Regional Office for Asia Pacific                      |
| SAARC            | South Asian Association of Regional Corporation       |
| SDMC             | SAARC Disaster Management Centre                      |
| SF <sub>6</sub>  | Sulphur Hexa-fluoride                                 |
| SMRC             | SAARC Meteorological Research Centre                  |
| SO <sub>2</sub>  | Sulfur Dioxide  |
| SPSS             | Statistical Package for Social Science                |

|        |  |
|--------|--|
| SSTs   | Sea Surface Temperatures                                 |
| THC    | Thermo-Haline Circulation                                |
| TSO    | Tropical intra-Seasonal Oscillation                      |
| UNCED  | United Nations Convention on Environment and Development |
| UNDP   | United Nations Development Program                       |
| UNEP   | United Nations Environmental program                     |
| UNFCCC | United Nations Framework Convention on Climate Change    |
| VDCs   | Village Development Committees                           |
| VSL    | Village Saving and Loans                                 |
| WB     | World Bank   |
| WFP    | World Food Program                                       |
| WMO    | World Meteorological Organization                        |
| WoV    | Window of Vulnerability                                  |
| WWF    | World Wildlife Fund                                      |

## CHAPTER I

### INTRODUCTION

Climate change has emerged as the major challenge to sustainable development. The issue is directly related with the life styles in developed economies and the livelihood constraints of large number of poor people in underdeveloped countries. The issue bears the ethics of climate justice, livelihood security of poor and vulnerable groups and magnified sections along with good governance & human right. Thus, it is logical corollary that climate change and global poverty have attracted a lot of attention in recent years as key global challenges of our times, Sharma (2009). Both are serious challenges to the future health and prosperity of our planet. They need to be combated simultaneously; we cannot take care of one without addressing the other. An effective attack on poverty and the ill effects of climate change requires taking comprehensive action that encompasses both issues. We may not be able to fight with climate change without considering the rising needs of poor people and tastes of developing poor countries, nor can we effectively address global poverty without accounting for the impacts of climate change on agriculture, especially violent weather events that has particular impact on the poorest sections of these countries, Shah (2011).

### Background

Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This may be caused primarily by increases

in greenhouse gases such as Carbon Dioxide (CO<sub>2</sub>). The seven indicators of global warming as mentioned by Shah (2011) are to increase the humidity or precipitation at atmosphere, to increase the temperature of troposphere layer, over oceans, sea surface, sea level, over land and ocean heat content. The three indicators of global warming are to decrease the glaciers, snow cover and sea ice, Alexander (2006).

The main greenhouse gases are Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>) (which is 20 times as powerful gas as Carbon Dioxide) and Nitrous Oxide (N<sub>2</sub>O), fluorinated industrial gases like Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Chloroflorocarbon (CFCs) and Sulphur hexafluoride (SF<sub>6</sub>), water vapor etc. These greenhouse gases trap some of the outgoing solar energy, retaining heat as a greenhouse and it affects to rise in temperature on Earth. Many of these greenhouse gases are actually life enabling by trapping heat from to escape back into space and the Earth's average temperature not to be a lot colder. If the greenhouse effect becomes stronger, then more heat gets trapped than needed and the Earth becomes less habitable for humans, plants and animals, Titus (1991).

Climate change presents significant threats to the achievement of the Millennium Development Goals (MDGs) especially those related to eliminating poverty & hunger and promoting environmental sustainability. An increasing number of evidence is pointing to the disproportionate negative impact of climate change on the poorest countries who ironically have contributed least to the problem. Climate change is expected to increase the frequency and intensity of severe weather events. Poor countries lack the infrastructure necessary (e.g. storm walls, water storage) to respond adequately to such events. Diseases such as malaria and cholera are likely to have wider ranges, affecting more people in the poorest regions of developing nations

that do such diseases affect already most. Changing rainfall patterns could devastate rain-fed agriculture on which so much of the population in developing countries depends to survive, SAAPE (2010).

Nepal held cabinet meeting high in the Kalapathar at the base of Mount Everest in an attempt to draw world attention to the danger of global warming posing on glaciers. Yet among Nepal's own citizens, awareness of global warming or climate change lacks much. Irrespective of whether Nepalese live in cities or the countryside, climate change is contributing to a crisis in their food supply especially hard hit is the one-third of the population that lives below the poverty line, Dixit (2011). Weather patterns that used to occur in predictable cycles now no longer do so. Sudden intense rainfall; longer, drier winters; delayed monsoon seasons; and dramatic changes in temperature are believed to be caused in part by expanding Himalayan glaciers, resulting in farm fields that are subjected to drought, fire, flash floods, landslides, and soil erosion. According to climate change experts, citizens of Nepal can undertake initiatives such as planting crops that are more resistant to climate variation, better water management, the use of certain plants to halt soil erosion, early flood warning systems, among many others. First, however, the Nepalese population must shift from passivity to adaptation and action. But majority of them do not know much about the environment.

In addition to their recent sky-top cabinet meeting, the government of Nepal has been proactively trying to limit negative environmental impact on its citizens by joining the United Nations Framework Convention on Climate Change and creating a National Adaptation Program of Action. These two initiatives, the government hopes may result in substantial funding for climate change adaptation. However, if progress

is to be made, Nepal's citizenry of poor rural farmers, in particular they need to be educated about global warming. Even during the recent years of poor crop yields attributable to temperature extremes and alternating tumultuous floods and drought, awareness of climate change has remained very sensitive, Paudel (2011).

Rural communities place on record how winters have become significantly drier over recent decades, that the onset of the monsoon is no longer predictable for planting, when the rains are more intense, and that insect habitats are changing. The average temperatures in Nepal are rising faster about double the global increase and even more in the mountain regions. Further temperature increase of  $0.5^{\circ}$ - $2.0^{\circ}$  by the 2030s, again a much faster rate than expected globally. Add we one pair on joint effort to promote adaptation and mitigation through the Co-operative approach etc.

In atmosphere, there is 78% Nitrogen, 21% oxygen and rest is other gases. The global warming and climate change have been top agenda since last three and four decades. The snow melting and the reducing permanent ice sheet in the polar region are the indicators to confirm rapid rise of atmospheric temperature. The climate change has become a great problem for farming, livelihood and food sovereignty of common people. In first time Swedish Scientist Svante Arrhenius had found in 1894 that rise in atmospheric temperature is in parallel with rise in carbon dioxide concentration. In 1896, Arrhenius had published first calculation of global warming from human emissions of  $\text{CO}_2$  and he calculated the effect of a doubling atmospheric carbon dioxide to be an increase in surface temperatures of 5-6 degrees Celsius. The sudden rise in carbon dioxide level in atmosphere during last three centuries from 280 ppm to 315 ppm proves that GHGs are increasing in the atmosphere. The GHGs

screen growing thicker and average 0.6 degree Celsius temperature is already raised, Sharma (2009).

The biggest sources of global warming are industrialized countries and industrialization of agriculture. Especially small farmers and rural communities of developing countries are more suffering from climate change. The changing weather patterns bring unknown pest, diseases, droughts, floods, storms which destroy the crops, farming land, farming stock and farmer's livelihood. The plant, animals and marine life are threatened and disappearing due to the combined effects of climate change and industrial exploitation. Also life is endangered by the decreasing of fresh water resources day by day due to the climate change pattern. The use of chemicals in agriculture and deforestation for farming are also contributing to climate change. The climate change affects the ability of developing countries to achieve their poverty reduction and sustainable development strategies, Sharma (2009).

More than sixty-five percent people of Nepal primarily depend on agriculture sectors and they are highly affected in their livelihood due to the climate change pattern. The emission of greenhouse gases is negligible of Nepal but impact of climate change is very high. The climate change directly affects to melt the ice in the Himalayan of the North and raising the temperature in South part of Nepal. The developed countries are mainly responsible for global warming and they need the concrete steps to reduce their emission of greenhouse gases. The climate change affects globally and all global communities should be focused to solve this serious global problem. Especially industrialized developed countries which produce more GHGs to atmosphere, these countries should be responded to reduce the GHGs and to raise the destroying funds for developing countries.

This study was designed to find out the impacts of climate change on livelihoods to enable and support effective adaptation decisions that would reduce the vulnerability to climate and environmental change while promoting sustainable development. It also seeks to generate information about the local adaptation strategies and mitigation measures that will be guidance for formation of appropriate policy and program in the national level.

### **Overview of Nepalese Economy**

Poverty and unemployment are rampant in Nepal. The economic growth of Nepal is 3.5 percent and seems the increasing trend of the gap between poor and rich. Seven million people are under poverty line, it means their income is less than one US dollar per day. 3.4 percent people go hungry every night, 25 percent people are landless. Daily more than 1000 youth are going to foreign countries for working and many workers are died. According to data of 2009, seven hundred fifty four Nepali workers died in Gulf countries. 16.4 percent of price rise in food and beverage items and the inflation in 2009/ 2010 is 14 percent. The unemployment population of Nepal is 18.3 % and 2.6 million child labor are at present in Nepal. According to government progress report, people below poverty line become 25.4 % in 2010 from 31% in 2004. The enrolment in primary education is 93.7% , infant mortality is 48 per thousand, under 5 years children mortality is 50 per thousand and maternal mortality is 229 in one hundred thousand, Khadka (2011).

According to census of 2001, the population of Nepal was 23.15 million, 85 percent is rurally-based. However, with 75 percent of the country's total area not suitable for agriculture combined with increasing environmental degradation and the decreasing productivity of croplands, forests and pastures, a sustainable form of



livelihood through agriculture and farming is no longer possible for many families and communities. The vast majority of people in Nepal are very much food insecure and have been struggling hard for a sustainable livelihood. About 68 percent of all hill districts and 88 percent of all mountain districts in Nepal are with food deficiency. The slow agricultural growth rate implying stagnation in the agricultural sector during the past three decades has clearly demonstrated the relative failure of past agricultural development policies and has indicated the urgent need for a new approach. Only through the organization and empowerment of rural communities may sustainable management of natural and agricultural resources and basic livelihood rights be achieved.

Bio-intensive farming (BIF) is an integrated, multi-disciplinary, humanitarian approach to agriculture based on the empowerment of farming community for adopting intensive organic farming to meet the steadily increasing need of the community on sustained food supply and security. It is friendly to human and animal health, and nutrition. The concept is based on the empowerment of local Community-Based Organizations (CBOs) and advocates for the rights of the farming community. The BIF technology is based on the utilization of indigenous and locally available technology resources and experiences.

International Centre for Integrated Mountain Development (ICIMOD) has suggested that only six glacial lakes in Nepal should be classed as potentially dangerous and that none posed an imminent threat. It has also pointed out that the volume of snow and rainfall in the mountain regions has much greater influence on the rivers than the glaciers. Water is the dominant feature of this topography; beyond the glaciers, lays 6,000 rivers that play their role in regular flooding and landslide

disasters, as well as the more positive value of irrigation and hydropower. Whilst an increase or decrease in rainfall might conceivably benefit certain crop yields, any long-term adjustment of input to the overall hydrological cycle represents a threat. The immediate urgency in assessing the impact of climate change in Nepal is the evidence that poor rural households are already unable to cope with deviation from benign weather patterns, from whatever cause. More change means more poverty. If the impact on the poor is the greatest concern relating to climate change in Nepal, then the optimum adaptation strategy is to accelerate steps towards poverty reduction and food security.

Nepal is a world leader in decentralized forest management, which aims to provide livelihoods for the poor without degrading the natural resource. Established for over three decades and substantiated in law by the Forest Act 1993, Community Forest User Groups now engage 1.6 million households in management of about a quarter of Nepal's forest cover. In the absence of significant government spending on the forest sector, other drivers of deforestation retain their force clearance for agriculture and grazing combines with the use of firewood as primary energy source by almost 70% of the population. The overall rate of deforestation in Nepal is believed to remain alarmingly high at 2% per annum. The weakened soil structure contributes to the loss of groundwater in lowland regions such as in Terai and increases the risk of floods and landslides, Dixit (2011).

The rural livelihood of Nepal is not running smoothly and there are so many challenges. Rural people should be worked jointly to withstand these challenges and now a day people are participated in co-operative movement and groups like mothers' group (Ama Samuha), Bachat Samuha, community forest preservation groups, etc. In

the context of under developing countries, cooperatives can play the important role for poverty alleviation. It is felt to change the rules and conduction of cooperative in the favor of Dalit, excluded, marginal and poor people.

### **Statement of the Problem**

The climate change patterns are more important for affecting the functioning of the earth's eco-system than any other environmental changes. The rate of carbon emission should be reduced to minimize the impacts of climate change. According to the Intergovernmental Panel on Climate Change (IPCC), a panel of 2000 scientists has determined that even if we take steps now to reduce our emission of greenhouse gases, the globe could warm up at a rate faster than it had been in the past 10,000 years. Carbon Dioxide (CO<sub>2</sub>) has been the most important Green House Gas (GHG), forming 80% of the world's GHG emission in 1990, which is principally produced by the combustion of fossil fuels such as oil, coal and gas. Rapid industrialization powered by burning of fossil fuel over the past 200 years has resulted in a dramatic rise for carbon dioxide in the atmosphere from 0.028% to 0.036%. The concentration of several greenhouse gases like methane, Carbon Dioxide, and CFCs has increased over time. Due to some of the anthropogenic sources, greenhouse gases increased leading to higher carbon dioxide concentration. Livestock and agriculture farming use the fertilizers, pesticides etc. that also affects the livelihood. Use of Chlorofluorocarbons (CFCs) in refrigeration systems and use of CFCs and halogens in fire suppression systems and manufacturing processes also has contributed for global warming that causing the climate to change.

Nepal (2009) mentioned that Chlorofluorocarbons (CFCs), Halos, Hydro-chlorofluorocarbons (HCFCs) etc. compounds which are emitting regularly from industrial sectors that destroy the Ozone ( $O_3$ ) of the Stratosphere layer of atmosphere. Chlorine radicals are released from these compounds when these contact with Ultra-violet Radiation of stratosphere layer. That chlorine radical reacts with Ozone and produces the highly active Chlorine monoxide (ClO) molecule that can destroy 100,000 molecules of Ozone. Due to decrease of the density of Ozone layer, Ultra violet Radiation enters to our environment and directly affects to the living being. The regular contact of Ultra Violet Radiation decreases immunity power of human being and animals and different types of diseases can attract easily. It also affects the vision of eyes and Deoxyribonucleic Acid (DNA) of the cell. That Radiation destroys phytoplankton and kills fishes of thousand-mile depth of sea. These plants and animals are basic food of the water ecosystem and food web may be affected. It means 30% animal protein of sea may be lost which is regularly getting by human. That radiation directly affects the photosynthesis process and plant's leaves become thick & narrow. It effects for growth and crop production.

Climate change is hitting hard the countries with poor and weak economies. Most developing countries and the poor are most vulnerable as they depend on climate sensitive sectors like agriculture. Adaptation to climate change requires multiple stakeholders to change their behavior. The process of adaptation is always constrained by the institutional, social, economic and political environment in which people must operate. This is fact in developing countries especially for poor people due to uncertainties associated with identifying the impacts of climate change and the

many problems that farmers and decision makers are facing, Titus (1991). The climate change becomes complexities and more challenges in the developing world.

Nepal is the vulnerable country because of the impacts of climate change. The impact of global warming is already being felt by the most vulnerable, the poorest people and countries and lack of resources to cope with the climate change. The overall effect of climate change on agriculture and livelihood may depend on the balance of these effects. The farmers have to adjust to the changes in climate by adapting their usual crop cycle and production systems to an unpredictable situation because of the climate change. Droughts and floods are leading to crop failures, increasing the number of people becoming hungry in the world. These issues make careful engagement of multiple decision makers in the development and implementation of adaptation strategies even more important. Therefore, the following major questions are still to be solved:

1. How can information of climate change be informed to poor and uneducated people for sustainable livelihood?
2. What are the sustainable strategies of decision makers for management of agricultural system and livelihood to withstand the climate change?
3. What are the economic and agricultural policies for managing the climate change?
4. What types of co-operatives are suitable for farmers and poor people to sustain their livelihood?

5. What are the government policies and strategies to reduce the global warming in own country and worldwide?
6. How are the poor and uneducated people managing their food security systems to face the climate change and get rid of hunger & food insecurity?
7. How can the poor, marginalized, Dalit, excluded people easily participate to co-operative organization to reduce their poverty?

There is lack of long term co-operative planning with a clear vision and insufficient legal provision, rules, regulations and standards to regulate and monitor co-operatives for sustainable economic, social and cultural development of low level people of Nepal, insufficient and ineffective structural and institutional arrangements for the co-operative sectors to withstand with climate change pattern, lack of formal co-operative education, trainings and systematic co-operative information system, distribution of information, business leadership development, among co-operatives and their associations, NPC (2007). There is the difficulty for registration of co-operative organization for the poor, marginalized, Dalit, excluded people and the minimum 25 members of 25 families and registration office are far from the rural area.

Based on the different questions raised in this sector, there exist different issues in the sectors of sustainable livelihood, climate change and cooperative movement of Nepalese society. My research problem is to assess the impacts of climate change in sustainable livelihood and response through cooperative movement of vulnerable groups like poor, marginalized, Dalit and excluded people.

### **Purpose of the Study**

The purpose of the study is to trace out the current trend of climate change, resulting impact on livelihood and required type of co-operative movements for their sustainable life. The specific objectives of this study are,

- a. To explore adaptation and mitigation measures for secure livelihood of people.
- b. To assess the impacts of climate change in livelihood of Nepalese people, and
- c. To analyze the suitable model of co-operative movement for sustainable livelihood of vulnerable groups ( poor, marginalized, Dalit, excluded people ) to withstand climate change.

### **Research Questions**

The research questions for guiding the research are devised as,

- a) What are the measurements of adaptation and mitigation for secure livelihood of people?
- b) How does climate change affect in livelihood of the Nepalese people? and
- c) How does co-operative movement promote sustainable livelihood of vulnerable and marginalized people to cope with climate change?

### **Rationale of the Study**

This study deserves to identify the effect of the global warming and analyze the impact of climate change on livelihood of Nepalese society. It also analyzes the economic role of co-operative movement for sustainable livelihood of poor, marginalized, Dalit, excluded people. There are very less studies on the effects of climate change in livelihood of the major of people of the country. The study can also

be helpful for the planners and decision makers to mitigate the impact of climate change. The climate change may be largest problem of the present world, the study on effect of climate change in agriculture, livelihood of the people and elements of the environment necessary. In a country where most of the people are farmers and facing the problem of food crisis and livelihood, this study can help in its solution.

This study analyzes the suitable model of co-operative movement for sustainable livelihood to withstand the climate change, which will be useful for poor people of the developing countries. The study has selected only geographical area of Hill, which can represent the scenario of hilly area of Nepal. Therefore, the study of impact of climate change analysis and mitigation measures in this research can provide useful insight to deal with climate risks in livelihood. Inequitable land distribution limits their access to natural resources, credit, improved technology and the support service needed to improve their production and income. The impact of climate change also hits and forces them to be more vulnerable in their livelihoods.

### **Scopes / Limitations of the Study**

This study reviewed the impact of climate change, livelihood and co-operative in the context of Nepal. It may be helpful to understand the shortcomings of the program, implemented by the government and put forward the recommendations in the concerned field for the betterment. This study analyzed impact of climate change and the suitable model of co-operative movement for sustainable livelihood to withstand the climate change which may be useful for people of the under developing and developing countries. This study helps for further study in the sector of socio economic and environmental studies.



### **Delimitations of the Study**

The study covered broad areas of climate change, livelihood and co-operative in the context of Nepal. The study is limited to option survey and qualitative research study. Due to the academic study for Ph. D course, it may not cover the large study area of Nepal and may not be generalized for whole Nepal. Further study is required for valid representative of whole Nepal in the context of climate change, livelihood and co-operative.

### **Operational Definition of the Key Terms**

**Greenhouse gases:** Greenhouse gases include methane, chlorofluorocarbons and carbon dioxide. These gases act as a shield that traps heat in the earth's atmosphere.

The resulting greenhouse gas effect is thought to contribute to global warming

**Livelihood:** livelihood is multi-dimensional, covering not only economic but also political, cultural, social and ecological aspects.

**Sustainable rural livelihoods:** The concept of 'sustainable rural livelihoods' is increasingly central to the debate about rural development, poverty reduction and environmental management. The term 'sustainable livelihoods' relates to a wide set of issues which encompass much of the broader debate about the relationships between poverty and environment.

**Co-operative:** The co-operative is comprised of two 'words, 'Co' stands for together and 'operative' stands for working. It means, the meaning of co-operative is working together. The term of co-operative is living together, thinking together and working together for common benefit of the members. The co-operative is neither communist ideology nor capitalist ideology; it is equipment for group business of members involved according to their felt needs. Similarly, the ICA congress (1995)

has defined co-operatives, as “A co-operative is an autonomous association of persons united voluntarily for the fulfillment of their common economic, social and cultural needs and aspiration through a jointly owned and democratically controlled enterprise.”

**Climate change:** Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors that include oceanic processes (such as oceanic circulation), variations in solar radiation received by Earth, plate tectonics and volcanic eruptions, and human-induced alterations of the natural world; these latter effects are currently causing global warming, and "climate change" is often used to describe human-specific impact.

**Vulnerability:** Vulnerability refers to the inability to withstand the effects of a hostile environment. A window of vulnerability (WoV) is a period within which defensive measures are reduced, compromised or lacking.

**Bio-diversity:** Biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance.

Ecosystem: An ecosystem is a community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. These components are regarded as linked together through nutrient cycles and energy flows. As ecosystems are defined by the network of interactions among organisms, and between organisms and their environment, they can come in any size but usually encompass specific, limited spaces (although it is sometimes said that the entire planet is an ecosystem).

Climate change mitigation: Climate change mitigation is action to decrease the intensity of forcing in order to reduce the effects of global warming. In contrast, adaptation to global warming involves acting to tolerate the effects of global warming. Most often, climate change mitigation scenarios involve reductions in the concentrations of greenhouse gases, either by reducing their sources or by increasing their sinks. The UN defines mitigation in the context of climate change, as a human intervention to reduce the sources or enhance the sinks of greenhouse gases.

Climate change adaptation: The UNFCCC defines it as actions taken to help communities and ecosystems cope with changing climate condition. The IPCC describes it as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. The UN Development Program calls it a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented.

### **Organization of the Study**

My thesis consists of seven chapters. The present chapter contains background, statements of problem, the purpose of the study, the specific objectives of the study,

research questions, significant of the study, scope of the study, organization of the study, delimitation of the study and chapter summary.

Chapter two provides a comprehensive literature review and chapter three discusses models, and methodology and research procedures in detail. Similarly, chapter four provides data tabulation and presentation of the livelihood. Chapter five provides data tabulation and presentation of the climate change sector and Chapter six provides data tabulation and presentation of co-operative sectors. Similarly, Chapter seven contains the discussion and new grounded setting of the study, Chapter eight contains the summary, conclusion of the study along with policy recommendations and further implications. Table 1.1 explains the details about my organization of the thesis report.

**Table 1.1**

**Organization of the Study**

| Chapter     | Organization of the Study   |
|-------------|---|
| Chapter I   | Introduction, research problem, purpose of the study, research question, significant of the study, scope of the study, organization of the study and chapter summary.   |
| Chapter II  | Literature review, thematic review, theoretical review, contemporary research studies and conceptual framework of the study, theoretic and chapter summary.   |
| Chapter III | Research Methodology, sampling strategies, data collection techniques, instruments, techniques of data analysis and reduction, validity and reliability and chapter summary.  |
| Chapter IV  | Data presentation and analysis of diversity in family composition, education as a lever for promoting employment, raising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement and chapter summary. |

|              |  |
|--------------|--|
| Chapter V    | Data presentation and analysis of climate change, the emerging themes like declination of quality life, shift in season, weather change, the changing pattern of insect adaption, changing time of flowering and ripping fruits, declining crops production, over rainfall and drought, people's feeling of climate change, variation in green coverage, and declination of water sources and chapter summary.   |
| Chapter VI   | Data presentation and analysis of cooperative, access of excluded communities in cooperatives, moving ahead: from group to primary cooperative versus micro-cooperative, primary cooperative (Micro-cooperative) management, future cooperative model: alternative platform for primary poverty alleviation and beyond the existing cooperative for poverty alleviation and chapter summary.   |
| Chapter VII  | Discussion and new grounded setting of the study, diversity in family composition, education as a lever for promoting employment, raising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement, declination of quality life and climate change, shift in season, weather change, variation in green coverage, declination of water sources, changing pattern of insect adaption, changing time of flowering and ripening fruits, declining crops production, over rainfall, drought, and people's feeling of climate change, the inclusion of the excluded groups in cooperatives, poverty alleviation versus cooperative movement, with, without and beyond cooperatives, micro-cooperatives and chapter summary. |
| Chapter VIII | Summary, Conclusion, recommendations and further implications.   |

### **Chapter Summary**

This chapter is a glimpse of my whole thesis work. It covers the background, statement of problems, purpose of the study, research questions, significant of the study, scope/limitation of the study, delimitation and organization of the study.

The next chapter presents the selected literature review related to the principles and practices of livelihood, climate change and cooperative theories in the topic of theoretical review. Similarly, literatures of the different themes including climate change, livelihood and cooperatives under different themes, contemporary research studies and conceptual framework of the study are integrated.

## CHAPTER II

### REVIEW OF LITERATURE

In the earlier chapter, I discussed about the introduction of research, statement of problem, purpose of the study, specific objective, research questions, scope/ limitation of the study, delimitation and organization of research. This chapter has presented on the subject of literature review, carried out based on available literatures. It has covered the thematic review, theoretical review and contemporary research studies and conceptual framework of the study.

#### **Thematic Review**

Literatures of the different themes including climate change, livelihood and cooperatives under different themes have been reviewed and presented in sequential manner in the subsequent chapters. The review has covered country scenario, atmospheric condition and evolution of Earth's atmosphere, atmospheric compositions, historical background of climate change, green house gases, climate change projection, impacts of climate change, indicators of climate change, mitigation of climate change in Agriculture programme in Tanzania and Kenya, cooperative movement in the world and also in Nepal, primary cooperatives in Nepal, problems and challenges of cooperatives and trends of registration of cooperatives in different countries.

## Country Scenario

This chapter dealt with the general introduction of overall view of Nepal. That country is landlocked and situated in the southern Himalayan side and its total area is 147,181 sq. km. The land and water cover 92.94% and 7.06 % of the total area respectively. It covers 0.03% part of world and 0.3% part of the Asia. The average North-South width is about 193 km and East-West length averages to 885 km. The country lies between India in the East, West and South by covering boarder of 1,690 Km and the People's Republic of China in the North with boarder of 1,236 km. It is situated at 26° 22' to 30° 27' North latitude and from 80° 04' to 88 ° 12' East longitudes with an altitudinal range from 60m in the south to 8,848m in the north, Sharma (2009).

Geographically, Nepal represents a transitional mountain area with over three quarters of the land covered by strong hills and mountains. The geological formations correspond to the physiographic zones and most parts of the country are geologically weak and easily broken. The Siwaliks or Chure Bhabhar and Middle Mountains are ecologically threatened and geologically vulnerable.

Nepal is broadly divided into three ecological regions: the Terai (plain area) in the south, the Hills in the middle and the Mountains in the north covering 23, 42 and 35 percent of the total area respectively. Terai is a low-lying plain and highly vulnerable to floods during the monsoon. Similarly, the mountain and hills, due to its sloppy and fragile landscape, is vulnerable to extreme climatic events. The Terai or Madhesh is situated between 60 metres to 300 metres above the sea level. It is southernmost part with plain area and its extension is to the Northern India. Due to irrigation and fertile land, it is also called Store of Crops. The Outer Terai ends at the first range of



foothills called the Siwaliks or Chure Bhabhar, which is densely forested. Below the Chure Bhabhar, there is greater permeable sediments and force groundwater to the surface in a zone of springs and marshes. The biggest forest called Charkose Jhadi lies in the Terai region. In several places beyond the Siwaliks there are Dun valleys called Bhitri Madhesh with productive soil, Sharma (2009). The main Dun valleys are Dang and Deukhuri in Western and the Chitawan Valley in central of Nepal. The Terai ends and the Hills begin at a higher range of foothills called the Mahabharat Range.

The hill region is situated south of the mountain region and north of Terai region. It is mostly between 600 metres to 3,336 meters altitude. It covers 68 % land of Nepal. The Chure and Mahabharat ranges are also included in this region. It is sloping land and also has valleys like Katmandu, Pokhara, Dang and Deukhuri. It is affected by soil erosion and land slide in monsoon. This land is good for vegetable, fruit, herbs and cash crops like Alaichi, Tea and Coffee etc.

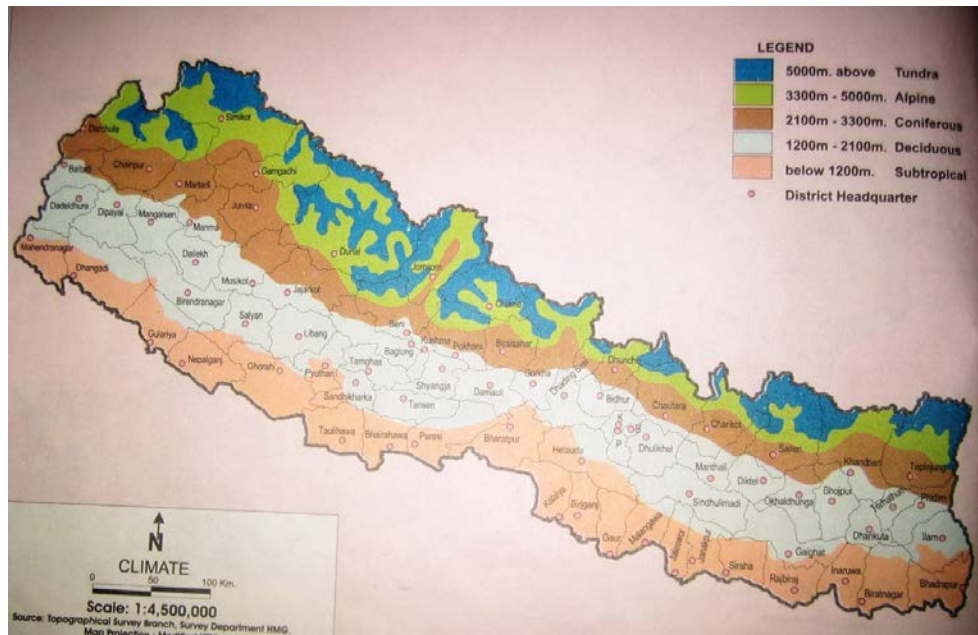
The Mountain region or Himalaya is situated from 3,360 to 8,848 metres. It rises as a virtual wall beyond the snowline at 5,000 to 5,500 metres to some 90 peaks over 7,000 metres and eight exceeding 8,000 metres including Mount Everest at 8,848 metres. The snow line begins up to 5000 metres and mostly almost area is covered by snow. There are other Himalaya not continuous across Nepal. Permanent villages in the mountain region stand as high as 4,500 metres with summer encampments even higher, Sharma (2009).

Nepal has tremendous variation in climate with wide range from the tropics to the alpine regions. The remarkable differences in climatic conditions are primarily related to the enormous range of elevation within a short north south distance. There are four seasons in Nepal namely Spring, Autumn, Summer and Winter. The national

mean temperature is around  $15^{\circ}\text{C}$ , and studies carried out by the Department of Hydrology and Meteorology showed that the average temperature in Nepal is increasing at the rate of approximately 0.06 degrees Celsius per year. The maximum temperature of the year occurs in May or early June, starts decreasing rapidly from October, and reaches the minimum of the year in December or January.

The average rainfall of the country is 1,500 mm. Nepal receives abundant rainfall, but the distribution throughout the year is of great concern about the occurrence of floods, landslides, and other extreme events. Most floods occur during the monsoon season when heavy precipitation coincides with snowmelt in the mountain. Rainfall occurs within the monsoon, receiving of the total precipitation between June and September. The annual mean precipitation is around 1800 mm in Nepal with 80 percent of occurring during the monsoon season (June to September). Rains diminish in September and generally end by mid-October, generally cool, clear, and dry weather, as well as the most relaxed and jovial period in Nepal. There are more than 600 rivers and rivulets including major three rivers like Sapta Koshi in the East, Sapta Gandaki in the middle and Karnali in the west. The figure 2.1 illustrates the types of climate found in Nepal, Sharma (2009).

**Figure 2.1 Climatic Variations in Nepal**



Source: Everest Atlas, 2007

Tundra Climate is found above 5,000 metres where snow falls all over the year.

Temperature becomes below  $0^{\circ}$  Celsius. Alpine Climate is found in Himalayan region of 3,350 metres to 5,000 metres. Winter temperature becomes below  $0^{\circ}$  Celsius and maximum summer temperature becomes  $10^{\circ}$  Celsius. The rainfall is below 30 centimetres all over the year. Similarly, Coniferous climate is found between 2,100 metres to 3,350 metres. Winter temperature becomes below  $0^{\circ}$  Celsius and summer temperature becomes  $10^{\circ}$  Celsius to  $15^{\circ}$  Celsius. The rainfall is below 50 centimetres all over the year. In winter, snow falls less. Due to the low temperature and low rainfall, crops production is also low. The deciduous climate is found below 1,200 metres altitude. Summer becomes warm and shorter but the winter becomes cold and longer. Winter temperature becomes below  $5^{\circ}$  Celsius and summer temperature becomes  $15^{\circ}$  Celsius, Sharma (2009). The rainfall is 250 centimetres in south part and

100 centimetres in north part due to the moving monsoon from south to north.

Subtropical Climate is found between 1,200 metres to 2,100 metres altitude. Winter temperature becomes 15<sup>0</sup> Celsius to 5<sup>0</sup> Celsius and summer maximum temperature becomes 38<sup>0</sup> Celsius to 42<sup>0</sup> Celsius. The rainfall is above 200 mililitres due to the good monsoon weather. This climate is best for cultivation.

By religion Nepal is composed of 80.62 percent Hindu and the remainder is made up of Buddhists (10.70 %), Muslims (4.20%), Kirat (3.60%), Christian (0.45 %) and others (0.40%) CBS (2001). The census of 2001 has listed more than 100 caste/ethnic groups as inhabitants of Nepal having their own culture and languages. Almost half of the population lives in the Terai region, where the land is more suitable for cultivation. Like many other Least Developed Countries (LDCs), Nepal's development process has commenced relatively recently and has faced challenges of inadequate infrastructure in a highly rugged terrain, little exploitable natural resources, a shortage of skilled labor, and a landlocked location. Nepal's GDP is US\$5.5 billion; an annual average growth rate of 4.9 percent and per capita income is US\$250, which is among the lowest in the world, ADB (2011).

Nepal has a population of 23 million with a growth rate of 2.24 percent (NPC, 2001). However, the population is overwhelmingly concentrated in rural areas, with only 12 percent living in urban areas (World Bank, 2002). Consequently, rural population density is relatively high at 686 people per square kilometer, a figure that exceeds that for most low-income countries (World Bank, 2002). Nepal has one of the highest population densities in the world with respect to cultivable land (MoPE, 2000). Population projected for the year 2006 is 25.8 million. Life expectancy at birth is 63.3 years, the lowest in South Asia. According to HRD (2007), infant mortality per

1,000 live births is 64.4, the highest in South Asia; and illiteracy among the population above the age of 15 is 62 percent.

The agriculture sector employs most of the labor force, which was at 82 percent in 2000. Despite engaging a majority of the population, agriculture is primarily a subsistence activity and contributes only 38 percent to GDP, compared to industry at 23 percent, and services at 39 percent (NAPA Case Study, 2003). The preliminary estimates of per capita GDP and per capita GNP in terms of US dollar are 315 and 322 at a current price respectively for the year 2005/2006. Thirty one percent of the populations are below the absolute poverty line. Nepal's economic growth of the country has not improved substantially over time to overtake population growth. Nepal's economy is overwhelmingly dependent on agriculture. Approximately 40 percent of the country's GDP came from agriculture in 2000, down from 52 percent in 1990 (MoF, 2002). Nepal is a major tourist destination: a significant fraction of foreign earned income is dependent on the country's natural resources.

A heavy reliance on tourism and agriculture makes Nepal's economy very sensitive to climate variability (World Bank, 2002). With a Human Resource Development Index of 0.332, Nepal ranks 151 among 174 countries (HRD, 2001). Nepal is one of the poorest countries in the world, with 82.5 percent of the population living below the international poverty line of \$2 per day (World Bank, 2003). A Gini coefficient of 0.37 indicates that income distribution is somewhat uneven. In fact, some 38 percent of the population survives on less than US\$1 per day. However, Nepal has considerable scope for accelerating economic growth by exploiting its potential in hydropower and tourism; these are the areas of recent foreign investment interest (World Bank, 2002). About 80 percent of the population of Nepal depends on

the forests for daily fuel wood supply and 42 percent on the fodder for livestock as these are extracted from the forest (WECS, 1997). Therefore, forest stands as one of the most important natural resources to meet the basic needs of firewood, fodder and timber of the people. The land resource map of the country has revealed that cultivated land covers about 20 percent of the total land, forest 29 percent, grassland covers 12 percent, shrub lands 11 percent, and other categories like rocks, snow lands and settlements make up the rest. Of the total forestland, 35 percent is in the hills and one-third in the mountain region (UNEP, 2001).

**Figure 2.2      Types of Forest in Nepal**



Source: Everest Atlas, 2007

Nepal is also rich in fascinating biological diversity. Nepal occupies only 0.03 percent of the total surface of the earth (MoPE, 2001) and covers 0.1 percent of the world's land area but has high representation of biotic diversity. It claims 9.3 percent of bird, 4.5 percent of mammal, 2 percent of reptiles, 6 percent of butterfly, 1.0 percent of fish and over 2.0 percent of the flowering plant species of the world. This richness of

species can be attributed to the immense physical and climatic variation of the land. The immense bio-climatic diversity in Nepal supports more than 35 forest types (Stainton, 1972). They are home to 5833 species of flowering plants, including about 248 species of endemic plant and 700 species of medicinal plants. Nepal's landmass is also home to 185 species of mammals, 847 species of birds, 645 species of butterflies, 170 species of fish and other animals (MoPE, 2001).

Nepal is one of the richest countries in water resources. The monsoon contributes significantly in water regime of the country. As a result, several sources of water in the form of glaciers, snow pack, groundwater, and river networks exist in Nepal. The country has about 6000 rivers and streams including three major river basins: Sapta Kosi in the east, Karnali in the west and Sapta Gandaki in the central of Nepal. The annual run-off from the total drained areas is estimated to be 202 billion  $\text{m}^3$ . The contribution from the Nepalese territory accounts to an annual run-off of 170 billion  $\text{m}^3$ . About 4063 sq km is estimated to be covered by surface water, of which 97.3 percent is under the large rivers followed by natural lakes (1.2 %), ponds (1.2 %) and reservoirs (0.3 %) (HMG, 1992). The area under snow and ice is 17,920  $\text{km}^2$ , which represents about 13 percent of the country's total area (WECS, 1988). Nepal's Terai belt has rechargeable ground water potential, which occurs in both artesian and non-artesian aquifers (WECS, 2002). The theoretical potential on the basis of average flow is estimated to be 83000 MW electricity (Shrestha, 1968), out of which 44,600 MW has been assessed to be technically feasible, while 42,130 MW (50.6 Percent) could be economically harnessed (Sharma and Adhikari, 1990).

According to Paudel (2009), in the past, Nepal was known as a mineral producing country and the metals such as iron and copper were exported to Tibet. But

at present, most of existing mineral deposits are known to be small and unprofitable. The total reserve of natural gas from whole of the prospective area is expected to be around 300 million m<sup>3</sup>. Exploration has revealed that about 15.3 million tons of limestone and 10 million tons of proved cement grade limestone are known to exist in average down to a depth of 60 m in Nepal. High-grade limestone reserve of 70 million tons is also known to occur in Nepal. Further, 64.58 million tons of cement grade limestone are the expected reserves waiting to be exploited in the near future. As for the coal, apart from the low quality lignite deposits, commercial coal deposits supply about 25 Percent of the total demand of coal in Nepal (Sharma and Thapa, 2000).

### **Evolution of Atmosphere**

Earth's atmosphere can be divided into five main layers. From highest to lowest, these layers are. The outermost layer exosphere of Earth's atmosphere extends from the Exobase upward. Its thickness is about 10,000 kilometres. It is mainly composed of hydrogen and helium. The particles are so far apart that they can travel hundreds of kilometres without colliding with one another. The thickness of thermosphere layer of atmosphere is about 690 kilometres. Unlike in the stratosphere, where the inversion is caused by absorption of radiation by ozone, in the thermosphere the inversion is a result of the extremely low density of molecules. The temperature of this layer can rise to 1,500 °C. The air is so rarefied that an individual molecule travels an average of 1 kilometer between collisions with other molecules. The International Space Station orbits in this layer, between 320 and 380 km. The point dividing these two regions is known as the Turbopause. The region below is the hemisphere, and the region above is the Heterosphere. The top of the thermosphere is the bottom of the



exosphere, called the Exobase its height varies with solar activity and ranges from about 350 to 800 km, Schmidt (2004).

The mesosphere layer extends from the Stratopause to 80 to 85 km. It is the layer where most meteors burn up upon entering the atmosphere. Temperature decreases with height in the mesosphere. The Mesopause, the temperature minimum that marks the top of the mesosphere, is the coldest place on Earth and has an average temperature around  $-85^{\circ}\text{C}$ , Schmidt (2004). At the Mesopause, temperatures may drop to  $-100^{\circ}\text{C}$ . Due to the cold temperature of the mesosphere, water vapor is frozen, forming ice clouds. The stratosphere layer extends from the Tropopause to about 50 km. Temperature increases with height due to increased absorption of ultraviolet radiation by the ozone layer, which restricts turbulence and mixing. While the temperature may be  $-60^{\circ}\text{C}$  in the troposphere, the top of the stratosphere is much warmer, and may be near freezing Schmidt (2004). The Stratopause, which is the boundary between the stratosphere and mesosphere, typically is at 50 to 55 km. About 90% of the ozone in our atmosphere is contained in the stratosphere, Schmidt (2004).

The troposphere layer begins at the surface and extends to between 6 km to 20 km with some variation due to weather. The troposphere is mostly heated by transfer of energy from the surface, so on average the lowest part of the troposphere is warmest and temperature decreases with altitude. This promotes vertical mixing. The troposphere contains roughly 80 % of the mass of the atmosphere. The Tropopause is the boundary between the troposphere and stratosphere. 50% of the atmosphere by mass is below an altitude of 5.6 km (18,000 ft). 90% of the atmosphere by mass is below an altitude of 16 km, Anwar (1999) of the atmosphere by mass is below 100 km.

The evolution of Earth's surface is divided into three stages. The outgassing of the Earth was stripped away by solar winds early in the history of the planet until a steady state was established, the first atmosphere is called earliest atmosphere. Based on today's volcanic evidence, this atmosphere would have contained 60% hydrogen, 20% oxygen (mostly in the form of water vapor), 10% carbon dioxide, 5 to 7% hydrogen sulfide, and smaller amounts of nitrogen, carbon monoxide, free hydrogen, methane and inert gases. A major rainfall led to the buildup of a vast ocean, enriching the other agents, first carbon dioxide and later nitrogen and inert gases. A major part of carbon dioxide exhalations were soon dissolved in water and built up carbonate sediments, Anwar (1999).

Water-related sediments have been found dating from as early as 3.8 billion years ago. About 3.4 billion years ago, nitrogen was the major part of the then stable "second atmosphere". An influence of life has to be taken into account rather soon in the history of the atmosphere, since hints of early life forms are to be found as early as 3.5 billion years ago. The fact that this is not perfectly in line with the - compared to today 30% lower - solar radiance of the early Sun has been described as the "faint young Sun paradox". The geological record however shows a continually relatively warm surface during the complete early temperature record of the Earth with the exception of one cold glacial phase about 2.4 billion years ago. In the late Archaean eon an oxygen-containing atmosphere began to develop, apparently from photosynthesizing algae which have been found as Stromatolite fossils from 2.7 billion years ago. The early basic carbon isotopy (isotope ratio proportions) is very much in line with what is found today, suggesting that the fundamental features of the carbon cycle were established as early as 4 billion years ago, Anwar (1999).

The third atmosphere about 3.5 billion years ago added plate tectonics, constantly rearranging the continents and shaping long-term climate evolution by allowing the transfer of carbon dioxide to large land-based carbonate storages. Free oxygen did not exist until about 1.7 billion years ago and this can be seen with the development of the red beds and the end of the banded iron formations. This signifies a shift from a reducing atmosphere to an oxidizing atmosphere. The following time span was the Phanerozoic eon, during which oxygen-breathing metazoan life forms began to appear, Anwar (1999).

Currently, anthropogenic greenhouse gases are increasing in the atmosphere. According to the Intergovernmental Panel on Climate Change, this increase is the main cause of global warming.

### **Composition of Atmospheric Gases**

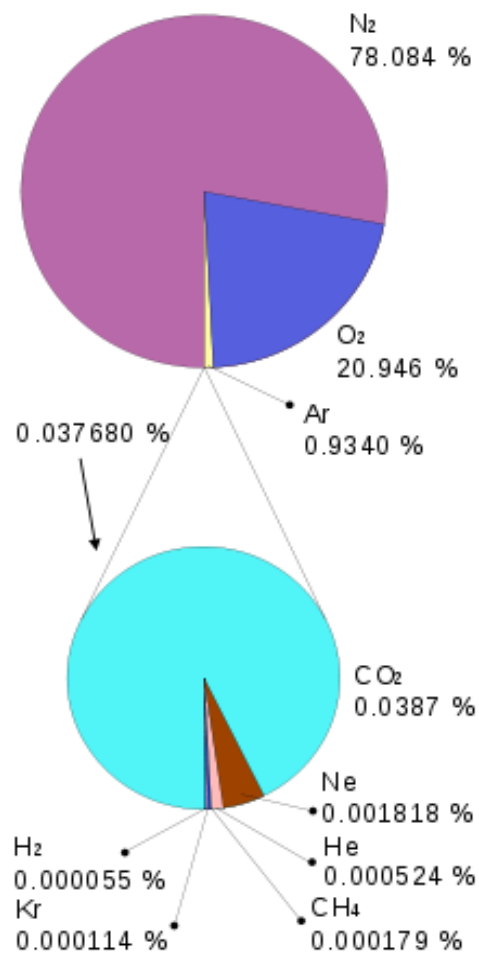
The atmosphere is a layer of gases, surrounding the Earth that is retained by gravity. The atmosphere protects life on Earth by absorbing ultraviolet solar radiation, warming the surface through heat retention (greenhouse effect), and reducing temperature extremes between day and night.

Air is mainly composed of nitrogen, oxygen, and argon, which together constitute the major gases of the atmosphere. The remaining gases are often referred to as trace gases among which are the greenhouse gases such as water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Filtered air includes trace amounts of many other chemical compounds. Many natural substances may be present in tiny amounts in an unfiltered air sample, including dust, pollen and spores, sea spray, and volcanic ash. Various industrial pollutants also may be present, such as chlorine

(elementary or in compounds), fluorine compounds, elemental mercury, and sulfur compounds such as sulfur dioxide, Kunzing and Broecker (2009).

The composition of dry gases of atmosphere is shown in figure 2.3 that shows the real image of atmospheric gases. The detail tabulation of the composition of atmospheric gases is in annex.

**Figure 2.3      Composition of Earth's Atmosphere**



Source: Wikipedia.org/wiki/File, Atmosphere\_ga\_proportions.svg, 2012.

Nitrogen and Oxygen contain 78.084 % and 20.946 % volume of atmospheric gases respectively. Similarly Argon and Carbon dioxide cover the 0.9340% and 0.037680%

volume of the air and rest nominal volume is covered by hydrogen, krypton, and Neon, Helium and methane gases.

### **Historical Background of Climate Change**

According to Kunzing and Broecker (2009), the history of climate change has briefly described since 1800 to till now. In 1800-1870, the level of carbon dioxide gas in the atmosphere was about 290 ppm (parts per million). In 1824, Joseph Fourier calculated that the Earth would be far colder if it lacked an atmosphere. In 1859, Tyndall discovered that some gases block infrared radiation. He had suggested that changes in the concentration of the gases could bring climate change. In 1896, Arrhenius had published first calculation of global warming from human emissions of CO<sub>2</sub> and he calculated the effect of a doubling atmospheric CO<sub>2</sub> to be an increase in surface temperatures of 5-6 degrees Celsius.

In 1897, Chamberlin had produced a model for global carbon exchange including feedbacks. In 1870-1910, Second Industrial Revolution had started and Fertilizers, other chemicals, electricity and public health were further accelerated. In 1930, global warming trend had reported since late 19th century. Milankovitch had proposed orbital changes as the cause of ice ages. In 1938, Callendar had argued that CO<sub>2</sub> greenhouse global warming is underway, reviving interest in the question.

In 1945, U.S. Office of Naval Research had begun generous funding of many fields of science, some of which happen to be useful for understanding climate change. In 1956, Ewing and Donn had offered a feedback model for quick ice age onset and Phillips had produced a somewhat realistic computer model of the global atmosphere. Plass (1956) had calculated that the adding CO<sub>2</sub> to the atmosphere might

have a significant effect on the radiation balance. In 1957, Soviet Sputnik satellite had launched and the Cold War had concerned, support 1957-58 International Geophysical Year, bringing new funding and coordination to climate studies. At the same year 1958, Revelle had found that, CO<sub>2</sub> produced by humans will not be readily absorbed by the oceans. In 1958, Telescope had studied to show a greenhouse effect raises temperature of the atmosphere of Venus far above the boiling point of water. In 1959, John Tyndall determined that coal gas, a mix of methane and other gases, strongly absorbed infrared radiation. Methane was subsequently detected in the atmosphere in 1948, and in the 1980s, scientists realized that human emissions were having a substantial impact, Kunzing and Broecker (2009).

In 1960, Keeling had accurately measured the CO<sub>2</sub> in the Earth's atmosphere and detected an annual rise when the level was 315 ppm. In 1963, Calculations had suggested feedback with water vapor could make the climate acutely sensitive to changes in CO<sub>2</sub> level. In 1965, Lorenz and others scientists had pointed out the chaotic nature of the climate system and the possibility of sudden shifts in Boulder meeting on causes of climate change. In 1966, Emiliani's analysis of deep-sea cores showed the timing of ice ages was set by small orbital shifts, suggesting that the climate system is sensitive to small changes.

International Global Atmospheric Research Program established, mainly to gather data for better short-range weather prediction but including climate. In 1967, Manabe and Wetherald had made a convincing calculation that doubling CO<sub>2</sub> would raise world temperatures a couple of degrees. In 1968, scientific Studies had suggested a possibility of collapse of Antarctic ice sheets, which would sea levels catastrophically. In 1969, astronauts walked on the Moon, and people perceived the

Earth as a fragile whole. At the same year 1969, Budyko and Sellers had presented models of catastrophic ice-albedo feed backs and Nimbus III satellite began to provide comprehensive global atmospheric temperature measurements (Kunz and Broecker, 2009).

In 1970, Environmental movement attained strong influence, spreads concern about global degradation on First Earth Day. Creation of U.S. National Oceanic and Atmospheric Administration, the world is leading funder of climate research. Bryson claimed that the human activity counteract global warming and may bring serious cooling. In 1971, SMIC conference of leading scientists had reported a danger of rapid and serious global climate change caused by humans, calls for an organized research effort. Mariner 9 spacecraft had found a great dust storm warming the atmosphere of Mars, plus indications of a radically different climate in the past. In 1972, Ice cores and other evidence showed big climate shifts in the past between relatively stable modes in the span of a thousand years. Serious droughts and other unusual weather since 1972-increased scientific and public concern about climate change, with cooling from aerosols suspected to be as likely as warming; journalists talk of ice age.

In 1973, British scientist James Lovelock speculated that chlorofluorocarbons (CFCs) could have a global warming effect. In 1975, Veerabhadra Ramanathan found that a CFC molecule could be 10,000 times more effective in absorbing infrared radiation than a carbon dioxide molecule, making CFCs potentially important despite the small amount in the atmosphere. While most early work on CFCs focused on their role in Ozone Depletion, by 1985, scientists had concluded that CFCs together with methane and other trace gases could have nearly as important a climate effect as

increases in CO<sub>2</sub>. In 1975, it is concerned about environmental effects of airplanes leads to investigations of trace gases in the stratosphere and discovery of danger to ozone layer. The plausible computer models which showed a temperature rise of several degrees for doubled CO<sub>2</sub> (kunzing and Broecker, 2009).

In 1976, Studies found that CFCs (1975) and methane and ozone (1976) can make a serious contribution to the greenhouse effect. Deep-sea cores showed a dominating influence from 100,000-year Milankovitch orbital changes, emphasizing the role of feedbacks (kunzing and Broecker, 2009). Deforestation and other ecosystem changes were recognized as major factors in the future of the climate. Eddy had showed that there were prolonged periods without sunspots in past centuries, corresponding to cold periods. In 1977, scientific opinion had tended to converge on global warming as the biggest climate risk in next century. Strengthened environmental movement encourages renewable energy sources, inhibits nuclear energy growth. U.S. National Academy of Sciences report found it highly credible that doubling CO<sub>2</sub> will bring 1.5-4.5EC global warming. Same year, World Climate Research Programme launched to coordinate international research.

In 1981, Election of Reagan brought backlash against environmental movement; political conservatism is linked to skepticism about global warming. Hansen and others showed that sulfate aerosols could significantly cool the climate, raising confidence in models showing future greenhouse warming. Some scientists predicted greenhouse-warming signal should be visible by about the year 2000. In 1983, Reports from U.S. National Academy of Sciences and Environmental Protection Agency sparked, conflict, as greenhouse warming becomes prominent in mainstream politics (Weart, 2007).



In 1985, Villach conference declared expert consensus that some global warming seems inevitable, calls on governments to consider international agreements to restrict emissions. Antarctic ice cores showed that CO<sub>2</sub> and temperature went up and down together through past ice ages, pointing to powerful biological and geochemical feedbacks. Broecker speculated that a reorganization of North Atlantic Ocean circulation can bring swift and radical climate change. In 1987, Montreal Protocol of the Vienna Convention imposed international restrictions on emission of ozone-destroying gases (Kunzig and Broecker, 2009).

In 1988, Toronto Conference called for strict, specific limits on greenhouse gas emissions. Ice-core and biology studies confirmed that living ecosystems make climate feedback by way of methane, which could accelerate global warming. Intergovernmental Panel on Climate Change (IPCC) is established in 1998. At that time, level of CO<sub>2</sub> in the atmosphere reached 350 ppm. In June 1988, James E. Hansen made one of the first assessments that human-caused warming had already measurably affected global climate. After 1998, many groups started the study of climate change and variety of results came (Weart, 2007).

In 1989, Fossil fuel and other industries form Global Climate Coalition in US to lobby politicians and convince the media and public that climate science is too uncertain to justify action. In 1990, First IPCC report says world had been warming and future warming seems likely. Industry lobbyists and some scientists disputed the tentative conclusions (Weart, 2007).

In 1991, Global warming skeptics emphasize studies indicating that a significant part of 20th-century temperature changes were due to solar influences. The correlation would fail in the following decade. Studies from 55 million years ago

showed possibility of eruption of methane from the seabed with enormous self-sustained warming. In 1992, Conference in Rio de Janeiro produced UN Framework Convention on Climate Change, but US blocks called for serious action. Study of ancient climates reveals climate sensitivity in same range as predicted independently by computer models. In 1993, Greenland ice cores suggested that great climate changes (at least on a regional scale) could occur in the space of a single decade (Weart, 2007).

In 1995, Second IPCC report detected signature of human-caused greenhouse effect warming declared that serious warming is likely in the coming century. Reports of the breaking up of Antarctic ice sheets and other signs of actual current warming in Polar Regions began affecting public opinion. In 1997, Toyota introduced Prius in Japan, first mass-market electric hybrid car; swift progress in large wind turbines and other energy alternatives. International conference produces Kyoto Protocol, setting targets to reduce greenhouse gas emissions if enough nations signed onto a treaty. In 1998, Qualms about arbitrariness in computer models diminished as teams' model ice-age climate and dispense with special adjustments to reproduce current climate. In 1999, satellite measurements showed no warming are dismissed by National Academy Panel. Ramanathan detected massive brown cloud of aerosols from South Asia.

In 2000, Global Climate Coalition dissolved as many corporations grapple with threat of warming, but oil lobby convinced US administration to deny problem. Variety of studies emphasized variability and importance of biological feedbacks in carbon cycle, liable to accelerate warming. In 2001, Third IPCC report stated baldly that global warming, unprecedented since end of last ice age, is very likely, with

possible severe surprises. Bonn meeting, with participation of most countries but not US, developed mechanisms for working towards Kyoto targets. National Academy panel saw a paradigm shift in scientific recognition of the risk of abrupt climate change (decade-scale). Warming observed in ocean basins; match with computer models gives a clear signature of greenhouse effect warming.

In 2002, Studies found surprisingly strong global dimming, due to pollution, has retarded arrival of greenhouse warming, but dimming is now decreasing. In 2003, Variety of studies increased concern that collapse of ice sheets (West Antarctica, perhaps Greenland) can raise sea levels faster than most had believed. Deadly summer heat wave in Europe accelerated divergence between European and US public opinion. In 2004, the controversy over temperature data covering past millennium, most conclude climate variations were substantial but not comparable to the post-1980 warming. First major book, movie and art work featuring global warming appeared. In 2005, Kyoto treaty goes into effect, signed by major industrial nations except US. Japan, Western Europe, regional US entities accelerate work to retard emissions. The level of CO<sub>2</sub> in the atmosphere reached 380 ppm till 2005, Weart (2007).

### **Status of Green House Gases**

The main greenhouse gases are carbon dioxide, methane, water vapour and ozone that cause the global warming. Roughly, the contribution of greenhouse effect of water vapour is 60%, Carbon Dioxide 20% and rest 20% is caused by Ozone (O<sub>3</sub>), Nitrous Oxide (N<sub>2</sub>O), Methane (CH<sub>4</sub>) and several other species.

**Table 2.1****Contribution of Greenhouse Effects of GHGs**

| Gas            | Formula          | Contribution (%) |
|----------------|------------------|------------------|
| Water vapor    | H <sub>2</sub> O | 36 – 72 %        |
| Carbon dioxide | CO <sub>2</sub>  | 9 – 26 %         |
| Methane        | CH <sub>4</sub>  | 4 – 9 %          |
| Ozone          | O <sub>3</sub>   | 3 – 7 %          |

Source: [en.wikipedia.org/wiki/Greenhouse\\_gas](http://en.wikipedia.org/wiki/Greenhouse_gas), 2011

Water and carbon dioxide contribute the 36-72 % and 9-26 % greenhouse effects respectively. Similarly, the greenhouse gases methane and ozone contribute the 4-9 % and 3-7 % greenhouse effects respectively (Schmidt, 2004).

In addition to the main greenhouse gases listed above, other greenhouse gases include sulfur hexafluoride, hydro fluorocarbons and per fluorocarbons (IPCC list of greenhouse gases), Nitrous Oxide (N<sub>2</sub>O), Chlorofluorocarbon-12 (CCl<sub>2</sub>F<sub>2</sub>), hydrochlorofluorocarbon-22 (CHClF<sub>2</sub>), Tetrafluoromethane (CF<sub>4</sub>), Hexafluoroethane (C<sub>2</sub>F<sub>6</sub>), Nitrogen trifluoride (NF<sub>3</sub>) etc. Some greenhouse gases are not often listed. For example, nitrogen trifluoride has a high global warming potential (GWP) but is only present in very small quantities (Schmidt, 2004).

Methane (CH<sub>4</sub>) is a very simple molecule and is created mostly by bacteria that feed on organic material. In wet areas such as swamps, wetlands and in the ocean, there is not enough oxygen and so complex hydrocarbons get broken down to methane by anaerobic bacteria. Although methane was detected in the atmosphere in 1948 that methane in the atmosphere was actually a significant greenhouse gas. It absorbs some frequencies of infrared radiation (emitted from the Earth's surface) that would otherwise go straight out to space. In fact, CH<sub>4</sub> concentrations have more than

doubled over the last 150 years, and the contribution to the enhanced greenhouse effect is almost half of that due to  $\text{CO}_2$  increases over the same period (Schmidt, 2004).

The emissions of methane due to human activities are leaks from mining and natural gas pipelines, landfills, increased irrigation (particularly rice paddies, which are essentially artificial wetlands) and increased livestock producing more intestinal  $\text{CH}_4$ . The methane is a greenhouse gas that changes to emissions can affect the atmospheric concentration. Around 10% of the  $\text{CH}_4$  makes it into the upper atmosphere (the stratosphere, between 15 and 50 km above sea level)) where it also gets oxidized. Given that both  $\text{CH}_4$  and its oxidization product  $\text{CO}_2$  are greenhouse gases, this might explain the global warming as well. Since 1750, methane concentrations in the atmosphere have increased by more than 150%. The primary sources for the additional methane added to the atmosphere (in order of importance) are rice cultivation, domestic grazing animals, termites, landfills, coal mining, and oil and gas extraction. More than 60% of all rice paddies are found in India and China where scientific data concerning emission rates are unavailable (Schmidt, 2004).

Methane is also released from landfills, coal mines, and gas and oil drilling. Landfills produce methane as organic wastes decompose over time. Coal, oil, and natural gas deposits release methane to the atmosphere when these deposits are excavated or drilled.

Carbon is a very important element, as it makes up organic matter, which is a part of all life. Carbon follows a certain route on earth, called the carbon cycle. Through following the carbon cycle we can also study energy flows on earth, because most of the chemical energy needed for life is stored in organic compounds as bonds

between carbon atoms and other atoms. The carbon cycle naturally consists of two parts, the terrestrial and the aquatic carbon cycle. The aquatic carbon cycle is concerned with the movements of carbon through marine ecosystems and the terrestrial carbon cycle is concerned with the movement of carbon through terrestrial ecosystems (Schmidt, 2004).

The seven sources of Carbon Dioxide (CO<sub>2</sub>) from fossil fuel combustion are (with percentage contributions for 2000–2004) is illustrated in table 2.2

**Table 2.2**

**Seven Main Fossil Fuel Combustion Sources**

| S.N | Seven main fossil fuel combustion sources                                      | Contribution (%) |
|-----|--|------------------|
| 1   | Liquid fuels (e.g., gasoline, fuel oil)  | 36 %             |
| 2   | Solid fuels (e.g., coal)   | 35 %             |
| 3   | Gaseous fuels (e.g., natural gas)  | 20 %             |
| 4   | Cement production  | 3 %              |
| 5   | Flaring gas industrially and at wells  | < 1 %            |
| 6   | Non-fuel hydrocarbons  | < 1 %            |
| 7   | "International bunker fuels" of transport not included in national inventories | 4 %              |

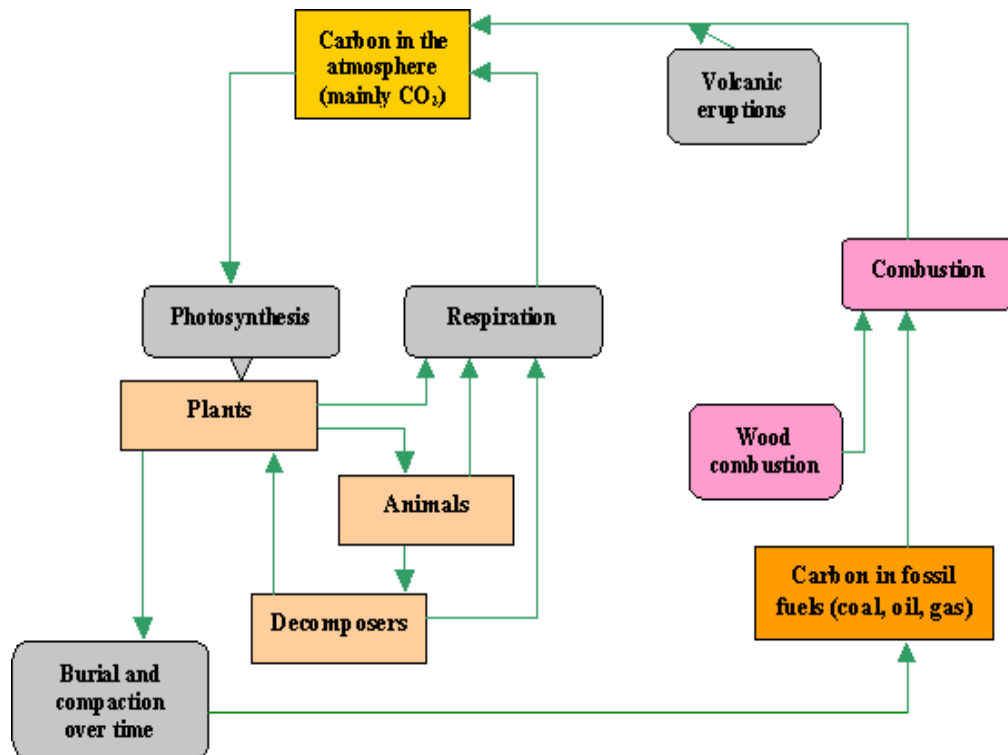
Source: wikipedia.org/wiki/Greenhouse gas, 2011

The carbon cycle is based on Carbon Dioxide (CO<sub>2</sub>), which can be found in air in the gaseous form and dissolved in water. Carbon dioxide is released into the atmosphere during respiration of consumers, which breaks down glucose and other complex organic compounds and converts the carbon back to carbon dioxide for reuse by producers (Schmidt, 2004).

Carbon that is used by producers, consumers and decomposers cycles rapidly through air, water and biota. But carbon can also be stored as biomass in the roots of trees and other organic matter for many decades. This carbon is released back into the atmosphere by decomposition but not all-organic matter is immediately decomposed. When layers of sediment compress this matter, fossil fuels may be formed, after many centuries. Long-term geological processes may expose the carbon in these fuels to air after a long period of time, but usually the carbon within the fossil fuels is released during humane combustion processes. The combustion of fossil fuels has supplied us with energy for as long as we can remember. However, the human population of the world has been expanding and so has our demand for energy. That is why fossil fuels are burned very extensively. This is not without consequences, because we are burning fossil fuels much faster than they develop. Because of our actions fossil fuels have become non-renewable recourses (Shah, 2011).

Although the combustion of fossil fuels mainly adds carbon dioxide to air, some of it is also released during natural processes, such as volcanic eruptions. In the aquatic ecosystem, carbon dioxide can be stored in rocks and sediments. It may take long time before this carbon dioxide is released, through weathering of rocks or geologic processes that bring sediment to the surface of water. Carbon dioxide that is stored in water may be present as either carbonate or bicarbonate ions. These ions are important part of natural buffers that prevent the water from becoming too acidic or too basic. When the sun warms up the water Carbonate and Bicarbonate ions may be returned to the atmosphere as Carbon dioxide. Schematic representations of the aquatic and terrestrial part of the Carbon cycle are shown here (Shah, 2011).The figure 2.4 illustrates terrestrial Carbon cycle.

**Figure 2.4 Terrestrial Carbon Cycle**

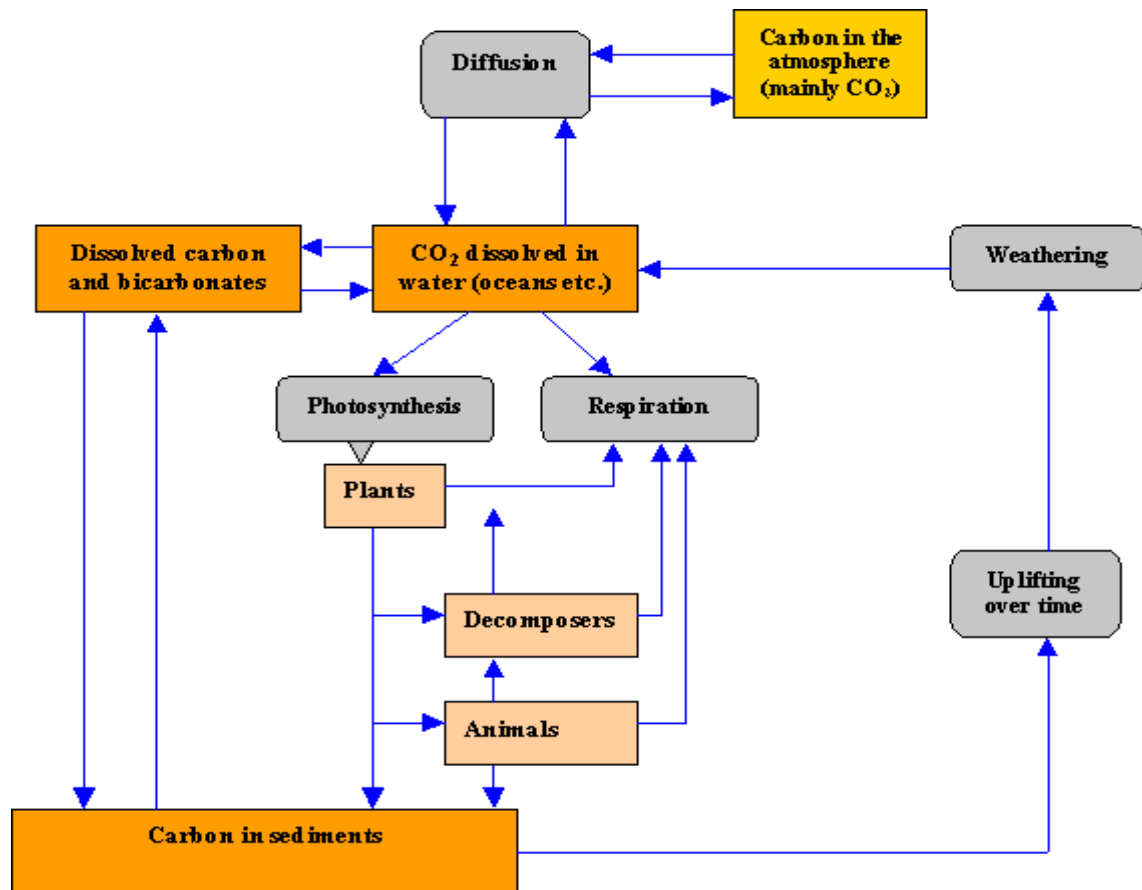


Sources: [www.lenntech.com/carbon-cycle.htm](http://www.lenntech.com/carbon-cycle.htm), 2012

In terrestrial carbon cycle, Carbon dioxide is released to atmosphere by respiration, decomposing, combustion and volcanic eruptions. Figure 2.5 illustrates aquatic Carbon cycle.



**Figure 2.5     Aquatic Carbon Cycle**



Sources: [www.lenntech.com/carbon-cycle.htm](http://www.lenntech.com/carbon-cycle.htm), 2012

It is one of the most important cycles of the earth and allows Carbon to be recycled and reused throughout the biosphere and all of its organisms. The Carbon cycle was initially discovered by Joseph Priestley and Antoine Lavoisier and popularized by Humphry Davy (Shah, 2011).

Carbon is released into the atmosphere in five ways namely respiration, decay, combustion, Production of Cement and Volcanic Eruptions and Metamorphism. Plants and animals exchange the gases through respiration. This is an exothermic reaction and it involves the breaking down of glucose (or other organic molecules)

into Carbon dioxide and water. Through the decay of animal and plant matter, fungi and bacteria break down the carbon compounds in dead animals and plants and convert the Carbon to Carbon dioxide if oxygen is present or methane if not (Shah, 2011).

Through combustion of organic material, which oxidized the carbon, it contains, producing Carbon dioxide .Burning fossil fuels such as coal, petroleum products, and natural gas releases carbon that has been stored in the geosphere for millions of years. Burning agro-fuel also releases Carbon dioxide that has been stored for only a few years or less. Carbon dioxide is released when limestone is heated to produce lime, a component of cement. At the surface of the oceans where the water becomes warmer, dissolved Carbon dioxide is released back into the atmosphere. Volcanic eruptions and metamorphism release gases into the atmosphere. Volcanic gases are primarily water vapor, Carbon dioxide, ashes etc. (Shah, 2011).

Nitrous oxide ( $N_2O$ ) is commonly known as laughing gas or sweet air and its chemical compound with the formula  $N_2O$ . At room temperature, it is a colorless non-flammable gas, with a slightly sweet odor and taste. It is used in surgery and dentistry for its anesthetic and analgesic effects. It is known as laughing gas due to the euphoric effects of inhaling it (Weart, 2007).

Nitrous oxide (NO) gives rise to NO on reaction with oxygen atoms, and this NO in turn reacts with ozone. As a result, it is the main naturally occurring regulator of stratospheric zone. It is also a major greenhouse gas and air pollutant. Nitrous oxide gas is 310 times more effective in trapping heat than carbon dioxide. Sixty percent of the nitrous in the atmosphere is produced naturally. The average concentration of nitrous oxide in the atmosphere is now increasing at a rate of 0.2 to

0.3% per year. Sources for this increase include land-use conversion; fossil fuel combustion; biomass burning; and soil fertilization. The use of nitrate and ammonium fertilizers to enhance plant growth is another source of nitrous oxide (Weart, 2007).

The contribution of water vapour to the anthropogenic greenhouse effect is still controversial. The water vapour works as a secondary effect that means the average temperature of atmospheric layers near to the ground, as a consequence of anthropogenic CO<sub>2</sub> and methane emissions, is rising the evaporation of water is increased.

The most abundant form of gas repeatedly produced and part of the water cycle. People think that water vapor is even good because it helps produce rain. Unfortunately, other forms of water vapor such as steam can have a big impact since it contributes to almost 70 percent of the total greenhouse effect (Weart, 2007). Water vapor accounts for the largest percentage of the greenhouse effect, between 36% and 66% for clear sky conditions and between 66% and 85% when including clouds. Water vapor concentrations fluctuate regionally, but human activity does not significantly affect water vapor concentrations except at local scales, such as near irrigated fields. The atmospheric concentration of vapor is highly variable, from less than 0.01% in extremely cold regions up to 2% in warm, humid regions (Nepal, 2009).

If sky is clear, heat may escape, the temperature may drop. If there is cloud cover, the heat is trapped by water vapor and the temperature stays warm. It is caused because there is very little water vapor in the atmosphere and is a demonstration of water vapor as the most important greenhouse gas (Ball, 2010). The other factor to consider is that water is evaporated from the land and sea and falls as rain or snow all

the time. Thus the amount held in the atmosphere as water vapor varies greatly in just hours and days as result of the prevailing weather in any location. So water vapor is the greatest greenhouse gas but relatively short-lived (Ball, 2010).

Ozone ( $O_3$ ) is trioxide molecule, consisting of three oxygen atoms. Ozone, in the lower atmosphere, is an air pollutant with harmful effects on the respiratory systems of animals and may burn sensitive plants; however, the ozone layer in the upper atmosphere is beneficial, preventing potentially damaging electromagnetic radiation from reaching the Earth's surface. Ozone is present in low concentrations throughout the Earth's atmosphere.

The highest levels of ozone in the atmosphere are in the stratosphere, in a region also known as the ozone layer between about 10 km and 50 km above the surface. Low-level ozone (or troposphere ozone) is an atmospheric pollutant. It is not emitted directly by car engines or by industrial operations, but formed by the reaction of sunlight on air containing hydrocarbons and nitrogen oxides that react to form ozone directly at the source of the pollution or many kilometers down wind. The atmospheric lifetime of tropospheric ozone is about 22 days; its main removal mechanisms are being deposited to the ground, the above mentioned reaction giving OH, and by reactions with OH and the proxy radical  $HO_2\cdot$  (Stevenson et al., 2006).

Although ozone was present at ground level before the industrial revolution, peak concentrations are now far higher than the pre-industrial levels, and even background concentrations well away from sources of pollution are substantially higher. This increase in ozone is of further concern because ozone present in the

upper troposphere acts as a greenhouse gas, absorbing some of the infrared energy emitted by the earth (Ball, 2010).

However, the most widely accepted scientific assessments relating to climate change (the IPCC Third Assessment Report) suggest that the radioactive forcing of tropospheric ozone is about 25% that of carbon dioxide. However, tropospheric ozone is a short-lived greenhouse gas, which decays in the atmosphere much more quickly than carbon dioxide. Because of its short-lived nature, tropospheric ozone does not have strong global effects, but has very strong radioactive forcing effects on regional scales (Weart, 2007).

A Chlorofluorocarbon (CFC) is an organic compound that contains carbon, chlorine, and fluorine, produced as a volatile derivative of methane and ethane. A common subclass is the Hydro Chlorofluorocarbons (HCFCs), which contain hydrogen, as well. Chlorofluorocarbons are the strongest greenhouse gas per molecule. Reports of the development of ozone holes over the North and South Poles and a general decline in global stratospheric ozone levels over the last two decades has caused many nations to cut back on their production and use of these chemicals. In 1987, the signing of the Montreal Protocol agreement by forty-six nations established an immediate timetable for the global reduction of chlorofluorocarbons production and use (Weart, 2007).

The atmospheric impacts of CFCs are not limited to its role as an active ozone reducer. This anthropogenic compound is also a greenhouse gas, with a much higher potential to enhance the greenhouse effect than CO<sub>2</sub>. The strength of CFC bands and the unique susceptibility of the atmosphere, at which the compound absorbs and emits radiation, are two factors that contribute to CFC's super greenhouse effect. The

chlorofluorocarbons and Halons act as greenhouse gases and are considered major contributors to the concerns discussed in the fact sheet Greenhouse effect (Weart, 2007).

Chlorofluorocarbons and Halons are not destroyed in the lower atmosphere but float slowly upward towards the stratosphere where they finally break down. Each of the chlorine or bromine atoms released in that breakdown is capable of destroying tens of thousands of Ozone ( $O_3$ ) molecules - thus contributing to the thinning of the protective ozone layer. It sets a schedule for reducing use of chlorofluorocarbons and halons by 1999 to 50 percent of the levels used in 1986. At a meeting in Helsinki in 1989, participating nations agreed to accelerate that time table to 85 percent reduction by 1999. More recently Canada announced that it was prepared to end their use by 1997 and urged other nations to agree to meet earlier targets.

Measurements of Sulfur hexafluoride ( $SF_6$ ) show that its global average concentration has increased by about 7% per year during the 1980s and 1990s, from less 1 ppt in 1980 to almost 4 ppt in the late 1990's (IPCC, 2001). According to the Intergovernmental Panel on Climate Change,  $SF_6$  is the most potent greenhouse gas than it has evaluated, with a global warming potential of 22,800 times that of  $CO_2$  when compared over a 100-year period. Measurements of  $SF_6$  show that its global average mixing ratio has increased by about 0.2 ppt per year to over 7 ppt. Sulfur hexafluoride is also extremely long-lived nearly atmospheric lifetime of 800–3200 years. Given the low amounts of  $SF_6$  released compared to carbon dioxide, its overall contribution to global warming is estimated to be less than 0.2 percent (Weart, 2007).

Hydro fluorocarbons (HFCs) or super greenhouse gases are gases used for refrigeration and air conditioning, and known as super greenhouse gases because the

combined effect of their soaring use and high global warming potential could undercut the benefits expected from the reduction of other greenhouse gases such as carbon dioxide. Used as refrigerants, they were introduced by the chemical industry to replace Ozone destroying CFCs which have (almost) been phased out by the Montreal Protocol. However, HFCs production is rising by 15% per year. HFCs are 3,830 times more potent than CO<sub>2</sub> with a lifetime of 14 years (Weart, 2007).

According to Will (1998), a senior consultant at SRI Consulting, HFC-134 used in home, auto, and retail refrigeration applications made up 16% of 2007 global fluorocarbon consumption of 1.2 million metric tons. The trouble with HFC-134 is that it has a GWP (global warming potential) 1,400 times greater than that of CO<sub>2</sub>, the standard against which other global-warming substances are measured.

HFCs are man-made chemicals, many of which have been developed as alternatives to ozone-depleting substances (ODS) for industrial, commercial, and consumer products. The global warming potentials of HFCs range from 140 (HFC-152) to 11,700 (HFC-23). The atmospheric lifetime for HFCs varies from just over a year for HFC-152 to 260 years for HFC-23. Most of the commercially used HFCs have atmospheric lifetimes less than 15 years; (Weart, 2007). HFC-134, which is used in automobile air conditioning and refrigeration, has an atmospheric life of 14 years. HFC-134a has an atmospheric lifetime of about 14 years and its abundance is expected to continue to rise in line with its increasing use as a refrigerant around the world. HFC-152a has increased steadily to about 0.3 ppt in 2000; however its relatively short life time (1.4 years) has kept its atmospheric concentration below 1 ppt (IPCC, 2001).

Perfluorocarbons (PFCs) are fluorocarbons, compounds derived from hydrocarbons by replacement of hydrogen atoms by fluorine atoms. PFCs are extremely potent greenhouse gases, and they are a long-term problem with a lifetime up to 50,000 years. In a 2003 study, the most abundant atmospheric PFC was tetrafluoromethane. The greenhouse warming potential (GWP) of tetrafluoromethane is 6,500 times that of carbon dioxide, and the GWP of hexafluoroethane is 9,200 times that of carbon dioxide. PFCs are one of the classes of compounds regulated in the Kyoto Protocol (Shrestha, 1999).

The primary source of tetrafluoromethane in the environment is from the production of aluminium by electrolysis of alumina. Aluminium producers are taking effective steps in reducing emissions by better controlling the electrolysis process. Primary aluminum production and semiconductor manufacture are the largest known man-made sources of two perfluorocarbons –  $\text{CF}_4$  (tetrafluoromethane) and  $\text{C}_2\text{F}_6$  (hexafluoroethane). The GWP of  $\text{CF}_4$  and  $\text{C}_2\text{F}_6$  emissions are equivalent to approximately 6,500 and 9,200 tonnes, respectively. PFCs are also relatively minor substitutes for ozone-depleting substances (ODSs).

PFCs have extremely stable molecular structures and are largely immune to the chemical processes in the lower atmosphere that break down most atmospheric pollutants. Not until the PFCs reach the mesosphere, about 60 kilometers above Earth, do very high-energy ultraviolet rays from the sun destroy them. This removal mechanism is extremely slow and as a result PFCs accumulate in the atmosphere and remain there for several thousand years. The estimated atmospheric lifetimes for  $\text{CF}_4$  and  $\text{C}_2\text{F}_6$  are 50,000 and 10,000 years respectively. Measurements in 2000 estimate  $\text{CF}_4$  global concentrations in the stratosphere at over 70 parts per trillion (ppt). Recent



relative rates of increase in concentrations for two of the most important PFCs are 1.3% per year for  $\text{CF}_4$  and 3.2% per year for  $\text{C}_2\text{F}_6$  (IPCC, 2001).

Nitrogen trifluoride ( $\text{NF}_3$ ) is the inorganic compound with the formula  $\text{NF}_3$ .  $\text{NF}_3$  is a greenhouse gas, with a global warming potential (GWP) 17,200 times greater than that of carbondioxide when compared over a 100 year period. Its GWP would place it second only to  $\text{SF}_6$  in the group of Kyoto-recognized greenhouse gases, although  $\text{NF}_3$  is not currently included in that grouping. It has an estimated atmospheric lifetime of 740 years, although other work suggests a slightly shorter lifetime of 550 years (and a corresponding GWP of 16,800) (IPCC, 2001).

Although  $\text{NF}_3$  has a high GWP but only small quantities are released into the atmosphere. Industrial applications of  $\text{NF}_3$  routinely break it down, while in the past previously used regulated compounds such as  $\text{SF}_6$  and PFCs were often released. Since 1992, when less than 100 tons was produced, production has grown to an estimated 4000 tons in 2007 and is projected to increase significantly. World production of  $\text{NF}_3$  is expected to reach 8000 tons a year by 2010.

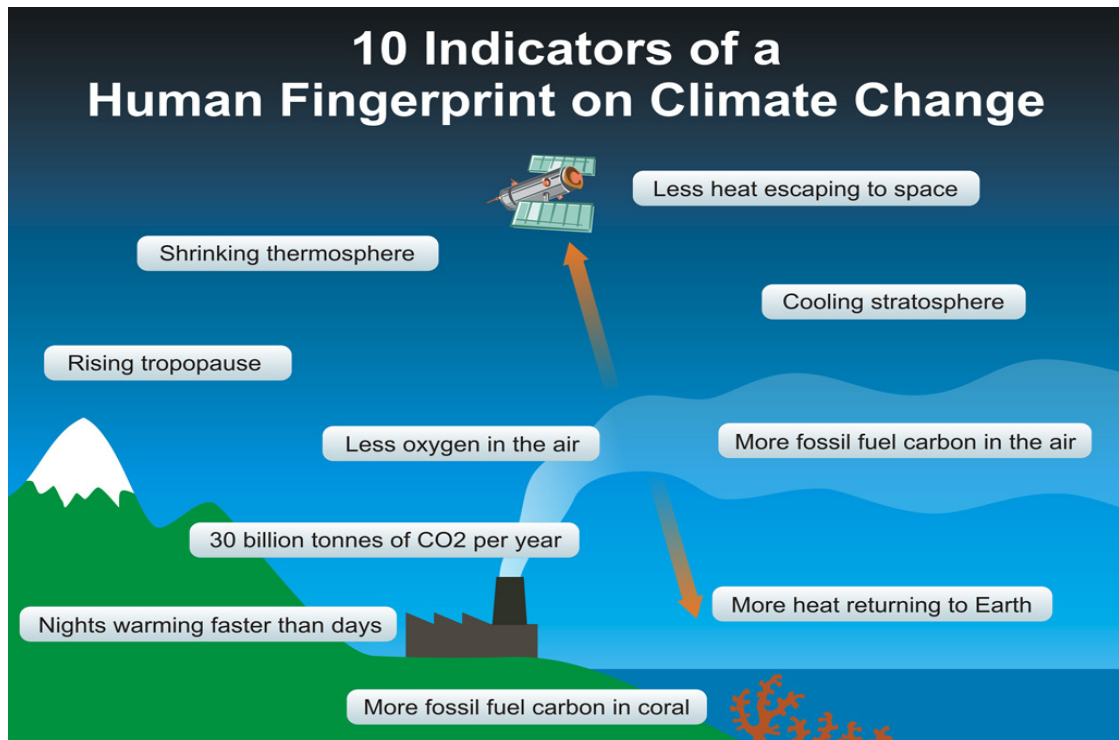
This rise rate corresponds to about 620 metric tons/y of 2009  $\text{NF}_3$  emissions globally, or about 16% of the  $\text{NF}_3$  production estimate of 4000 metric tons  $\text{yr}^{-1}$ . One study suggests that the contribution of the  $\text{NF}_3$ -Emissions to the overall greenhouse gas budget of thin-film Si-solar cell manufacturing is overestimated. Instead, the contribution of the Nitrogen trifluoride to the  $\text{CO}_2$ -budget of thin film solar cell production is compensated already within a few months by the  $\text{CO}_2$  saving potential of the PV technology.

### **Indicators of Human Fingerprint on Climate Change**

Humans are currently emitting around 30 billion tones of CO<sub>2</sub> into the atmosphere every year. Of course, it could be coincidence that CO<sub>2</sub> levels are raising so sharply at the same When we measure the type of carbon accumulating in the atmosphere, we observe more of the type of carbon that comes from fossil fuels (Manning, 2006).

This is corroborated by measurements of oxygen in the atmosphere. Oxygen levels are falling in line with the amount of carbon dioxide rising, just as you'd expect from fossil fuel burning which takes oxygen out of the air to create carbon dioxide (Manning, 2006). Further independent evidence that humans are raising CO<sub>2</sub> levels comes from measurements of carbon found in coral records going back several centuries. These find a recent sharp rise in the type of carbon that comes from fossil fuels (Pelejero, 2005). Figure 2.6 demonstrates ten indicators of a human fingerprint on climate change.

**Figure 2.6 Ten Indicators of a Human Fingerprint on Climate Change**



Source: The NOAA State of the Climate 2009 report, 2009

So we know humans are raising CO<sub>2</sub> levels. What is the effect? Satellites measure less heat escaping out to space, at the particular wavelengths that CO<sub>2</sub> absorbs heat. A closer look at the downward radiation finds more heat returning at CO<sub>2</sub> wavelengths, leading to the conclusion that this experimental data should effectively end the argument by skeptics that no experimental evidence exists for the connection between greenhouse gas increases in the atmosphere and global warming (Evans 2006).

If an increased greenhouse effect is causing global warming, we should see certain patterns in the warming. This is indeed being observed (Braganza 2004, Alexander, 2006). Another distinctive pattern of greenhouse warming is cooling in the upper atmosphere, otherwise known as the stratosphere. This is exactly what is happening (Jones, 2003). With the lower atmosphere warming and the upper atmosphere (the stratosphere) cooling, another consequence is the boundary between

the troposphere and stratosphere, otherwise known as the tropopause, should rise because of greenhouse warming. This has been observed (Santer, 2003).

An even higher layer of the atmosphere, the ionosphere, is expected to cool and contract in response to greenhouse warming. This has been observed by satellites (Latovika 2006). Science is not a house of cards, ready to topple if you remove one line of evidence. Instead, it is like a jigsaw puzzle. As the body of evidence builds, we get a clearer picture of what is driving our climate. We have many lines of evidence all pointing to a single, consistent answer - the main driver of global warming is raising carbon dioxide levels from our fossil fuel burning (IPCC, 2001).

### **Global Impacts of Climate Change**

The effects or impacts of climate change affects to the physical, ecological, social or economic sectors. It means increasing of greenhouse gas includes rising Sea level and decreasing snow cover in the Northern hemisphere or Himalayan regions. According to definition of IPCC (2001), climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties and that persists for extended periods, typically decades or longer. The climate change occurs due to natural causes and human activities.

Global warming means surface temperature difference from the average for 1880 to now. The mean surface temperature changes for the period 1999 to 2008 relative to the average temperatures from 1940 to 1980. Over the last hundred years, the instrumental temperature record has shown a trend in climate change by increasing global mean temperature and that is called global warming. Some of the physical impacts of climate change are irreversible at continental and global scales.

The impacts of climate change across world population will not be distributed equally. Low latitude and less-developed areas are probably at the greatest risk from climate change. The climate change would likely result in reduced diversity of ecosystems and the extinction of many species (IPCC, 2001).

Increasing temperature is likely to lead to increasing precipitation in the atmosphere. The extra-tropical storms partly depend on changing the temperature. If the polar region warms more than the rest of the hemisphere, the areas may be affected by drought and there may be increased tropical cyclone activity and sea level rise. Similarly, there is to be decreased snow cover in the polar region and both Northern & Southern Hemisphere.

According to the research based satellite observations (2010), an increase in the flow of freshwater into the world's oceans, partly from melting ice and partly from increased precipitation driven by increasing in global ocean evaporation. The increase in global freshwater flow, based on data from 1994 to 2006, was about 18%. The regional effects of global warming vary in nature. There are three major ways in which global warming will make changes to regional climate: melting or forming ice, changing of evaporation and precipitation. The coast will suffer from sea level rise. The climate change may have an effect on the carbon cycle process of atmosphere (IPCC, 2001).

According to IPCC (2007), it is found that the average mountain glaciers and snow cover had decreased in both the northern and southern hemispheres. This widespread decrease in glaciers and ice caps has contributed to observed sea level rise. Mountainous areas of the world will face glacier retreat.

The role of the oceans in global warming is a complex one. The oceans take much Carbon dioxide from the atmosphere and that increased levels of  $\text{CO}_2$  is dissolved in water and that makes the ocean acidification due to the formation of Carbonic acid ( $\text{H}_2\text{CO}_3$ ). Global warming is projected to have a number of effects on the oceans. Ongoing effects include rising sea levels due to thermal expansion and melting of glaciers & ice sheets and warming of the ocean surface. Other possible effects include large-scale changes in ocean circulation. The acidic water affects the Ocean life (Shrestha and Devkota, 2010).

According to IPCC (2007), the global average sea level had risen at an average rate of 1.8 mm/yr since 1961 and between 1993 and 2003, the rate increased above the previous period to 3.1 mm/yr. Also IPCC (2007) had projected sea level rise to the end of the 21<sup>st</sup> century by 18 to 59 cm. The global Ocean and sea temperature has risen year to year.

The social impacts of the Climate change will impact agriculture and food production around the world due to the effects of high  $\text{CO}_2$  in the atmosphere, higher temperatures, altered precipitation and transpiration regimes, increased frequency of extreme events, and modified weed, pest and pathogen pressure. In general, low-latitude areas are at most risk of having decreased crop production and in high altitude area productivity will be increased. Most of the studies on global agriculture have not incorporated a number of critical factors, including changes in extreme events, or the spread of pests and diseases. Studies have also not considered the development of specific practices or technologies to aid adaptation (IPCC, 2001).

Human beings are exposed to climate change through changing weather patterns and indirectly through changes in water, air and food quality and changes in

ecosystems, agriculture, industry and settlements and the economy. The health status of millions of people would be affected by increasing the malnutrition, diarrheal diseases, dio-respiratory diseases, some infectious diseases and injury due to climate change. Climate change would bring the negative health effects of rising temperatures, especially in developing countries. The diarrhea disease and malnutrition will be large burden of developing countries (Sharma, 2009).

The climate change would increase the number of people suffering from death, disease and injury from heat waves, floods, storms, fires and droughts. The impacts of weather disasters are considerable and unequally distributed. The floods, storms and tropical cyclones have the greatest impact in South Asia and Latin America. High-density populations in low-lying coastal regions experience a high health burden from weather disasters. Hot days, hot nights and heat waves have become more frequent. Heat waves are associated with marked short-term increases in mortality (Sharma, 2009).

The effects of drought on health include deaths, malnutrition, infectious diseases and respiratory diseases. Cold waves bring problem in northern latitudes, where very low temperatures can be reached in a few hours and extend over long periods. The climate change would result in the extinction of many species and a reduction in the diversity of ecosystems (Sharma, 2009).

### **Mitigating Climate Change: Learning from African Peninsula**

According to final report of FAO (2012) Working within FAO's main efforts of sustainable food security, nutrition Socio-economic and productivity, the Mitigation of Climate Change in Agriculture (MICCA) Programme's main goal is to help

developing Countries contribute to climate change mitigation in agriculture and move towards low-carbon emission agriculture. In Kenya, the MICCA Programme, in collaboration with the East African Dairy Development Project (EADD), is focusing on introducing climate-smart agriculture into the livestock sector.

After the lunching of project, the daily average volume for all cows per farm is 9.8 litres. Calculations show that the monthly income generated from selling milk accounts for 30 percent of the monthly household income (mean). The main feed for livestock is grass. Two-thirds of the farmers feed Napier grass mainly to milk cows. About three-quarters of the farmers use feed supplements, one-quarter use feed concentrates, and small number use crop residues as feed. The reasons why on-farm fodder production is not higher include a shortage of land, limited finances and lack of knowledge. However, the awareness of the impact of improved fodder on milk production and the willingness to learn about it is evident. Farmers apply manure on their own fields, especially for fodder crops, or discard it in the surrounding land.

The main goal of FAO's Mitigation of Climate Change in Agriculture (MICCA) Programme is to facilitate the contribution of developing countries to the mitigation of climate change in agriculture and supporting them towards adopting low-carbon emission agriculture. The Programme also supports FAO's primary objective of improving food security, nutrition and agricultural productivity. In the United Republic of Tanzania, the MICCA Programme is cooperating with CARE International and the World Agro forestry Centre (ICRAF) within the framework of CARE's Hillside Conservation Agriculture Project (HICAP). The objective of the cooperation is to broaden the perspective of the project, which currently focuses on conservation agriculture (CA), to include climate change mitigation.



Farmers are involved in several activities simultaneously and most participate in groups, such as Farmer Field Schools (FFS) or VSL (Village Saving and Loans). Through these groups, farmers have access to specific services and training opportunities provided by HICAP. Wood is the predominant source of energy used by local households. Three-quarters of farmers practice cropping and raise livestock. The rest engage in cropping only. The majorities of households consume their own products and sell any surplus (91.6 percent). Animals raised as livestock are mainly poultry, goats and sheep. Others practice 'traditional' agriculture (FAO, 2012). More than half of all farmers cultivate their own land. More than a third works on rented land. Only 5 percent use irrigation. More than a quarter of all planted crops are maize, followed by cassava and paddy. Banana, sorghum and sesame are also cultivated. Intercropping is practiced by both project participants and non- participants. Main household incomes are generated by selling maize, sorghum, sesame, cassava and chicken. The revenue from crop sales is 33 percent higher for project participants than for non-participants (FAO, 2012).

Farmers are hesitant to join the project, as they first want to see for themselves that the new practices work. The benefits of CA are seen in higher yields, which lead to surplus production and potentially increased incomes and food security. CA requires less work, and less land needs to be cultivated to obtain high yields. The findings indicate that investments can be recovered relatively quickly through increased income. This allowed one-quarter of the farmers practicing CA to open crop-based businesses, such as restaurants and shops. Farmers gave the following reasons for not joining the project or using CA: lack of knowledge about the project and CA.

Rain patterns have changed in a way that makes it difficult for farmers to plan and produce the same yields as in the past. This leads to food shortages and decreased livelihoods. However, more than half of the samples have not made any adjustments to prepare for or adapt to these changes. The findings emphasize that the population in the project area earn their livelihoods from their own farming and practice more or less subsistence agriculture (FAO, 2012).

To improve livelihoods and introduce climate change themes into HICAP activities, possible entry points for the MICCA Programme could be raising awareness about climate change and CA's potential to help farmers adapt to and mitigate, increasing farmers' knowledge about the causes of climate change; emphasizing and supporting the 'proper' application of CA as a tool to assist farmers adapt to and mitigate climate change and providing technical training on other climate change (FAO, 2012).

The mitigation practices; and developing clear communication strategies and materials on the costs and benefits of CA, demonstrating the negative impact of slash and burn on climate change; demonstrating that CA is an alternative to slash and burn and mitigates climate change; and developing clear messages on the cost and benefits of CA in comparison to slash and burn (FAO, 2012).

The emphasizing the need for agro forestry as mean of generating income and as a climate change mitigation tool; developing a strategy to disseminate knowledge on tools and practices to increase, reforestation (e.g. planting trees, setting up nurseries, maintaining trees); and Finding ways for farmers to combine CA and agro forestry (FAO, 2012).

### **Impact of Climate Change in SAARC Countries**

The effects of Climate Change in Bhutan Protected Areas (PA's) of forest cover 41% of the country, while biological corridors occupy an additional 9%. Export of timber products is banned and forest cover is reported to be 72%. Such is the absorption of atmospheric carbon by these forests that Bhutan claims to be the only country in the world which is a net sink of carbon dioxide emissions. In UN climate change negotiations, the government has made a commitment to sustain its Carbon negative status (Shah, 2011).

Bhutan's total Carbon emission is about 1.5 million tones and its Carbon absorption capacity is about 6.3 million tons annually. Bhutan's Carbon balance of minus 4.7 million tones that means it can still absorb more carbon. According to the report of World Bank (2003), Bhutan may see an increase in winter temperature of 1.5°C to 4.0°C by 2050s. The increasing in temperature and rainfall that is more irregular patterns threat to Bhutan, its people, and its economy. According to report of Bhutan, out of 2,674 glacial lakes in Bhutan, 24 are considered to be potentially dangerous. The increase in temperatures in recent decades has led to a reduction in Bhutan's glacial cover. Some glaciers in Bhutan have been disappearing at a rate of 30 to 60 meters in a year. Bhutan faces today the damages from glacial melt, impact of increased temperature on rangelands and agriculture, potential loss of forest biodiversity due to vegetation shift and increased incidence of forest fire due to temperature increase. A high dependency monsoon rains, and export of hydropower makes the country vulnerable. Visible effects of climate change in Bhutan are reduced agricultural production, water shortage and groundwater depletion, loss of forest area or production, threat of biodiversity loss, and exposure to glacial lake outburst floods,

among others. Increase in cases of diarrhea, malaria, cholera and dengue also indicate climate change's impact on health (Shah, 2011).

Bangladesh is a disaster-prone country. Almost every year, the country experiences disasters of tropical cyclones, storm surges, coastal erosion, floods, and droughts causing heavy loss of life and property and jeopardizing the development activities. The above mentioned types of disasters make the problems all the more complicated. Bangladesh is likely to be one of the most vulnerable countries of the world in the event of climate change. The global warming due to the increase in greenhouse gas concentration in the earth's atmosphere and the consequent sea level rise (SLR) are going to add fuel to the fire. Almost every sector of socio-economic life in Bangladesh is likely to be affected by climate change (Shah, 2011).

According to report of Space Research and Remote Sensing Organization (SPARRSO, 2009), both qualitative and quantitative discussions are made on cyclone intensity increase for a sea surface temperature rise of 2 and 4°C. Different scenarios of storm surges under different climate change conditions are developed by using a numerical model of storm surges for the Bay of Bengal.

Possible loss of land through beach erosion due to sea level rise on the eastern Coast of Bangladesh is examined. Storm surges are generated by the winds and the atmospheric pressure changes associated with cyclones. The maximum wind speed of the cyclone was 225 km/h. The wind speed rises 10 and 22% due to a rise in temperature of 2 and 4°C, respectively. There were the deaths of thousands of fishermen of Bangladesh in summer. The Bay of Bengal was unusually rough. The authorities only issue a storm warning to fishermen to stay at home once or twice a year (Shah, 2011).

Scientists have measured small rises in the sea level at various points around the coast, and almost all of Bangladesh lies less than 10m above sea level. Bangladesh is highly vulnerable, as it is low-lying, located on the Bay of Bengal in the delta of the Ganges, Brahmaputra and Meghna and densely populated. Sea level rise, temperature rise, increased evaporation, changes in precipitation and changes in cross boundary river flows are identified as the agents of change, which cause the most threatening impacts in the natural, social and economic systems of the country (Titus and James, 1991). Especially in the coastal zone, long-term changes are caused by a combination of climate change and sea level rise. Bangladesh' agriculture at risk to climate change depends on the adaptations in the coastal and water resources sector. In particular, in coastal areas, agricultural activities may be conflicting with industrial development, where as fresh water availability depends on successful water resources management. The study shows that Bangladesh is particularly vulnerable to climate change in its coastal zone, covering about 30 per cent of the country.

Afghanistan is currently suffering the most severe drought in living memory. The snow season varies considerably with elevation. The Asian summer monsoon system helps to keep rainfall low over Afghanistan. Dust storms are significant parts of the climate system associated with northerly winds in warm months. Neighboring countries indicate that mean annual temperature has increased by 0.6°C since 1960, at an average rate of around 0.13°C per decade. Increases have been most pronounced during the autumn with increases at an average rate of 0.29°C per decade and a significant increase in the number of exceptionally hot days and nights. Floods due to untimely rainfall and a general increase in temperature are of secondary importance (Titus,1991).

The vulnerability of the agricultural sector to increased temperatures and changes in rainfall patterns and snow melt is high. Increased soil evaporation, reduced river flow from earlier snow melt, and less frequent rain during peak cultivation seasons will impact upon agricultural productivity and crop choice availability. Crop failure levels due to water shortages and the amount of potentially productive land left uncultivated may likely increase. The poor are most vulnerable to the effects of climate change in Afghanistan (Derar, 2007). Climate change is likely to compound existing food security issues and affect heavily upon those dependent on the agricultural economy. A large proportion of the Afghan population live just above the poverty line, climatic shocks have the potential to tip a large percentage of population into poverty. Impacts on human health, such as increased prevalence of disease affect the amount of labor available for agriculture and other non-farm rural economic activities (Derar, 2007).

The impact of increasingly frequent flash floods is exacerbated by drought, which has the effect of hardening soils and reducing their permeability. Climatic impacts are most likely to be felt in hydro-electricity production, although large thermal power plant and transmission infrastructure are also susceptible to flash flooding and heat stress. Changes in precipitation, ice pack and snow melt patterns, combined with climate change-related land use change can impact upon the variability and availability of water flow. Smaller hydropower plants are particularly vulnerable (Derar, 2007).

Average mean temperature along the coast is 26.7 °C and 19.7° C in the hill country. Two new studies paint contrasting views of whether climate change-induced weather will force millions of people to migrate to safer areas. In an upcoming report

(2010), the Asian Development Bank (ABD) warns that the extreme weather of climate change, floods, droughts and storms will prompt mass migration that no international organization is set up to handle. Sri Lanka has caused temporary or longer-term dislocation of millions. Like the ABD report, however, this research agrees that migration can ultimately help people reduce their vulnerability, and it urges governments to better understand the issue.

The climate of Maldives is tropical, hot, humid, dry, Northeast monsoon (November to March); rainy, southwest monsoon (June to August). It is very vulnerable to climate change and its associated impacts especially the predicted sea level rise. Although the Maldives contributes minimally to the global greenhouse gas emissions 0.001% (MHAHE, 2001), it is among the most susceptible to impacts of the changes in climate. The Intergovernmental Panel on Climate Change (IPCC) in its Third Assessment Report estimates a projected sea level rise of 0.09m to 0.88m for 1990 to 2100 (IPCC, 2001). With about three-quarters of the land area of Maldives less than a meter above mean sea level, the slightest rise in sea level will prove extremely threatening (Derar, 2007). Maldives has the impact of climate change on the groundwater availability. In the islands rainwater lenses lie atop salt water. By rising the sea level, the thickness of the freshwater decreases. Beach erosion is now among the most serious environmental issues facing the islands of Maldives (Derar, 2007).

According to records kept by the Ministry of Home Affairs Housing and Environment, at present nearly 50 percent of all inhabited islands and nearly 45 percent of tourist resorts suffer varying degrees of coastal erosion (MHAHE, 2000). The Maldives government had made an eye-catching plea for climate change action

by holding the world's first underwater cabinet meeting on 20 Oct 2009. Politicians from the Indian Ocean island nations geared to send a message to world leaders ahead of December's UN climate change conference in Copenhagen. Maldivian president Mohammed Nasheed and his ministers signed a document calling on all countries to cut their carbon dioxide emissions. The 30-minute cabinet meeting held six metres below sea-level was intended to show what the future could hold for the Maldives (Shah, 2011).

The climate of Pakistan is mostly hot, dry desert; temperate in northwest; arctic in north. Many destructive activities against the environment disproportionately affect them, because most women in Pakistan are dependent on primary natural resources: land, forests, and waters. In case of droughts, they are immediately affected, and usually women and children cannot run away. In addition, women and children are most affected at the time of deforestation, drought and crops failure. More than 67 percent of women are engaged in agriculture related activities but only 1 per cent own land. The rise in temperature is going to affect the farming communities in Pakistan as a whole, but will have severe impacts on individuals/households specially women, who are socially, politically and economically more vulnerable. The climate change could hamper the achievement of many of the Millennium Development Goals (MDGs), including those on poverty eradication, child mortality, malaria, and other diseases, and environmental sustainability.

Climate change in South Asia has affected Pakistan a loss of around \$3.57 billion over the past 18 years, according to a World Bank report. The report alarms



Pakistan of the existence of five major risks related to climate change/global warming and potentially risking half of the country's population.

The MDG report (2009), warns the disasters in five main areas: rise in sea level, glacial retreat, floods, higher average temperatures, and high frequency of droughts. Around 23% of the country's land and nearly 50% of the entire population is vulnerable to the damage resulting from these potential disasters (Dixit, 2011).

Thousands of peasant families and fisher folk community already had to migrate to other areas in search of livelihood. The cyclones often visit the coastline and their intensity has increased many times more. Poor peasant and fisher folk communities always hit hard by these cyclones. The coastal area is most vulnerable to climate change with rising sea surface, temperature and atmospheric water vapor causing an increase in cyclone intensity and rainfall.

The formation of the Himalayas resulted in blockage of Central Asian air, preventing it from reaching India; this made its climate significantly warmer and more tropical in character than it would otherwise have been. Ongoing sea level rises have submerged several low-lying islands in the Sundarbans, displacing thousands of people. Temperature rises on the Tibetan Plateau, which are causing Himalayan glaciers to retreat. Increased landslides and flooding are projected to have an impact upon states such as Assam (Shah, 2011). The Indira Gandhi Institute of Development Research (2009) has reported climate-related factors could cause India's GDP to decline by up to 9%; contributing to this would be shifting growing seasons for major crops such as rice, production of which could fall by 40%. Around seven million people are projected to be displaced due to, among other factors, submersion of parts of Mumbai and Chennai, if global temperatures were to rise by a mere 2 °C. Villagers

in India's North East state of Meghalaya are also concerned that rising sea levels will submerge neighboring low-lying Bangladesh, resulting in an influx of refugees into Meghalaya which has few resources to handle such a situation (Shah, 2011).

Climate change in India may have a disproportionate impact on the more than 400 million that make up India's poor. This is because so many depend on natural resources for their food, shelter and income. More than 56% of people in India work in agriculture, while many others earn their living in coastal areas. Impacts are already being seen in unprecedented heat waves, cyclones, floods, Stalinization of the coastline and effects on agriculture, fisheries and health. Decreased snow cover, affecting snow-fed and glacial systems such as the Ganges and Bramhaputra, 70% of the summer flow of the Ganges comes from melt water (Shah, 2011).

India imports large quantities of fossil fuels to meet its energy needs, and the burning of fossil fuels alone accounts for 83% of India's carbon dioxide emissions. Nearly 70% of electricity supply comes from coal. With 27.5% of the population still below the poverty line, reducing vulnerability to the impacts of climate change is essential (Shah, 2011). The report also predicts huge coastal erosion due to a rise in sea levels of about 40 cm resulting from faster melting of glaciers in the Himalayan and Hindukush ranges. It can affect half-a-million people in India because of excessive flooding in coastal areas and also can increase the salinity of ground water in the Sunderbans and surface water in coastal areas (Shah, 2011)..

### **Scenario of Climate Change**

Evidence presented by the IPCC (2010) reveals that the world's climate is changing. Humans have exerted and continue to exert an influence on the world's climate. The

IPCC asserts that the warming of the last 100 years was unusual and unlikely. As humans have increased their levels of production and consumption, greenhouse gas emissions have also increased. Since 1750 at the time of the industrial revolution, CO<sub>2</sub> has increased by 31 percent, methane by 151 percent and nitrous oxide by 17 percent (Paudel, 2011).

In the case of Nepal, it was found that temperature in Nepal is increasing at a high rate. The warming seems to be consistent and continuous after the mid-1970s. The average warming in annual temperature between 1977 and 1994 was 0.060°C/year (Shrestha, 1999). The warming is found to be more pronounced in the high altitude regions of Nepal such as the middle mountain and the high himalaya, while the warming is significantly lower or even lacking in the terai and siwalik regions. Further, warming in the winter is more pronounced compared to other seasons. According to one recent study, Nepal's temperature is rising by about 0.41 degrees Celsius per decade.

Similar to temperature, precipitation in Nepal is found to be influenced by or correlated to several large scale climatologically phenomena including, regional scale land and sea surface temperature changes and extreme events such as volcanic eruptions. Mean annual precipitation is increasing, as is the occurrence of intense rainfall. This causes more erosion of soils and riverbeds and banks, as well as sedimentation on fertile land. Weather-related extreme events like excessive rainfall, stronger drought periods, landslides and floods are increasing both in terms of magnitude and in terms of frequency. More floods and glacial lake outbursts are expected to destroy irrigation and water supply systems, roads, bridges, settlements and productive land. Flood- related deaths may increase. Land degradation may

reduce crop productivity and put more pressure on remaining fertile land. In the dry season, increased evaporation may lead to water scarcity. Soil moisture deficits, droughts, fire and possible pest outbreaks will decrease crop yields. It is perceived that climate change may have major impacts on ecosystems, land and water resources, health, and major economic sectors such as agriculture in days to come. Communities of different parts of Nepal have already begun experiencing unusual changes in weather patterns. Although some farmers in some parts of Nepal might be benefiting in the short run due to increases in temperature there are farmers in other parts of the country who are really worried about the changing climatic scenario. The delay in monsoon season experienced recently in last few years in Nepal has changed the cropping pattern and crop maturity period (Paudel, 2011).

### **Issues of Climate Change in Nepal**

Agriculture is a main activity of the economy and this covers more than 80 % of the population. About 80% of the total population depends on the forest for the daily fuel wood supply. Nepal, along with over 150 other countries, signed the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992. Nepal ratified the convention on 2<sup>nd</sup> May in 1994, and this convention came into force on 31st July in 1994 (SAAPE, 2010).

Majority Nepalese people are dependent on agriculture and this sector is adversely affected by the loss of the top fertile soil due to soil erosion, landslides and floods. Soil loss is one of the major causes of decline in agricultural production. The increase in temperature may adversely affect warmer environment crop. The yield

will be reduced for all crops at 4° C temperature rise. It is also estimated that a temperature rise of 4° C can result in the loss of 70% of snow and glacier area due to melting of snow and ice. This melt water may contribute to the faster development of glacier lakes, and this may lead to increased potential for Glacier Lake outburst flood hazards. Further, global warming may cause forest damage through migration towards the polar region, changes in their composition and extinction of species. Reducing snowfall and retreating of the glaciers are due to increase in atmospheric temperature in mountain environment. At Kathmandu Valley, frost day is decreasing in winter and cold shifted to a month later than regular (Feb 2007, after 60 years). Late monsoon, un-usual precipitation, decreased rainy days and intense rainfall events caused more runoff and low ground water recharges. Extreme fog conditions have been observed in Terai regions of Nepal. Traditional rainfall pattern is being changed and affected to crop production.

Risk of diseases like Malaria, Kalaazar and Japanese Encephalitis outbreak on health is another potential impact of climate change. Particularly, subtropical and warm temperate regions of Nepal would be more vulnerable. Mosquitoes are able to survive in high hills and people of high hill will be more affected. Technology transfer is an important to assist developing country like Nepal to address climate change appropriately. Financial support and appropriate terms and condition are the crucial things governing the transfer process.

### **Contribution of GHGs Emission by Nepal**

In accordance with the IPCC guidelines, Nepal's GHG inventory is divided into 5 main categories: Energy activities, Industrial Processes, Agriculture, Land-use change

& Forestry, and Waste Management. The total emission of GHGs is negligible compared to global community; it means only 0.025% of total global emission. The national GHG inventory represents emission data for three gases having direct Greenhouse effects: Carbon dioxide, Methane and Nitrous Oxide (SAAPE, 2010).

The global gas inventory of 1998 showed that every year the world and Nepal are producing 24,215 million tons and 3.04 million tons of carbon dioxide respectively. It shows that, although Nepal shares only 0.03 percent of global land surface area, its share is only 0.0126%. Net emissions of CO<sub>2</sub> in the country were estimated at 9747Gg for the base year 1994/1995. The contributor includes the transport sector (31%), Industrial sector (27%), Residential sector (22%), Commercial sector (11%) and the remaining (9%) is shared by Agriculture sector. The per capita CO<sub>2</sub> emission in Nepal is nearly 0.14 tones whereas industrialized countries are emitting more GHGs (SAAPE, 2010).

In 1994/95, total methane emissions in Nepal were estimated at 948Gg. Nearly 867Gg emissions came from Agriculture sector. Energy related combustion activities, such as biomass burning; incomplete combustion of fossil fuels had also contributed in methane production. Lower amount of methane was also estimated from solid waste disposal and waste water treatment. Nepal Agricultural Research Council (NARC) at Khumaltar showed average seasonal methane emission from rice fields was 28 Kg/Ha/season in rain-fed condition (SAAPE, 2010).

It was also found that average maximum Methane emission from the field supplied with 50% Nitrogen +15 cm stubble was 49.03 Kg/Ha and minimum of 7.7Kg/Ha of Methane was found in the control fields. Korea, Thailand and India were 367, 49 and

45 Kg/ Ha respectively. The emission of Nepal was lower due to the lack of irrigation facilities and minimum application of fertilizer as compared to developed countries.

The major source of nitrous oxide emissions in 1994/95 was agriculture soils from where 27 Gg of this gas were released to the atmosphere. Also 2 Gg of N<sub>2</sub>O emissions were estimated from manure management for the same year. Indirect N<sub>2</sub>O emissions from human sewage were estimated to be 1.10 Gg for the base year 1994/95.

### **Climate Change Projections in Nepal**

The temperature differences in Nepal are most pronounced during the dry winter season and least during the time of monsoon. There is also significantly greater warming at higher elevations in the northern part of the country than at lower elevations in the south.

As 68% of the Nepalese population depends on agriculture for a livelihood and follow traditional cultivation practices, relying on rainwater and the seasons, any changes in climatic conditions affecting rainfall patterns will have an adverse impact on the livelihoods of most of the Nepalese people (SAAPE, 2010).. It means that there is always the high risk of food insecurity. The impact of climate change on agriculture will eventually affect the economic wellbeing population because it will have either a decreasing effect or an increasing effect on the production pattern of the agriculture sector affecting in turn economy of the country in the similarly way.

Drought has multiple effects since it affects not only water resources but also agriculture and subsequently food security. The effect of climate change and drought on agriculture and food security will have serious implications for sustainable

development. Climate change is a factor threatening the ability of people to obtain food. Warming of more than  $2.5^{\circ}\text{C}$  could reduce global food supplies and contribute to higher food prices. In Nepal, most of the irrigated terraces are turned into rainfed land and due to this production is decreasing. Decline in food production would lead to more malnutrition and huge consequences particularly for women and children.

### **Climate Change Impacts on Livelihood**

The effects of climate change on agriculture in Nepal can be divided between systems that are dependent on the summer monsoon and those that are dependent on snow, ice and glacial melt. Agricultural systems dependent on water sourced from snow, ice and glacial melt may see an immediate increase in water supply, but may also be in greater danger of GLOFs that threaten crops, water infrastructure, and mountain livelihoods, in general. Whether such an increase may consequently increase productivity in the short term is unknown, as very little exists in terms of water storage in Nepal, however primitive, to harvest such an excess of water supply. Long term, the effects of reduced water storage and variability of supply from earlier thawing of the snowpack and deglaciation have the potential to be significant, with glacial melt accounting for 30% of per capita consumption in some lowland regions (Eriksson et al., 2009) and increases in temperature causing consequent increases in agricultural water demand (IPCC, 2007). Unfortunately, because these effects are not likely to be felt for decades, the short-term benefits of increased runoff will likely delay any comprehensive long-term proactive management plans.

For systems dependent on the summer monsoon, multiple scenarios are possible due to the pervasive uncertainty in the models and lack of data, including the



‘roller coaster’ discussed previously, where the monsoon could abruptly transition between ‘dry’ and ‘wet’ states. In the short term, however, when taking into account the effects of increased aerosol production and ABCs, there is more certainty that less precipitation is likely to occur during the summer months as the number of rainy days decreases, even though the frequency of intense rainfall events will increase (UNEP, 2008). Increasing variability of precipitation patterns may have significant effect crop productivity, as farmers may have to adapt to changing onset and termination dates of the monsoon. Later start dates significantly impacted rice crops in 2009, as many seedlings were lost due to increase in the number of days and nights considered hot by current climate standards highest temperature increases during the months of June to August and at higher elevations, increase in monsoon rainfall towards the end of the century due to the delay in rainfall, and many did not have enough time to mature enough for a viable yield (Subel, 2009).

The impacts of less water during the dry months are much easier to visualize, as recent winter droughts have continued to show the effects of low water supply. During the drought of fall 2008 to spring 2009, agricultural systems experienced significantly reduced crop yields, resulting in food insecurity for millions. Such effects would be augmented by a more intense dry season. Western regions may be the most detrimentally affected because they rely heavily on winter rains and cannot depend as reliably on summer monsoon rains, which are not as intense in the west due to the natural pattern of rainfall intensity from east to west (SAAPE, 2010).

Though determining how agricultural systems in Nepal may be affected by the potential impacts of CC is difficult due to the lack of data in the country and the uncertainty in the climate models, there is nevertheless little doubt that significantly

more pressure may be placed on food systems that are already incapable of feeding the domestic population. Extreme poverty and high levels of malnourishment make even the slightest fluctuation in climate potentially disastrous to the economy. The population is thus extremely vulnerable, not only to longer term CC that will ultimately reduce water availability and limit crop productivity, but even more so to the immediate threats of increasingly frequent GLOFs, landslides, flash floods and droughts (SAAPE, 2010).

### **Hosting Cabinet Meeting at Kalapatthar**

The government billed the stunt as the world's highest Cabinet meeting. The Everest declaration was a message to the world to minimize the negative impact of climate change. Nepal's cabinet met at the base of Everest called Kalaththar of 17192 feet height on December 4<sup>th</sup> 2009 to highlight the impact of climate change on the Himalayas and adopted a 10-point declaration on Mount Everest and other Himalayan mountains. Everest Declaration, the Himalayas are important not only for the people of Nepal but for 1.3 billion people who depend on waters from the mountains for their livelihoods," said Nepal's Prime Minister at the cabinet meeting.

The Prime Minister, his two deputy prime ministers and the 20 Cabinet ministers were examined by doctors before boarding helicopters to Kalapathar, a flat area at an altitude of 17,192 feet next to Everest base camp, the jumping point for climbers seeking to scale the peak. The event came ahead of the international climate change conference was on next week of that cabinet meeting in Copenhagen, Denmark, and was intended "to get the world's attention on the impact global warming is having on underdeveloped countries like Nepal.

### **Co-operative Movement**

The co-operative is comprised of two words, 'Co' stands for together and 'operative' stands for working. It means, the literal meaning of co-operative is working together. The term of co-operative is living together, thinking together and working together for common benefit of the members. The co-operative is neither communist ideology nor capitalist ideology; it is equipment for group business of members involved according to their felt needs. The co-operatives are community organizations for to support the group business of farmers, workers, low-income group, landless people, and also the unemployed. Similarly, the ICA congress (1995) has defined co-operatives as an autonomous association of persons united voluntarily for the fulfillment of their common economic, social and cultural needs and aspiration through a jointly owned and democratically controlled enterprise.

The cooperative movement has considerable growth throughout Great Britain and the Commonwealth, where local cooperatives have been federated into national wholesale and retail distributive enterprises and whereas large proportion of the population has membership. Various examples of cooperative organization are also found in the Scandinavian countries, Israel, the People's Republic of China, Russia, and France. In the United States, the cooperative movement began in the 19<sup>th</sup> century, first among workers and then among farmers. Although co-operation as a form of individual and societal behavior and that is intrinsic to human organization. The history of modern co-operative forms of organizing dates back to the agricultural and industrial revolutions of the 18<sup>th</sup> and 19<sup>th</sup> centuries. The status of which was the 'first co-operative' was under some dispute, but various milestones in the history may be

identified. In 1761, the Fenwick Weavers' Society was formed in Fenwick, East Ayrshire, and Scotland to sell discounted oatmeal to local workers. Its services expanded to include assistance with savings and loans, emigration and education. In 1810, Welsh social reformer Robert Owen, from Newtown in mid Wales, and his partners purchased New Lanark mill from Owen's father-in-law and proceeded to introduce better labor standards including discounted retail shops where profits were passed on to his employees (Thakuri, 2010).

Owen left New Lanark to pursue other forms of co-operative organization and developed co-op ideas through writing and lecture. Co-operative communities were set up in Glasgow, Indiana and Hampshire, although ultimately unsuccessful. In 1828, William King set up a newspaper, the *Cooperator* to promote Owen's thinking, having already set up a co-operative store in Brighton. In nutshell, cooperative movement began in Europe in the 19th century, primarily in Britain and France. The Shore Porters Society claimed to be one of the world's first cooperatives, being established in Aberdeen in 1498. The industrial revolution and the increasing mechanization of the economy transformed society and threatened the livelihoods of many workers. The concurrent labor and social movements and the issues they attempted to address describe the climate at the time (Thakuri, 2010).

Nepalese people have a long tradition in co-operation taking many forms of labour sharing in villages, informal mutual aid groups and rotating savings and credit associations. Modern co-operatives began in Nepal in 1954 when a Department of Co-operatives (DOC) was established within the Ministry of Agriculture to promote and assist development of co-operatives. The first co-operatives formed in Nepal were co-operative credit societies with unlimited liability created in the Chitwan District as

part of a flood relief and resettlement programme. The traditional informal co-operation of Nepalese society had worked as co-operatives like different types of Guthis (Rajguthi, Amalguthi, Oliguthi, Devguthi, Monastery guthi), Parma (exchange of labors in farming), Dhikuri (Thakali community provided the credit to start a business in the need of their members), and Mankakhala in Newar society. These institutions worked long time. In Nepal farmers' co-operatives etc. are related to agricultural poor people's co-operatives.

They had to be provisionally registered under an Executive Order of HMG and were legally recognized after the first Co-operative Societies Act of 1959 was enacted.

The history of co-operatives in Nepal is closely related to Government's initiatives to use co-operatives as part of its development programmes. During the First Five-Year-Plan (1956/7-1960/1) Government embarked an ambitious programme to 4,500 agricultural multipurpose co-operatives. In fact only 378 co-operatives were organized. During the Second Three-Year-Plan (1962/63-1964/1965) a Land Reform Act came into force in 1964 including a compulsory savings scheme, according to which farmers had to save a portion of their crop. The co-operative programme was integrated into the land reform programme. A total of 542 societies were organized during the Plan period. A Land Reform Savings Corporation was established in 1967 to accept compulsory savings and advance loans to farmers. Government during this period was that the co-operative development programme was integrated into the overall rural development programme.

During the Third Five-Year Plan (1965/66-1969/1970) the total number of co-operatives reached 1,489 operating in 56 out of 75 districts. Many of these co-

operatives were formed in a hurry without taking economic feasibility and social viability into consideration. During the Fourth Five-Year Plan (1970/71-1974/75) a massive reorganization programme launched already in 1969 was pursued, placing emphasis on the quality rather than on the quantity of co-operatives. The Plan gave priority to 28 districts where the Intensive Agricultural Development Plan was to be implemented. Under the Fifth Five-Year Plan (1975/76-1979/80) a massive Co-operative Expansion Programme was launched, the Sajha Programme, this initially aimed at running 1,163 co-operatives in 1,827 village panchayats (now VDCs) of 30 districts, with some 808,000 members reaching 4.4 million people. During the Sixth Five-Year Plan (1980/81-1984/85) an Intensive Sajha Programme was launched in 1981 focusing more on and made more responsive to the needs and problems of small farmers. This programme started in 20 districts of the Terai (Nepal Gov, 2000).

During the Seventh Five-Year Plan (1985/86-1989/90) efforts made to reshape the co-operative movement. It was planned to extend co-operative services to the people through newly established service centres. Existing co-operatives were placed at service centres and where no co-operatives existed. A total of 144 new societies were formed mainly in the remote. The National Co-operative Development Board (NCDB) is a high powered body established under the NCDB Act of 1992 and composed of Government representatives from different ministries appointed and people having experience and knowledge about the co-operative.

Co-operatives work for the sustainable development of their communities through policies approved by their members. The co-operative sector has been recognized as one of the three pillars of development along with the public and private sectors according to the interim constitution of Nepal. Various policies and

programs mentioned in the approach paper of the interim Plan have considered co-operatives as the medium of economic, social and cultural development through the saving mobilization and increase in investments to restructure and strengthen the co-operative software, aimed at rural development. At present, Nepal has 9,720 primary co-operatives, 5 central federations, one national co-operatives bank and 133 district and sectorial federations. Altogether 1 million and 251 thousand members are associated with those co-operatives and their associations, including 33 percent women members. Annual transaction of the co-operatives sector amounts to approximately about Rs. 1,040 million whereas balance of savings and investments amounts to Rs. 20 billion and Rs. 24 billion respectively. According to an estimate, the transaction of these co-operatives has a contribution of approximately one percent in the GDP. Fifteen thousand people are directly employed in this sector (Nepal Gov, 2007).

The main objectives of co-operatives are organized for the fulfillment of their common economic and socio-cultural needs and aspiration. The economic objectives are collection and marketing of members produces, providing the financial assistance to the members for production and on needs, creation of self-employment and employment for members and community, improve productivity of capital and labour of their members, professional of business of members, income generation of members, operate processing and refining business, supply of qualitative agro-input for the production function to their members, develop entrepreneurship in members, transfer modern technology for production functions, operate insurance to protect member business, provide the business counseling service to their members (Thakuri, 2010).

The social-cultural objectives of co-operatives are decreasing disparity of ethnicity and caste among the members, eradicating gender discrimination of male and female, take care of senior citizens, promote talents of society, prepare physically and mentally healthy citizens in the community, develop social leaders in the community, providing training and education to their members, provide the health security through the medical insurance of members and their family, create the environment of working culture and respect for work, protect environment for their long life, encourage respect and solidarity among members, help government for social mobilization and social justice, encourage people for good habits, encourage accountable citizens their community and action.

After the restoration of Democracy in 1990, new co-operative Act, 1991 and new co-operative Rules, 1992 are promulgated providing autonomy to the co-operative sector. Mainly co-operatives are registered based on purpose of multiple subject or multipurpose co-operatives, single subject or single purpose co-operatives, products' co-operatives and service provided co-operatives. Most of these co-operatives are related to agricultural base. The agricultural co-operatives are agriculture producers' co-operatives, milk producers' co-operatives, milk powder producers' co-operatives, silk cocoon producers' co-operatives, potatoes producers' co-operatives, vegetable producers' co-operatives, herbal producers' co-operatives, fresh vegetable and fruit growers' co-operatives, Coffee growers' co-operatives, tea growers' co-operatives, mushroom growers' co-operatives, cardamom growers' co-operatives, organic vegetable growers' co-operatives, seed growers' co-operatives, fish keeper' co-operatives, honey bees keeper' co-operatives, goat keeper' co-operatives, buffalo keeper' co-operatives, sheep keeper' co-operatives, cow keeper'



co-operatives, cold store co-operatives, herbs growers' co-operatives, handicraft co-operatives, dry meat producers' co-operatives, irrigation co-operatives, poor farmers' co-operatives and so on.

The community based saving and credit co-operatives are more helpful for development of agricultural sectors. Kamaiya co-operatives, Halia co-operatives, Landless farmers' co-operatives are small. The different types of co-operatives are working with different objectives in Nepal for helping the poverty reduction sectors. This research is focusing on poverty reduction in Nepal through the agricultural cooperative organizations. The ICA congress has defined co-operative in 1995 as an autonomous association of persons united voluntarily for the fulfillment of their common economic, social and cultural needs and aspiration through a jointly owned and democratically controlled enterprise.

Saving and credit co-operatives are helping for regular saving, optional or irregular saving, fixed saving, special saving, Pawa Bachat, Children's saving, special saving account for business member, provident saving, pension saving etc. Co-operative Management is managing under the ministry of land reform, Agricultural Development Bank of Nepal, department of co-operatives, Board of Directors etc. Co-operatives are helping by providing the production credit on agriculture, cattle & birds, small industry, tourism industry, trade, real-state and hire purchase, service sectors like purchasing rice, food, treatment of the members and their family members, education of children of member etc., agro-input purchase (marketing), production selling like milk, green vegetable, spices, non-timber forest product like handmade paper, herbals etc. (Thakuri, 2010).

Skill based commodity production, raw materials, agro-processing, silkworm, silk thread and cloth production, fish keeping and cattle farming, fruits and juice production, Honey bee keeping, coffee & tea production, etc. Co-operatives also help for electrification program in rural area, elephant safari, ambulance service, Co-operative hospitals, Public bus service and socio-cultural development sectors of the community (Thakuri, 2010).

### **Problems and Challenges of Co-operative in Nepal**

There are lack of long term co-operative planning with a clear vision and insufficient legal provision, rules, regulations and standards to regulate and monitor co-operatives, insufficient and ineffective structural and institutional arrangements for the co-operative sector, lack of formal co-operative education, trainings and systematic co-operative information system and distribution of information, lack of business leadership development, business competence and capital and inadequate co-operation among co-operatives and their associations, NPC (2007).

There is also decreased level of confidence among the general public and passiveness of members due to the profit making tendency in some co-operatives and lack of adequate co-operation between the government and co-operatives, and lack of provision of appropriate institutional arrangements to regulate and supervise savings and credit co-operatives, lack of participation of excluded, marginal and Dalit due to far registration office and needed of huge number of members for registration of primary cooperatives.

The challenges of the co-operatives are to strengthen the structure, human resources, economic and physical condition of public and the co-operative sector this

manages the activities of the co-operative sector, to orient the leadership of the co-operative sector towards business entrepreneurship for balancing self-discipline, regulation and self-governance by developing the system of institutional good governance in the co-operatives and to develop capable of human resources with practical knowledge in the co-operative sector, NPC (2007)..

Similarly, other challenges are to manage and operate co-operative production making system in the economic and social sector of the country, to enhance the capacity of producing quality commodity and services, capable of facing the competitive situation created by the development of information and communication technology and globalization, to make co-operatives member centered and to increase their participation in the activities of the co-operatives, to arrange the supply of institutional capacity by developing a co-operative banking system, and to expand and strengthen co-operatives in remote, hilly and backward areas, NPC (2007).

### **Trends of Institutionalization of Co-operatives**

In Nepal, a co-operative society needs to be registered in accordance to co-operative Act 2048 BS. For registration, it is essential to complete some documentation and government producers. Generally, following procedures are essential to complete for the registration of a co-operative society (Thakuri, 2010).

Preliminary consultation and meeting is the formal primary procedure for the co-operative society. It is discussion among the people having common interest and problem. In this stage, people agree about the framework of co-operative organization. They have to discuss about pre-requisites for the formation of a co-operative and its further plan. After the development of better environment and

mutual understanding, they have to manage a meeting to discuss about various elements of the co-operative like its name, address, area of operation, capital structure so on. A prescribed application form is needed to submit to the office of registrar by completing all necessary requirements. Along with application arrested citizenship certificate of minimum 25 members and bank deposited voucher of registration fee must be submitted. On a receipt of application for the registration of a society or union according to section four of co-operative Act, registrar conducts necessary investigation. In case, registrar finds requirement any amendment in by-law of society, may provide notice for amendment to the concerned members within 15 days of application (Thakuri, 2010). When registrar of department of cooperative satisfies with the documents submitted, it registers the name of the society in office book and provides registration certificate to members. A cooperative has separate entity. It has authority to purchase, use and dispose of any moveable and immovable property. It may sue and sued as person by its own name.

In Bangladesh, the registration of a cooperative society is subject to satisfaction of the Registrar of the Cooperative Societies (RCS) and the person has to give reasons for registration (within 90 days, under article 10.4). In case of registration, refusal by the RCS, an appeal can be made to the Bangladesh Government. In case of refusal by the subordinates of the RCS senior officer under Schedule four (1) can be appealed (Bangladesh cooperative act, 2003).

In Fiji, the conditions under Section 7 of the Fiji cooperative law are primary cooperative. There should be at least 10 members or associations or both; at least 2 primary cooperatives in case of secondary cooperatives; at least 2 primary or

secondary cooperatives in case of an apex organization and under the section 12.2 the Registrar must either register or refuse within 2 months, (Fiji cooperative law, 2004).

In India under the multi state cooperative societies Act in India, the conditions of registration are, in the case of a multi-state cooperative society of which all members are individuals by at least fifty persons should be from each of the states concerned, in the case of a multi-state cooperative society of which the members are cooperative societies, by duly authorized representatives on behalf of at least two such societies, as are not registered in the same State; and in the case of multi-state cooperative society of which another multi-State cooperative society and other cooperative societies are members, by duly authorized representatives of each of such societies. The RCS under Section 7 (3) has been given six months' time to register. He can ask the central government for an unlimited extends of this period. There is a within-sixty-days provision for appeal against orders of the RCS, under section 90/92(Indian cooperative society act, 1995).

In Indonesia, under article 44 of the Indonesian Co-operative Act the founders of cooperatives have to submit copies of the memoranda to the administrator, appointed by the minister. The maximum period allowed for registration is six months. However, in case, the Administrator does not intend to register the society, he must inform the promoters within three months on the reasons for not registering. The applicants can file an appeal to the Minister, who must then take stand on the appeal within three months. His decision shall then be final. There are no other conditions for registration like minimum membership (Indonesia cooperative act, 1997).

In Japan, the law provides a detailed procedure for formation of an agricultural cooperative. A minimum of 15 farmers are required for primary cooperatives. Once

the application is made decision shall be given within two months, according to article 60. In case the authorities fail to make approval or disapproval within two months, the society may demand registration and can ask for a registration certificate (Article 61), (Japan cooperative society act, 1993).

In South Korea, registration of cooperatives in South Korea under Agricultural Cooperative Law is governed by Article 16, 17 and 87. Under the South Korean Agricultural Cooperative Law (Article 22) only farmers can be member of a cooperative. There are 2 important conditions for registration. The minimum number of members has to be 20 and the bye-laws have to be according to the model by-laws approved by the minister and any change in this has to be with the approval of the Minister. This seems to be a restrictive provision. The members of a cooperative should have power to make changes in the by-laws. Of course, they have to be unconformity with the law (South Korean cooperative act, 1996), In Malaysia the minimum number of members in a primary society is 100 and in Farmers' Organization it is fifty. There is no time limit for the registrar to decide the application for registration. Only in case of refusal, an appeal can be made to the minister within two months.

A cooperative in the Philippines shall hold a minimum of 15 members. The Cooperative Development Authority must register a cooperative within 30 days. In case of refusal to register an appeal can be made to the office of the President within 90 days. If registration is not done within 30 days the society is to be registered (Philippines cooperative act, 1999).

In Sri Lanka, the minimum number of memberships for a primary cooperative is ten. A detailed procedure is provided for registration, but there is no time limit

within which the registrar must approve or disapprove registration. The registrar will register only if it is found that societies in question are economically viable. In case of refusal, an appeal can be made to the minister (Sri Lanka cooperative act, 1999).

While procedures and conditions are prescribed as in other cooperative laws, one interesting provision in the Thai Law is that the Cooperative Society to be registered may not be detrimental to the cooperative society system. In Africa, the minimum number of memberships for registration of a primary cooperative is five (African cooperative society act, 2003).

A time limit for the registration, by the registering authority, should exist. At present it ranges from 30 days (Philippines) and 2 months (Japan) to six months (India and Indonesia), while some countries have no time limit (Bangladesh, Malaysia, Nepal, Sri Lanka, Thailand). It will be desirable to fix a time limit for registration, possibly around 60 days.

The Cooperative Act (Amendment) of Bhutan, 2009 defines a Primary Cooperative as one where a minimum of fifteen natural persons who are Bhutanese citizens with common bond of interest in the area of operation of the cooperative. In Afganstan, co-operative is an association of persons who have voluntarily joined together to achieve a common social and economic status through the formation of a democratically managed and controlled organization. Primary Co-operative is a cooperative formed by at least eleven individuals and Secondary Co-operative' as a co-operative formed by at least three co-operatives (Afghanistan cooperative act, 1997).

In Pakistan, at least ten persons qualified in accordance with the requirements of section 7, sub-section (1); and in the case of a society of which a member is a

society by a duly authorized person on behalf of every such society and where all the members of the society are not societies, by ten other members or, when there are less than ten other members, by all of them (Pakistan cooperative act, 1999).

**Table 2.3**

**Minimum Requirements of Members for Registration of Primary Cooperative**

| S.N | Country      | Required members for registration of cooperative |
|-----|--------------|--|
| 1   | Nepal        | 25   |
| 2   | Fiji         | 10   |
| 3   | India        | 15   |
| 4   | Indonesia    | No condition for minimum memberships             |
| 5   | Japan        | 15   |
| 6   | South Korea  | 20   |
| 7   | Malaysia     | 100, agricultural cooperative 50                 |
| 8   | Sri Lanka    | 10   |
| 9   | South Africa | 5  |
| 10  | Bhutan       | 15   |
| 11  | Afghanistan  | 11   |
| 12  | Pakistan     | 10   |
| 13  | Canada       | 15   |
| 14  | Alberta      | 3  |
| 15  | German       | 7  |
| 16  | Philippines  | 15   |
| 17  | Thailand     | Now 40, at beginning 10 members                  |
| 18  | USA          | 10   |
| 19  | Australia    | 5  |

Source: Relative Country Registration Office of Cooperative, 2012

The minimum number of members for registration of cooperative in different countries is different. According to a table 2.3, Malaysia is strong for registration of primary cooperative because there are needed 100 members for registration of



cooperatives but farmers can registration the cooperative with 50 members. In Indonesia, there is no condition for minimum memberships for registration of cooperative. Nepal becomes second country for maximum members required for registration of cooperative after Malaysia.

### **Primary Co-operatives in Nepal**

Primary cooperative is the basic level cooperative and at least 25 members are required for registration. Savings and Credit Cooperatives, Multipurpose Cooperatives, Dairy Cooperatives, Agricultural Cooperatives, Vegetable and Fruit Producers' Cooperatives, Electricity Cooperatives, Consumer Cooperatives, Communication Cooperatives, Coffee Producers Cooperatives, Health Cooperatives, Medicinal Herb Cooperatives, Tea Producers Cooperatives, Bee Keeping Cooperatives are main primary cooperatives of Nepal (Nepal Gov, 2012).

**Table 2.4****Number of Primary Cooperatives in Nepal**

| S.N. | Types of Cooperatives                      | Number | Male Members | Female Members | Total Members |
|------|--|--------|--------------|----------------|---------------|
| 1    | Savings and Credit Cooperatives            | 10997  | 786088       | 703583         | 1489671       |
| 2    | Multipurpose Cooperatives                  | 4075   | 544374       | 504044         | 1048418       |
| 3    | Dairy Cooperatives                         | 1747   | 71969        | 23273          | 71692373      |
| 4    | Agricultural Cooperatives                  | 3612   | 164371       | 142298         | 178669        |
| 5    | Vegetable and fruit producers cooperatives | 174    | 6170         | 6201           | 12371         |
| 6    | Electricity Cooperatives                   | 313    | 36712        | 8337           | 45049         |
| 7    | Consumer Cooperatives                      | 1339   | 31827        | 18262          | 50089         |
| 8    | Communication Cooperatives                 | 68     | 4125         | 2175           | 6300          |
| 9    | Coffee Producers Cooperatives              | 75     | 2437         | 1320           | 3757          |
| 10   | Health Cooperatives                        | 70     | 3150         | 3531           | 6681          |
| 11   | Herbal Cooperatives                        | 89     | 1969         | 1267           | 3236          |
| 12   | Tea Producers Cooperatives                 | 103    | 2845         | 1230           | 4075          |
| 13   | Bee keeping cooperatives                   | 54     | 1068         | 860            | 1928          |
| 14   | Other Cooperatives                         | 585    | 35128        | 32967          | 68095         |
|      | Total                                      | 23301  | 1692233      | 1449348        | 3141581       |

Source: Statistics on Nepalese Cooperative Societies & Unions, 2012

According to statistical data of department of cooperative (2012), the number of primary co-operatives is 23301 and the total members are 3141581. The participation members of male and female in primary cooperative are 53.87 % and 46.13 % respectively. It means that the participation of female is good. Out of total primary cooperatives, Savings and Credit Cooperatives and Multipurpose Cooperatives are

47.2 %, 17.49 % respectively. Similarly, the percentage of Dairy Cooperatives, Agricultural Cooperatives and Consumer Cooperatives are 7.5%, 15.5 % and 5.8 % respectively. Other cooperatives like Communication Cooperatives, Coffee Producers Cooperatives, Health Cooperatives, Herbal Cooperatives, Tea Producers Cooperatives, and Bee keeping cooperatives are less in member.

There are some cooperatives which have only female memberships or only woman based cooperatives. It is positive perception and mainly woman based cooperatives are savings and credit cooperatives, multipurpose cooperatives, dairy cooperatives, agricultural cooperatives, vegetable and fruit producers' cooperatives and consumer cooperatives.

**Table 2.5****Number of Primary Co-operative of Woman in Nepal**

| S.N. | Types of Cooperatives                      | Number | Female Members |
|------|--|--------|----------------|
| 1    | Savings and Credit Cooperatives            | 1641   | 245633         |
| 2    | Multipurpose Cooperatives                  | 536    | 109267         |
| 3    | Dairy Cooperatives                         | 20     | 747            |
| 4    | Agricultural Cooperatives                  | 268    | 54130          |
| 5    | Vegetable and fruit producers cooperatives | 9      | 302            |
| 6    | Consumer Cooperatives                      | 31     | 882            |
| 7    | Tea/Coffee Producers Cooperatives          | 1      | 42             |
| 8    | Health Cooperatives                        | 1      | 61             |
| 9    | Bee keeping cooperatives                   | 1      | 197            |
| 10   | Fish keeping cooperatives                  | 1      | 63             |
| 11   | Other Cooperatives                         | 35     | 2173           |
|      | Total                                      | 2544   | 413497         |

Source: Statistics on Nepalese Cooperative Societies & Unions, 2012

According to statistical data of primary co-operatives of woman in Nepal till July, 2012, the number is 2,544 and the total members of woman involved are 413,497.

There are 1,641 savings and credit cooperatives, which are 64.5 % of the total woman, based cooperatives. Similarly, Multipurpose Cooperatives are 536 with 21.07 %, agricultural cooperatives are 268 with 10.53 %, dairy cooperatives are 20 with 0.79 % and vegetable and fruit producers' cooperatives are 9 with 0.35 % and consumer cooperatives are 31 with 1.22 %. There are single cooperative of the tea/coffee

producer cooperative, health Cooperative, bee keeping cooperatives and fish keeping cooperative (Nepal Gov., 2012).

### **Theoretical Review**

Literatures of the different theories including climate change, livelihood and cooperatives under different theories have been reviewed and presented in sequential manner in the subsequent chapters. The review has covered sustainable livelihood approach, seven theories of climate change and principle of cooperative.

### **Sustainable Livelihood Approach**

The livelihood of a household or individual can be interpreted as their 'means of living'. Their means of living is based on their capabilities, assets (financial, physical, human, natural resource and social) and activities. The Sustainable Livelihoods Approach (SLA) was developed to help understand and analyze the livelihoods of the poor in order to improve the effectiveness of livelihoods-related development assistance. It is generally seen as a successor to the Integrated Rural Development approach, and has commonalities with contemporary Area-Based Development and Community-Development approaches. The SLA essentially comprises six core principles and a conceptual framework (Elis, 1998).

The principles of sustainable livelihood approach are, people centered that focuses on perspectives, priorities and strengths of people - especially poor and vulnerable women/girls and men/boys, holistic that recognizes that different factors and processes influence the livelihood opportunities and choices of people and that people have multiple livelihood strategies in pursuit of multiple livelihood outcomes.

Similarly, dynamic recognizes that poor people's livelihood strategies can change rapidly, building on strengths that with an analysis of strengths rather than needs, macro-micro linkages: Consider the linkages between the two levels to inform more supportive policies and institutions and sustainability that includes analysis of environmental, social, economic and institutional sustainability (Elis, 1998). NZAID's Growth and Livelihoods Policy recognizes the relevance of the sustainable livelihoods approach, especially its principles, to all of NZAID's assistance in the economic development and livelihoods-related field (Elis, 1998).

The sustainable livelihoods approach provides a framework to help understand the main factors that affect poor people's livelihoods, and the relationships between these factors, and this in turn facilitates the planning and implementation of more effective development interventions. By centering our thinking around people rather than the technical inputs development might deliver to them the chances of achieving sustainable impacts on poverty reduction are significantly improved.

The sustainable livelihood approach identifies existing assets and strategies available to poor women and men and uses these as a starting point; Helps keep the focus on poor people and their varied livelihood assets, strategies and outcomes; Recognizes differences based on sex, gender, age, ethnicity, power and poverty status; Builds on strengths as a means to addressing needs and constraints; makes explicit the links between policy and institutional issues, and micro level realities, and helps in understanding how individual, possibly sector-specific, development programmes and projects fit into the wider livelihoods agenda and objectives (Ashley, 1999).

SL analysis (the application of the SL approach) is likely to identify a number of different options for supporting livelihoods but development programmes and

projects should not attempt to tackle all aspects of livelihoods. The emphasis should be on identifying and negotiating, together with partners and primary stakeholders, the 'best bet' entry points that will have a significant impact on the livelihoods of the poor. The SL approach helps to identify key pressure points, but other more specific methods are required to determine which to tackle first, and how (Ashley, 1999).

A key lesson from SL analysis is that holistic analysis is important but that does not imply that multi-sectorial and multi-level interventions are necessarily appropriate. Interventions might be best focused on addressing one or two pressure points/priorities in one sector and at one level. A helpful analogy is the 'acupuncture approach' that is an acupuncturist uses a holistic diagnosis of the patient, but the treatment is focused and specific. The SL principles are ones that are basic to good development practice and should be applied in the identification, design and appraisal of livelihood programmes and projects. There is no specific right way of applying the sustainable livelihoods approach and nor does it come with its own exclusive toolbox. Rather livelihoods analysis should draw upon, and flexibly combine, a variety of existing perspectives, analyses and methods to meet the breadth and depth of analysis required for a particular situation like participatory methods, stakeholder analysis, gender analysis, institutional analysis, value chain analysis, cost benefit analysis, environmental assessment and so on.

### **Theories of Climate Change**

The seven theories of climate change are important to understand the climate change process and it is summarized from the 'Seven Theories of Climate Change'. It is

written by President of the Heartland Institute Joseph L. Bast and published by Heartland Institute Chicago on 2010.

### **First Theory: Anthropogenic Global Warming**

The first theory of climate change is related with the human emissions of greenhouse gases, principally Carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide, water vapor which are causing rise in global temperatures. This theory is called anthropogenic global warming or AGW for short form. Energy from the sun travels through space and reaches Earth. It is absorbed and some is reflected back as hit out into the atmosphere. The greenhouse gases, absorb the outgoing reflected or internal thermal radiation, resulting in Earth's atmosphere becoming warmer. Water vapor is the major greenhouse gas, responsible for about 36 to 90 percent of the greenhouse effect, CO<sub>2</sub> about 1 to 26 percent, methane about 4 to 9 percent and Ozone about 3 to 7 percent. This theory also deals that continued burning of fossil fuels and deforestation could double the amount of CO<sub>2</sub> in the atmosphere during the next 100 years. Assumption of this theory is that doubling of CO<sub>2</sub> in the atmosphere would cause Earth's temperature to rise an additional 3.0° by 2100. Proponents of the AGW theory believe that man-made CO<sub>2</sub> is responsible for floods, droughts, severe weather, crop failures, species extinctions, spread of diseases, ocean coral bleaching, famines, and literally hundreds of other catastrophes (Joseph, 2010).

### **Second Theory: Bio-thermostat**

The second theory of climate change holds that negative feedbacks from biological and chemical processes entirely or almost entirely offset whatever positive feedbacks might be caused by rising CO<sub>2</sub>. These processes act as a global bio-thermostat keeping temperatures in equilibrium.



Increased carbon sequestration by plants is perhaps the best-known consequence of the rise in atmospheric CO<sub>2</sub>. The more CO<sub>2</sub>, there is in the air, the better plants grow and the more CO<sub>2</sub> they remove from the air and store in their leaves, branches, trunks, and roots, as well as in the soil beneath the plants – a suite of processes called sequestration. Carbonyl sulfide (COS) is a biologically produced sulphur gas emitted from soils. COS eventually makes its way into the stratosphere where it is transformed into sulfate aerosol particles, which reflect solar radiation back into space, producing a cooling effect on Earth's climate. A third negative feedback phenomenon is diffuse light. As higher levels of CO<sub>2</sub>, promote greater plant productivity, plants emit greater amounts of gases converted into aerosols called biosols. Bio-sols in turn act as cloud condensation nuclei, helping to create new clouds that reflect more incoming solar radiation back to space, thereby cooling the planet. More than that, they diffuse solar radiation close to the ground, reducing shade under plant canopies and thereby enhancing photosynthesis, which increases the amount of CO<sub>2</sub> plants absorb from the air and can sequester. Iodinated compounds, or iodo compounds, are particles formed in sea air from iodine-containing vapors emitted by marine algae. These compounds, like the biosols previously discussed, help create clouds, which reduce the amount of solar radiation reaching the surface. The creation of iodo compounds is stimulated by rising CO<sub>2</sub> levels and warmer temperatures (Joseph, 2010).

The amount of biologic Dimethyl sulfide (DMS) emitted by the world's oceans is closely related to sea surface temperature. The higher the sea surface temperature, the greater the sea-to-air flux of DMS. DMS is a major source of cloud condensation nuclei, which generate clouds with greater cloud albedo. The greater the

cloud albedo, the more incoming solar radiation gets blocked and reflected out to space. There are many other kinds of aerosols, which scientists classify as marine biological, terrestrial biological, anthropogenic non-biological, and natural non-biological. Many of them are created, distributed, or destroyed in biological and chemical processes that tend to be counter-cyclical to the forcing of CO<sub>2</sub>. In other words, when CO<sub>2</sub> is plentiful or when temperatures rise, these aerosols tend to increase in presence and reflect more solar radiation away from the planet's surface, causing it to cool. Some of these individual negative feedbacks may be sufficiently large to counter much of the effect of higher levels of CO<sub>2</sub> on global temperatures. It is highly likely they constitute a bio-thermostat keeping Earth's temperature relatively stable. This would mean rising CO<sub>2</sub> would not cause catastrophic global warming (Joseph, 2010).

### **Third Theory: Cloud Formation and Albedo**

A third theory of climate change postulates that changes in the formation and albedo of clouds create negative feedbacks that cancel out all or nearly all of the warming effect of higher levels of CO<sub>2</sub>. In 1999, Yogesh Sud, a NASA scientist, and his colleagues found that changes in cloud coverage in the tropics acted as a natural thermostat to keep sea surface temperature (SST) between approximately 28°C and 30°C. The cloud cover reduces the amount of solar radiation received at the surface of the sea and cool and dry downdrafts promote ocean surface cooling.

In 2008, climatologist and former NASA scientist Roy Spencer and colleagues used new satellite data to support Lindzen's adaptive iris thesis, finding the net ... radiative effect of clouds during the evolution of the composite TSO [tropical intra-seasonal oscillations] is to cool the ocean-atmosphere system during its tropospheric

warm phase, and to warm it during its cool phase. In 2009, Lindzen and Coauthor Yong-Sang Choi found “for the entire tropics, the observed outgoing radiation fluxes increase with the increase in sea surface temperatures (SSTs).

#### **Fourth Theory: Human Forcing Besides the Greenhouse Gases**

A fourth theory of climate change holds that mankind’s greatest influence on climate is not its greenhouse gas emissions, but its transformation of Earth’s surface by clearing forests, irrigating deserts, and building cities. Although the natural causes of climate variations and changes are undoubtedly important, the human influences are significant and involve a diverse range of first-order climate forcing, including, but not limited to, the human input of carbon dioxide (Joseph, 2010).

Urban heat islands cities tend to be warmer than suburbs, and suburbs warmer than rural areas, because they have greater concentrations of energy-producing machines and vehicles and large amounts of concrete, asphalt, and other building and road materials that absorb solar energy and then re-emit thermal energy. Advocates of the AGW theory, falsely attribute higher temperatures caused by urban heat islands to rising atmospheric CO<sub>2</sub> levels.

Anthropogenic aerosols and ozone have shorter lifetimes than greenhouse gases, and therefore their concentrations are higher in source regions and downwind. With many surface-based temperature stations located in urban or near-urban areas, it is likely they are registering the warming effects of these aerosols and ozone, not CO<sub>2</sub>. Removing trees by burning, a common practice in developing countries releases CO<sub>2</sub> into the atmosphere and prevents forests from sequestering carbon in the future. The pasture or crop land that replaces the forest lacks the shade created by a forest canopy and tends to be warmer. The IPCC has estimated that between one-quarter and

one-third of anthropogenic CO<sub>2</sub> emissions are due to deforestation, not the burning of fossil fuels (Joseph, 2010).

Anthropogenic activities in coastal areas such as logging, agriculture, construction, mining, drilling, dredging, and tourism all can increase or decrease surface temperatures of nearby bodies of water. Anyone living in or near a large city knows that jets often leave trails behind them, called contrails condensation trails. Composed of water vapor, they precipitate the creation of low clouds that have a net warming effect.

### **Fifth Theory: Ocean Currents**

The fifth theory of climate change contends that global temperature variations over the past century-and-a-half, and particularly the past 30 years, were due to the slow-down of the ocean's Thermohaline Circulation (THC). William Bill Gray, professor emeritus of atmospheric science at Colorado State University and head of the Tropical Meteorology Project at the university's Department of Atmospheric Sciences (Joseph, 2010), is the leading proponent of this theory. According to William, ocean water is constantly transferred from the surface mixed layer to the interior ocean through a process called ventilation. The ocean fully ventilates itself every 1,000 to 2,000 years through a polar region deep ocean subsidence of cold-saline water and a compensating upwelling of warmer less saline water in the tropics. When the Thermohaline Circulation (THC) is weaker than normal, as it is about half the time, global rainfall and surface evaporation are reduced about two percent (Joseph, 2010)..

### **Sixth Theory: Planetary Motion**

The sixth theory of climate change contends that most or all of the warming of the latter part of the twentieth century can be explained by natural gravitational and

magnetic oscillations of the solar system induced by the planet's movement through space. These oscillations modulate solar variations and/or other extra-terrestrial influences of Earth, which then drive climate change. Earth's orbit around the sun takes the form of an ellipse, not a circle, with the planet passing farther away from the sun at one end of the orbit than at the other end. The closest approach of the planet to the sun is called perihelion and the farthest is called aphelion. Perihelion now occurs in January, making northern hemisphere winters slightly milder (Joseph, 2010). The change in timing of perihelion is known as the precession of the equinoxes, and it occurs every 22,000 years. The earth shifts from a short broad ellipse that keeps Earth closer to the sun, to a long flat ellipse that allows it to move farther from the sun and back again. Scientists now know that the precession of Earth's orbit means that about 11,000 years from now, the northern midwinter will fall in July instead of January, and the continental glaciers may return. The forecasts indicate that climate may cool until the 2030s. At the end of the 21st century relative to today's temperature, the climate may warm at most by 1°C if the quadratic fit forecast holds (Joseph, 2010).

### **Seventh Theory: Solar Variability**

The seventh theory of climate change is that solar variability accounts for most or all of the warming in the late twentieth century and will dominate climate in the twenty-first century regardless of man-made greenhouse gas emissions. Changes in the brightness of the sun are caused by sunspots – bursts of energetic particles and radiation. The cycles cause changes in the amount of electromagnetic radiation also called solar wind that reaches Earth and its atmosphere, which in turn affects Earth's climate.

According to the IPCC, changes in solar irradiance since 1750 are estimated to cause a radiative forcing of  $+0.12 \text{ W/m}^2$ , which is an order of magnitude smaller than the IPCC's estimated net anthropogenic forcing of  $+1.66 \text{ W/m}^2$  from  $\text{CO}_2$  over the same time period. Around 2000, several scientists working independently made discoveries that demonstrated plausible mechanisms linking variation in solar radiation to decadal changes in global temperature (Joseph, 2010).

Henrik Svensmark and Eigil Friis-Christensen, astrophysicists at the Danish National Space Center, in a seminal scientific paper (1997), proposed that electrons released to the atmosphere by galactic cosmic rays stimulate the formation of ultra-small clusters of sulfuric acid and water molecules that constitute the building blocks of cloud condensation nuclei. During periods of greater solar magnetic activity, the stronger solar wind blocks some of the cosmic rays from penetrating the lower atmosphere, resulting in fewer cloud condensation nuclei being produced. The result is the creation of fewer and less reflective low-level clouds, resulting in increasing near-surface air temperatures and global warming.

A second group of scientists believes small changes in solar radiation entering Earth's atmosphere are amplified by positive feedbacks involving the transfer of energy between equator and arctic via wind patterns and oceans. Bond et al. envisioned solar variability provoking changes in North Atlantic deep water formation that alter the thermohaline circulation of the global ocean (Joseph, 2010).

Scientists have long known that many factors influence Earth's climate, including variations in the sun's brightness and magnetic field strength and the planet's orbit, the planet's movement through the galaxy, and changes in land use. Beginning in the 1970s, the rising concentration of carbon dioxide in the atmosphere

began to catch the attention of scientists and the public. At that time, some scientists thought industrial activities that cause rising levels of CO<sub>2</sub> and aerosol particles explained the cooling trend that had begun in the 1940s. Later, some of those same scientists would blame CO<sub>2</sub> for the global warming period that began in the 1980s and ended around 2000 (Joseph, 2010).

### **Principles of Co-operative**

There are seven principles of the cooperative. First principle of the cooperative is voluntary & open membership. Co-operatives are voluntary organizations and open to all persons able to use their services. Second principle is the democratic member control in which co-operatives are democratic organizations, controlled by their members, who actively participate in setting their policies and making decisions. Third principle is the member economic participation that is members democratically control the capital of their co-operative. Fourth principle is autonomy and independence that is co-operatives are autonomous; self-help organizations controlled by their members. If they enter into agreements, with say governments, they do so on terms that ensure democratic control by their members and that maintain their co-operative autonomy. Fifth principle is the education; training and information that is co-operatives provide education and training for their members, elected representatives, managers and employees so that they can contribute effectively to the development of their co-operative. Sixth principle is the co-operation among co-operatives that is co-operatives serve their members most effectively by working together. Seventh principle is that concern for the community. The International Co-operative Movement adopted it in 1995 (Thakuri, 2010).

### **Review of Contemporary Research Studies**

In this section, the review of contemporary research studies has been presented based on the study of related fields including livelihood, climate change and cooperatives.

Diamantopoulos (2011) in his doctoral thesis entitled *Globalization, Social Innovation, and Co-Operative Development: A Comparative Analysis of Québec and Saskatchewan from 1980 to 2010* stated that the regeneration of the Québec movement reflects the concentration (concerted action) of social movement, sector, and state actors. Deeply rooted in a collectivist tradition of cultural nationalism and state corporatism, this democratic partnership supported the renovation and expansion of the co-operative development system in a virtuous spiral of movement agency, innovation, and regeneration. Concentration of social movement and state actors created momentum for escalating orders of joint-action, institution-building, and policy and program development. By contrast, the degeneration of the Saskatchewan movement reflects the decline of the agrarian economy and movement and a failure to effectively coordinate the efforts of emerging social movements and the state for development action. This has yielded a vicious spiral moment of inertia, under-development, and decline. Although green shoots are in evidence, regeneration efforts in Saskatchewan lag Québec's progress in rebuilding the foundations for effective democratic partnership.

This study has not yet mentioned about impacts of climate change and the status of livelihood.

Cahn Miranda (2006) in his doctoral thesis entitled *Sustainable Livelihoods, Micro-Enterprise and Culture in the Pacific Islands: Case studies from Samoa* concluded that understanding the relationship between culture, and sustainable



livelihoods is critical for ensuring that good judgments are made about development intervention and policy. The revised sustainable livelihoods framework, and the concept of using the components of the frameworks as multiple entry points for analysis, provided an appropriate and useful theoretical framework for understanding the relationships between fa'a Samoa, sustainable livelihoods and micro-enterprise in Samoa.

This study has not yet mentioned about the impact of climate change and cooperative movement for sustainable livelihood.

Karianne, De Bruin (2011) in his doctoral thesis entitled an Economic Analysis of Adaptation to Climate change under Uncertainty. According to him the changing climate increases the vulnerability of societies around the world. Besides mitigation, adaptation measures are needed to counteract the impacts of climate change. However, there exist uncertainties about the impacts of climate change. Decision makers are faced with the challenge to implement economically efficient and effective climate change policies and adaptation measures to mitigate uncertain climate change impacts. This thesis presents an economic analysis of adaptation to climate change under uncertainty. The thesis focuses on the exploration and further development of economic assessment methods to support decision-making in adaptation to climate change. The results of this thesis show that Multi-Criteria Analysis and Cost-Benefit Analysis are appropriate decision-support tools in the context of adaptation to climate change. The priority ranking of adaptation options for the Netherlands based on Multi-Criteria Analysis, through evaluation and feasibility criteria, gives an indication of the priority options for the Dutch adaptation policy. The regional case study applies Cost-Benefit Analysis for a quantitative assessment of

the costs and benefits of climate proofing spatial planning at a regional level.

Furthermore, the investment decision model developed in this thesis, based on Cost-Benefit Analysis under climate change uncertainty, takes into account the effect of future investment moments and the availability of new information on climate change impacts. The model analysis and case study application show that the optimal mix of structural and non-structural adaptation measures depends on the level of the damage costs, the cost structure of the measures, the discount rate and the timing of future investment moments, including the timing of partial resolution and full resolution of uncertainty, Karianne, De Bruin (2011).

This study has not yet mentioned about cooperative movement for sustainable livelihood to withstand from the climate change.

Alexander Lorenz (2011) in his doctoral thesis entitled *Uncertainty & Learning in Global Climate Analysis* stated that climate change, the 21st centuries challenge for cooperative human decision making, is surrounded by large uncertainties concerning the scientific understanding of the climate system, of climate change induced changes of natural and social systems and of the impacts of those changes on human economic activities and human welfare in general. Parts of these uncertainties may be resolved as science advances and new observations are made. This learning may allow to refine the decisions undertaken to cope with the climate problem. This thesis is dedicated to examine the role of uncertainty and future learning in the formal assessment of optimal global mitigation strategies for global warming.

This study has not yet mentioned about sustainable livelihood for mitigation of climate change and cooperative movement.

Murphy Patrik (2010) in his doctoral thesis entitled *Design, Implementation and Characterization of a Cooperative Communications System* stated that Cooperative communications is a class of techniques which seek to improve reliability and throughput in wireless systems by pooling the resources of distributed nodes. While cooperation can occur at different network layers and time scales, physical layer cooperation at symbol time scales offers the largest benefit. However, symbol level cooperation poses significant implementation challenges, especially in the context of a network of distributed nodes.

This study has not yet mentioned about cooperative movement for sustainable livelihood to withstand from the climate change.

Mandke Pallavi (2007) in his doctoral thesis entitled *Understanding the Linkages between Tourism and Urban Poverty Reduction Using a Sustainable Livelihoods Framework* stated that tourism can have significant impact on the economic and social development in developing countries. Although tourism in cities is an old phenomenon, as is urban poverty in developing countries, the relationship between them has not been fully understood. Also statistics indicate that cities in developing countries are becoming important tourist destinations, as well as predominant sites of poverty, which creates an urgency to understand tourism's contribution to urban poverty reduction. The results indicate that the conceptual framework developed for this research provides two main findings. One is a better understanding of the linkages between tourism and livelihoods of the urban poor, generated from the analysis of the interactions between livelihoods of the urban poor and the tourism activities they engage in. The other is the identification of interventions/entry points to effectively apply tourism as a tool for urban poverty

reduction, development based on the analysis of strengths, weakness, opportunities and threats arising from the context.

This study has not yet mentioned about cooperative movement for sustainable livelihood and totally silence about the impacts of the climate change on livelihood. In overall, the present researcher reached into the conclusion that the factors related to climate change, livelihood and cooperative intervention have not been considered for integrated research study. The next section deals with the conceptual framework based on the literature study.

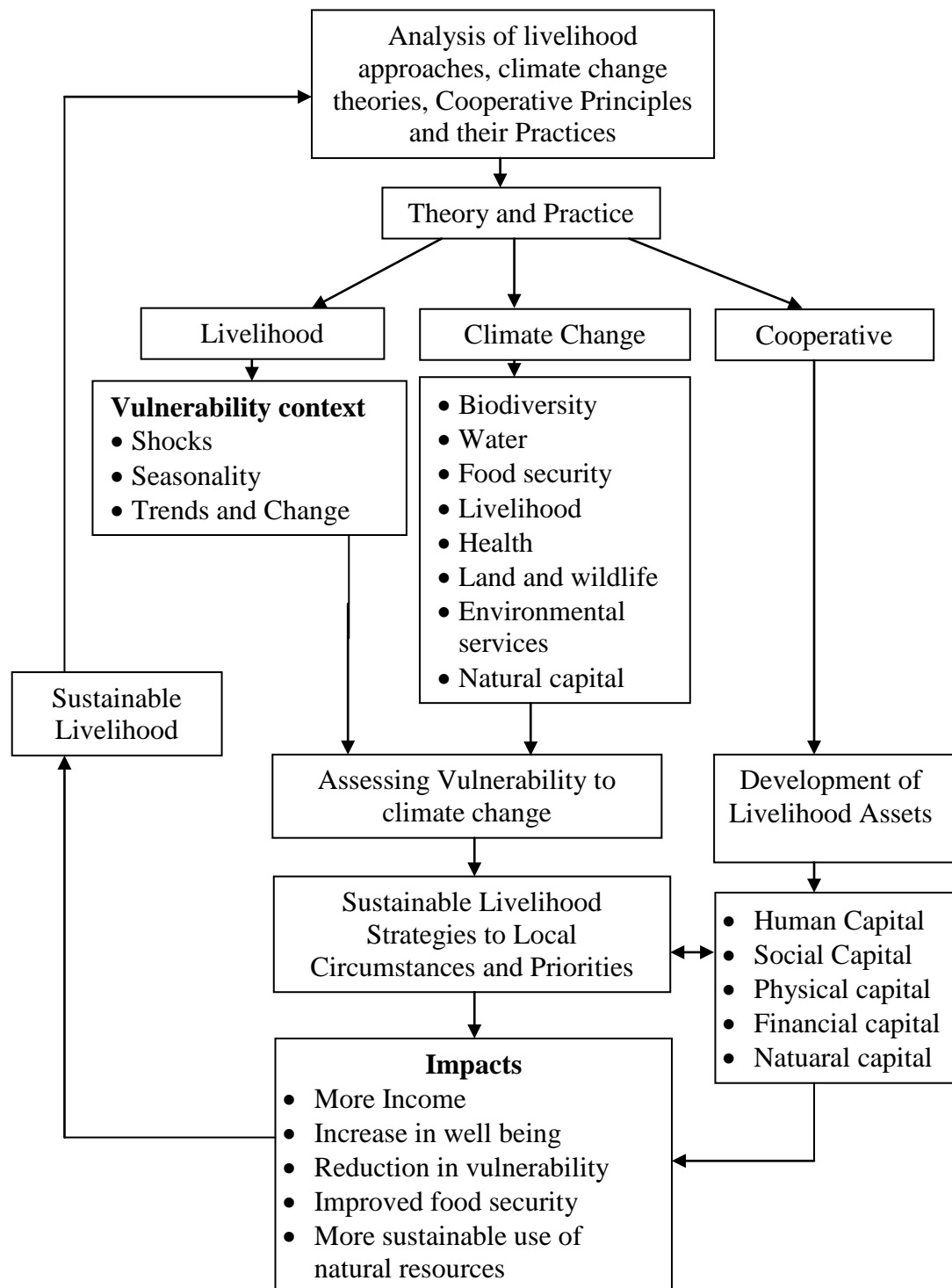
### **Conceptual Framework**

The compacted and integrated framework of livelihood, climate change and mitigating through cooperatives generated in this study is not the prescription. It is a framework suggesting an interrelated set of livelihood approach, theories of climate change, and principle of cooperatives to serve as an aid in the design, development and investigation of livelihood improvement and creating sustainable environments. The integrated framework comprises synthesis of theoretical concepts of livelihood, climate change and cooperative principles in current situation. The figure presented below illustrates the conceptual framework of the present study.

The framework consists of the three major components of the research strategy. The first component explains about the analysis of the livelihood. The second component of the conceptual frame incorporated the climate change and the third component of the research frame analyzed the cooperatives. Livelihoods become vulnerability context due to the shocks, trends and changes, and seasonality. Shocks covers the natural events like floods, droughts, cyclones, and deaths in

family, violence or civil unrest, human health, economical uncertainty, conflict, crop and livestock health. Similarly, trends and changes cover population, environmental change, technology, market and trade and globalization. The seasonality covers the weathers of the seasons like cold waves, hot waves, and climatic impact. The people of vulnerable context become poor and fall in vulnerable situation, and also they are affected from the impacts of climate change. The impacts of climate change directly affected to Bio-diversity, water, livelihood, food security, health, land and wildlife, environmental services and natural capital. Due to the impacts of climate change, livelihood becomes assessing vulnerability to climate change. Sustainable livelihood strategies to local circumstance and priorities is needed to withstand from vulnerable situation of the livelihood.

The cooperative is one of the important pillars of economic sector and that would be focused on development of livelihood assets to develop the human capital (health, nutrition, education, knowledge & skills, capacity to work and to adapt), social capital (Networks & connection, neighbourhood, leadership, kinship, relations of trust and mutual support, common rules, collective representation, participation in decision), physical capital (transport like roads and vehicles, secure shelter and buildings, water supply and sanitation, energy, communication). Financial capital (savings, credit, debt, remittances, pensions, wages) and natural capital (land, production, water and aquatic resources, trees and forest products, wild life, wild foods and fibres, bio-diversity, environmental services).

**Figure 2.7 Conceptual Framework of the Study**

The sustainable livelihood strategies to local circumstances and priorities are also interred linked with development of capitals. Due to the sustainable livelihood

strategies and economic activities of cooperative, livelihood becomes economically stronger and the livelihood converts to sustainable livelihood.

### **Chapter Summary**

In this chapter, the researcher reviewed related literatures on basic of thematic, theoretic and contemporary research studies. In this chapter presents a conceptual framework of this study based on the theoretical models discussed in the previous chapter. From the conceptual framework, an analytical framework is worked out. Components such as justification for the selection of field survey method as the main research method, use of study tools, data collection and analysis procedures and validity and reliability of the study tools are sketched in details under the respective readings.

The next chapter presents the detail of research methodology.

## CHAPTER III

### RESEARCH METHODOLOGY

#### Introduction

In the previous chapter, the present researcher reviewed related literatures and contemporary research studies. This chapter presents a conceptual framework of this study based on the theoretical models discussed in the previous chapter. From the conceptual framework, an analytical framework is worked out. Components such as justification for the selection of field survey method as the main research method, use of study tools, data collection and analysis procedures and validity and reliability of the study tools are sketched in details under the respective readings. This chapter presents the detail of research methodology.

#### Nature of the Research

There is hardly any studies conducted in the area of the sustainable livelihood, climate change and cooperatives. This study was thus an exploratory and descriptive research based on qualitative and quantitative research approaches. According to Leedy (1997), researchers do two things in employing descriptive method. They observe with close scrutiny the population bounded by the research parameters, and make a careful record of what they observe so that when the aggregate record is made, the researchers can then return to the record to study the observations described.



### Philosophical Approaches

Researchers state the paradigmatic assumptions underlying their research so that the reader can establish an overview of their position (Miles & Huberman, 1994). Behr (1983) defines the concept paradigm as an expression of the configuration of beliefs, values, explanations and basis for the solution of a problem, while Kuhn and Martorama (1982) regard it as a cluster of beliefs that influence what should be studied, how research should be conducted and how it should be interpreted.

Each and every research is undertaken within certain assumptions and researchers in economics are no exception. Behr (1983) defines the concept paradigm as an expression of the configuration of beliefs, values, explanations and basis for the solution of a problem while Kuhn and Martorama (1982) regard it as a cluster of beliefs that influence what should be studied, how research should be conducted and how the results should be interpreted. According to Gephart (1999) three paradigms are prominent in contemporary social research – positivism, interpretivism and critical postmodernism:

**A Positivist Framework:** It infers an objective world rejecting metaphysical nature of science (Gephart, 1999). It is concerned with uncovering truth and presenting it by empirical means (Henning, Rensburg & Smit, 2004). This position assumes that knowledge stems from experience and observation. It is challenged by interpretivists who assert that these methods impose a view of the world on participants in research rather than capturing, describing and understanding their world views (Gephart, 1999).

**An Interpretive Framework:** It is underpinned by observation and interpretation, thus to observe is to collect information about events, while to interpret

is to make meaning of that information by drawing inferences or by judging the match between the information and some abstract pattern (Aikenhead, 1997). In this regard, Henning et al. (2004) remark that within the interpretive paradigm, knowledge is constructed not only by observable phenomena but also by descriptions of people's intentions, beliefs, values and reasons, meaning making and self-understanding.

**A Critical Post-modernistic Framework:** The critical theory seeks to deconstruct the hidden curriculum or text and search for the truth and understanding within the social context (Reeves & Hedberg, 2003). The paradigm of critical theory encourages evaluators and designers to question and also to evaluate the cultural, political and gender assumptions underlying the effectiveness of the system product or programme (Reeves & Hedberg, 2003).

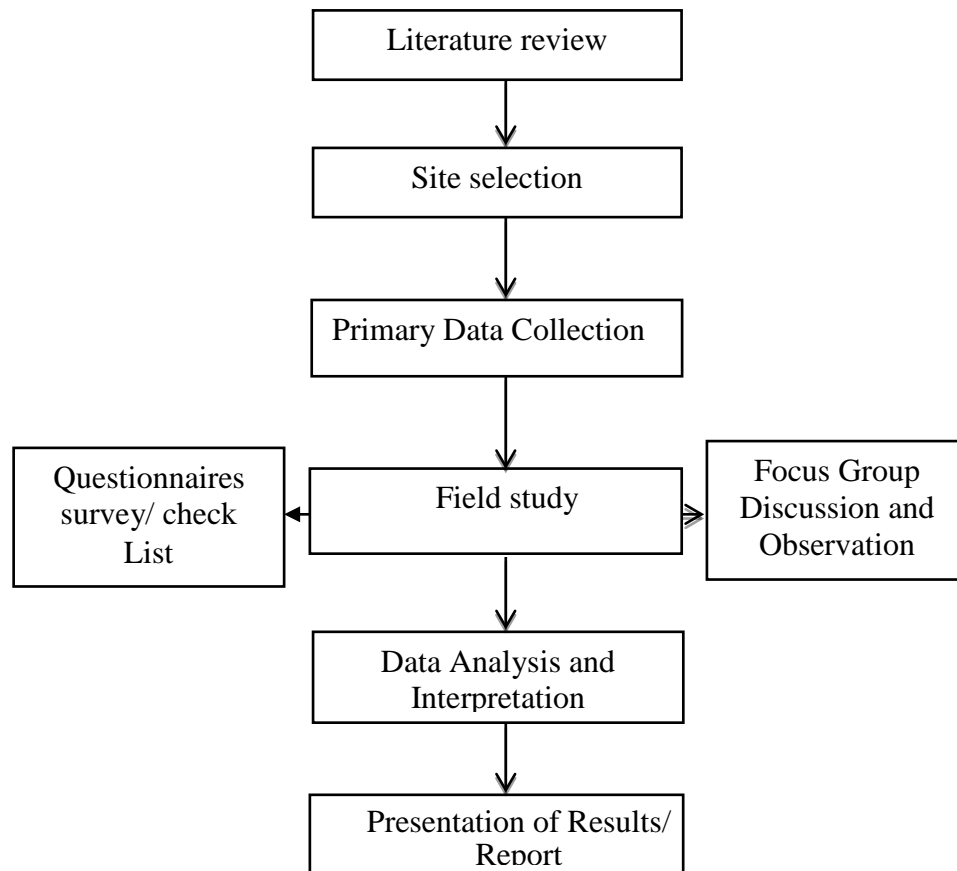
Following the above philosophical assumptions, the following are the justifications of the researcher to position in the context of the above perspectives. Firstly, identification of livelihood situation offers the development activists good opportunity for allocating resources. In light of this, the researcher position himself within the positivistic discourse, for assessing livelihood and climate change impacts. They can create environments that can be verified through experience and observation. In addition, the researcher holds the interpretive view that people, as individuals, experience their own knowledge and meaning within the socio-cultural context influenced by their prior knowledge and understanding. Consequently, the environment could be created in such a manner that development interventionists could express their understanding in the change process. This view is shared by the critical paradigm (Henning , 2004). As a critical researcher, the researcher endorsed the belief that when interventions in development fields like cooperative movements,

are evaluated in terms of people's preferences, concrete experience and knowledge, this could emancipate and liberate them in becoming critical reflectors and the designers of their own worlds rather than becoming passive recipients of information.

The purpose of this study is to explore the epistemological and ontological knowledge with the process of transforming things believed into things known. The next section describes the research design of the study.

### **Research Design**

A research design provides the glue that holds the research project together (Trochim, 2002). It is used to structure the research, to show how all of the major parts of the research project the samples or groups, measures, treatments or programs, and methods of assignment work together to try to address the central research question and purpose. The figure illustrates the logical framework about the design of the research works.

**Figure 3.1      Research Design Frameworks**

This study applies explorative and analytical research methods. The research includes the gathering of information and data, from quantitative and qualitative approaches. This study was mostly focused on primary data which was collected from field study. Interview bases on schedule, case study, focus group discussion and observation. The sources of secondary data were various published and unpublished books, journals, project reports, articles, feature writing, newspapers, official letters and statements, formal and informal speeches, governmental and non- governmental documents & reports, reports of different research centers and institutions, related conference papers and declarations and other many related materials.

The data were collected with the help of three types of questionnaires like

questionnaire related to climate change, livelihood and co-operative. At the sector of climate change, there were thirty-nine questions, among them, thirty eight questions were objective. Five group discussions were successfully organized. Similarly, in the sector of livelihood, there were thirty questions; among them twenty nine questions were objective. Lastly, in the sector of co-operative, there were twenty one questions, among them fourteen questions were objective and seven questions were subjective. Questionnaire sets were sent to different nature of co-operative organizations, governmental related offices of co-operatives and thirty-nine respondents answered the questionnaires. Except those thirty-nine answer sheets, other data were collected from the field study.

### **Selection of Study Area**

The study area of this survey research was focused in the Arun Valley which lies in the eastern part of Nepal. The Arun valley is the deepest valley of the world and values to understand the impacts of climate change. Arun River runs from China to Nepal and Nepal to India. In Tibet, the river is called Bum-chu. It is also known as Men Qu (Moinqu) in its upper reaches north of Xixabangma and then as the Peng Qu (Pumqu) for most of its course north of the Himalayan crests. In Nepal, it is called Arun river and joins with other rivers of Saptakoshi at Chatara of Sunsari district. The lowest level of Arun Valley at Tumlintar is 457 metres (Shrestha & Devkota, 2010).

The Arun River originates in Tibet of China and the river is called Bum-chu in Tibet. The Tibetan name Bum-chu may refer to a religious ceremony attempting to divine prospects for the coming year from the level of water in a pot or well, Chu is the Tibetan word for water. The river originates near Gutso in Nyalam Country of

Tibet. Around 17 kilometres downstream the Men-chu joins it. The Trigni Countries the upper reaches of the Bum-chu and the lateral valleys formed by its tributaries, the foremost of which are Lolo-chu, Shel-chu, Rongpu-chu, Trakar-chu, Kharda-chu, Ra-chu Tsangpo, and Langkor Gya-chu. There is also lower Bum-chu valley in Tibet.

The mighty rivers originating on the other side of Himal flows into Nepal creating the deepest valley like Arun Valley. The deepest valley of the world 'Arun Valley' lies in Sankhuwa sabha district of Nepal and its lowest level at 457 metres in Tumlingtar.

The Arun is the largest trans-Himalayan river passing through Nepal and also has the greatest snow and ice covered area of any Nepalese river basin. The river leaves the Tibet region at a height of about 3,500 metres. Most of the half-million people in the Arun basin live in this southern area between 300 metres and 1,000 metres in widely scattered villages near the slopes they farm (Shrestha & Devkota, 2010).

The mighty rivers originating on the other side of Himal flows into Nepal creating the deepest valley like Arun Valley. The deepest valley of the world Arun Valley lies in Sankhuwa sabha district of Nepal and its lowest level at 457 metres in Tumlingtar. The Arun is the largest trans-Himalayan river passing through Nepal and also has the greatest snow and ice covered area of any Nepalese river basin. The river leaves the Tibet region at a height of about 3,500 metres. Most of the half-million people in the Arun basin live in this southern area between 300 metres and 1,000 metres in widely scattered villages near the slopes they farm.

### **Sampling Criteria**

There are various reasons to select the sample area and sampling strategies. The following are the major criteria to select the Arun Valley for the purpose of the study:

1. The valley itself is the deepest in the world and has various climate variations and different climatic changes can be seen in the same place from plain to snow peaks.
2. There is a possibility to exist the cooperative interventions to cope with problems of livelihood mainly focusing on community user groups.
3. People from different caste, ethnicity and marginal communities exist in the place.
4. Disaster risk and vulnerability is more the study areas.

### **Sampling and Sample Size**

The research was focused about social and economic impacts of climate change in the Arun valley. The study was also focused to find out the reality of livelihood of that valley. The research was finally focused on co-operative movement for sustainable livelihood in the context of Nepal. Thus, the selection area of the study was riversides Village Development Committees (VDCs ) and Municipalities of Sankhuwa Sabha, Bhojpur and Dhankuta districts.

**Table 3.1****Study Area and Samples**

| <b>district</b><br><b>Criteria</b>              | <b>Sankhuwa<br/>Sabha</b> | <b>Bhojpur</b> | <b>Dhankuta</b> | <b>Total</b> |
|---|---------------------------|----------------|-----------------|--------------|
| VDCs & Municipality Arun valley                 | 4                         | 6              | 4               | 14           |
| Sample population for climate change assessment | 93                        | 126            | 87              | 306          |
| Sampled households for livelihood assessment    | 209                       | 256            | 159             | 624          |
| Population and Sample of cooperatives           | 83 (18 )                  | 114 (24 )      | 185 (27 )       | 382 (69 )    |

The study of climate change and livelihood of Arun valley is focused in three VDCs named Akhibhui, Kharang, Sitalpati and one municipality named Khadbari of Sankhuwa Sabha district, six VDCs named Kulung, Kaurenipani, Daurali, Nepaledada, Jarayatar, and Thulo Dumba of Bhojpur district and four VDCs named Chanuwa, Leguwa, Ghorlikharka and Phalate of Dhankuta district were taken for study. The study of cooperative is focused nationwide with different cooperatives, cooperative members, governmental personels, relatives of cooperative sectors, and policy makers of cooperative.

Samples of livelihood were taken by stratified sampling method. In a stratified sample, the sampling frame was divided into six groups with non-overlapping the groups. A sample was taken from each stratum, and when that sample was a simple random sample, it is referred to as stratified random sampling.



I had chosen the participants above the age of 45 years old, in order to meet the criteria of the question. They had experiences about the climate change more than thirty years past.

Participants were associated to members of co-operative, consumers of co-operative, personnel of governmental and non-governmental who were related to co-operative movement, co-operative organization of different natures, authors about the co-operative, publics who were concerned to co-operative sector etc. Data were collected from the study area with the help of questionnaires, interviews and other relevant tools.

### **Methods of Data Collection**

Checklist and interview schedule were constructed for fulfilling of objectives of this study. A semi structured interview is prepared by containing both closed and open ended questions. Questionnaires are designed to obtain the information about socio economic, demographic, farm characteristics, income sources, resource status, impacts of climate change on their livelihoods at the various levels and co-operative movements to withstand with changing climate.

Data was collected by using the structured questionnaires designed based on key informant survey and early assessment in the field survey. Similarly, focus group discussion, discussion with individuals, observation in field and documentation of individual case was carried out to generate information.

### **Observation**

Observational techniques are methods by which individuals gather first hand data on the programs, processing or behaviors being studied. In observation, the researcher

became a participant in the culture or context being observed (Torchim, 2002). In this study, the role of the researcher was that of an observer, field notes were taken as supportive sources of data collection during the observation.

### **Key Informant Interviews**

The primary aim of individual key informant interviews in this study was to elaborate on the focus group discussion in order to gain a more profound insight. The key informant interview was conducted with an in-depth, knowledgeable, informed subject who assisted the researcher to gain a deeper understanding of particular issues that were of interest. People were interviewed with length of each interview varied between each peoplet and the interview averaged 20 minutes to 30 minutes.

All informants interviewed were informed about what was taking place, who the researcher was, where the researcher as a doctoral candidate, and the purpose for the interview. People were given the opportunity to ask open ended questions before and after the interviewing process.

### **Focus Group Discussion**

A focus group discussion allows the researcher to gain insight into how people construct their world, and the dynamics of group discussion allow an interaction between participants, which leads to added insight and information. Interaction is a unique characteristic of a focus group and therefore the researcher used the focus group discussion as a qualitative technique in the collection of data. A number of open ended questions were asked with the aim of gaining an understanding of field reality of livelihood, climate change and cooperative.

### **Data Analysis**

The collected data was analyzed both descriptive and inferential statistical tools. The descriptive statistics was used to describe socio-economic characters such as sex, age, farm size, education and knowledge level of respondents whereas inferential tools were used to analyze their response to the impact of climate change, their livelihood and role of co-operative to withstand the climate change. Overall analysis was carried out by using statistical package for social science (SPSS) and MS- Excel Program. Descriptive statistics like mean, percent, and frequency was used to describe socio-economic, climate change impact on livelihoods.

In case of quantitative data, the researcher personally coded the various measurement scales in the SPSS package and transcribed quantitative data to process out the various statistical results and also to produce various measures of significances. The demographic information was analyzed using simple tabulation. For the purpose of discussions of the qualitative information, necessary qualitative triangulation was used. Following are some of the considerations made in the analysis of data.

The data collected from field skills questionnaires were tabulated in numbers. This allowed the data to be analyzed statistically (Gephat, 1999) and represented graphically for interpretation. Secondly, the data collected from the research tools were tabulated and presented graphically to describe, compare and to attribute causality.

### **The Validity of Quantitative Data**

The validity of this research was enhanced by the extensive and participatory nature of the investigations. Reigeluth and Frick (1999) emphasized the importance of construct validity, thoroughness, accuracy (internal validity), and external validity (the extent, to which results could be generalized).

To further guarantee validity, the same instruments, persons and procedure were used for data collection in all sectors of livelihood, climate change and cooperative. This measure was taken to ensure that the model produces the effect for which it was designed. The pre-test and piloting of the instrument provided the opportunity to check and revise of the instruments.

#### **Internal Validity**

Internal validity refers to the extent to which the research findings are due to the mechanisms suggested (Cardwell, Clark and Meldrum, 2004).

For this study, internal validity refers to the extent to which the findings of the research are due to the advantage development actors have over traditional followers. To further guarantee validity, the same instruments, persons and procedure were used for data collection in all sectors of livelihood, climate change and cooperative. The design of this study also enabled for the identification and isolation of intervening variables. This was achieved by ensuring that classes selected were as homogenous as possible. This measure was taken to ensure that the model produces the effect for which it was designed.

#### **External Validity**

External validity refers to the extent to which the results or a research can be

generalized to other settings beyond that where the study was conducted. The external validity of this study was determined from two perspectives: population validity and ecological validity.

Ecological validity is a measure of the extent to which the findings of a research can be interpreted to be true in settings different from the one in which it was conducted.

### **The Reliability of the Findings**

The reliability of the study was ensured through the use of multiple source of evidence, which leads to triangulation of data, the detailed, rich and thick descriptions of the researcher's own assumptions and position in the study, data collection, category derivation, decision making procedures and ultimate conclusions. These may lead the accuracy and credibility of the data. For the reliability and validity, designed instruments were tested and feed-backs were collected from experts providing proposal of research. The researcher reworked to modify the tools for further modification of research design.

### **Chapter Summary**

This chapter has included the basic fundamentals of research methodology adopted on the study. All sampling strategies, data collection techniques, instruments, and techniques of data analysis and reduction were discussed in this chapter. The strategies for minimizing errors had also been elaborated along with the validity and reliability of the research.

The next chapter presents the findings of the adaptation and mitigation for secure livelihood research in detail.

## CHAPTER IV

### **ADAPTATION AND MITIGATION FOR SECURE LIVELIHOOD**

The previous chapter explained the basic fundamentals of research methodology adopted on the study. All sampling strategies, data collection techniques, instruments, and techniques of data analysis and reduction were discussed in this chapter. The strategies for minimizing errors had also been elaborated along with the validity and reliability of the research.

This chapter presents the existing status of the livelihood in detail. The questions used for the inquiry covered family background, education, land status, economic status and profession and the entrepreneurial activities of the people with detail of all family members.

#### **Nature and Composition of the Participants**

The participants were categorized on the base of economic level into rich, middle and poor family. That represents the economic status of Nepalese people. The selection of households for the study according to their economic status has been presented in table 4.1

**Table 4.1****The Selection of Households Based on Economic Level**

| S.N | Survey Households | No. of Survey Households | Survey Households % |
|-----|-------------------|--------------------------|---------------------|
| 1   | Rich family       | 174                      | 33.33               |
| 2   | Middle family     | 174                      | 33.33               |
| 3   | Poor family       | 174                      | 33.33               |
|     | Total             | 422                      | 100                 |

Source: Field survey, 2012

Altogether, 624 households were participated in the research of livelihood of the people of Arun valley. Out of them, 422 households were selected on the base of the economic status as a rich family, middle family and poor family. Those were involved in the equal number of 117 households that is 33.33 % each.

The participants were also categorized on the base of socio-economic level into woman headed family, Dalit and landless family. That represents the socio-economic status of Nepalese people. The selection of households for the study according to their socio-economic status has been presented in table 4.2.

**Table 4.2****The Selection of Households Based on Socio-economic Level**

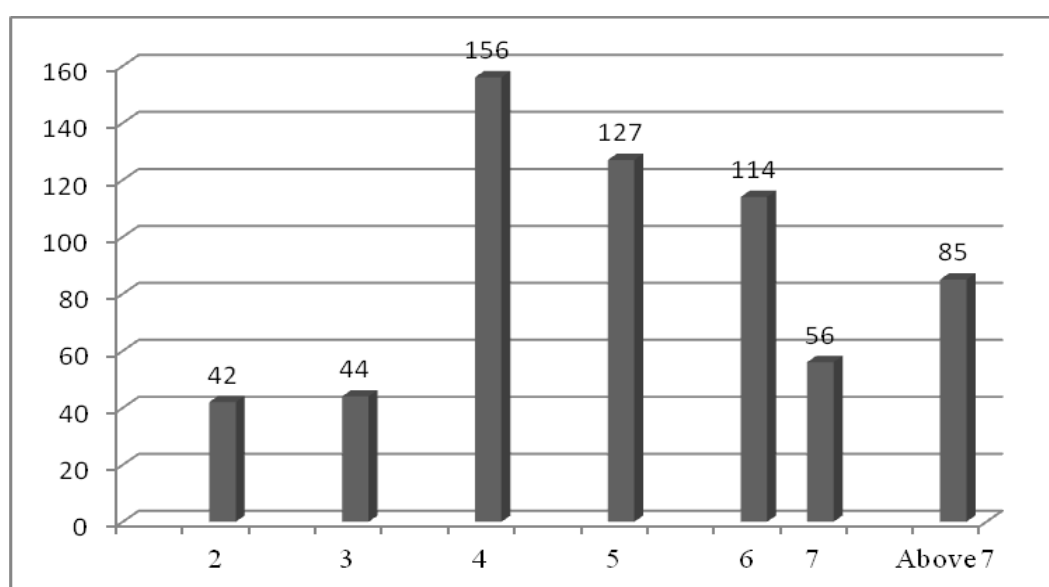
| S.N | Survey Households   | No. of Survey Households | Survey Households % |
|-----|---------------------|--------------------------|---------------------|
| 1   | Woman headed family | 42                       | 41.18               |
| 2   | Dalit family        | 42                       | 41.18               |
| 3   | Landless family     | 18                       | 17.64               |
|     | Total               | 102                      | 100                 |

Source: Field survey, 2012

Similarly, the number of woman headed family and Dalit family each were taken as 42 households that is 41.18 % each and remaining 18 households that is 17.64% was landless families.

The size of the family determines the source of income, expenditure and saving in a family. The nature of family based on the family size gives the information about the livelihood status. The number of family members of surveying households has been presented in figure 4.1

**Figure 4.1 Numbers of Family Members from Survey Households**



Source: Field survey, 2012

Out of 624 households, 42 households that is 6.73 %, 44 households that is 7.05 % and 156 households that is 25% had the number of family members of two, three and four respectively. Similarly, 127 households that is 20.35%, 114 households that is 18.27 % and 56 households that is 8.98 % had the number of family members of five, six and seven respectively. Remaining 85 households that is 13.62 % had the number of family members above seven. The total population of survey household was 3166, among them 1549 were male and 1617 were female. Thus, the average family



member of survey area is 5. The household of four family members are the larger number of the study area. It means families are being nuclear family. The family composition varies based on the number in the family and members in family in majority are four, five and six.

### **Education and Employment of the Households**

The education and employment shows the status of the quality life of the families. The status of the literacy rate indicates the future the families. The status of literacy rate of surveying households has been presented in table 4.3.

**Table 4.3**

#### **The Status of Literacy Rate of Surveying Households**

| S.N | Gender                      | Literacy | Literacy % | Total female population | Total male population |
|-----|-----------------------------|----------|------------|-------------------------|-----------------------|
| 1   | Female                      | 923      | 59.40      | 1554                    | -                     |
| 2   | Non-school going aged girls | -        | -          | 63                      | -                     |
| 3   | Male                        | 1039     | 70.92      | -                       | 1465                  |
| 4   | Non-school going aged boys  | -        | -          | -                       | 84                    |
|     | Total                       | 1962     | -          | 1617                    | 1549                  |

Source: Field survey, 2012

Out of 3166 members of 624 households, 1962 members were literacy and 1057 members were illiteracy. Non-school going aged children were 147. The literacy rate of female and male is 59.40% and 70.92% respectively. The male literacy rate is higher than the female. It means females are backward in education sectors and mostly engaged in the work of house. Non-school going boys are more than girls, it means may people want son and may be people are doing abortion to control the girls.

The status of population and employment of male and female according to age group is presented in table 4.4. The employment of female and male means they are busy in either domestic work or service sector, agriculture sector, business sector and so on.

**Table 4.4**

**The Status of Population and Employment of Households**

| S.N | Age group | No. of woman | woman (%) | Employed woman | Employed woman % | No. of Man | Man (%) | Employed Man | Employed Man % | Total population |
|-----|-----------|--------------|-----------|----------------|------------------|------------|---------|--------------|----------------|------------------|
| 1   | 0 – 10    | 328          | 50.15     | -              | -                | 326        | 49.85   | -            | -              | 654              |
| 2   | 10 - 20   | 298          | 51.38     | 89             | 29.87            | 282        | 48.62   | 84           | 29.79          | 580              |
| 3   | 20 - 30   | 216          | 48.32     | 206            | 95.37            | 231        | 51.68   | 210          | 90.91          | 447              |
| 4   | 30 - 40   | 193          | 52.02     | 155            | 80.31            | 178        | 49.98   | 168          | 94.38          | 371              |
| 5   | 40 - 50   | 181          | 51.27     | 156            | 86.19            | 172        | 48.73   | 142          | 82.56          | 353              |
| 6   | 50 - 60   | 153          | 51.17     | 124            | 81.05            | 146        | 48.83   | 108          | 73.97          | 299              |
| 7   | 60 - 70   | 139          | 52.85     | 96             | 69.06            | 124        | 47.15   | 84           | 67.74          | 263              |
| 8   | 70 -80    | 78           | 53.06     | 46             | 58.97            | 69         | 46.94   | 36           | 52.17          | 147              |
| 9   | 80 - 90   | 24           | 60.00     | -              | 0                | 16         | 40.00   | -            | 0              | 40               |
| 10  | 90-100    | 7            | 58.33     | -              | 0                | 5          | 41.67   | -            | 0              | 12               |
|     | Total     | 1617         | -         | 832            | -                | 1549       | -       | 882          | -              | 3166             |

Source: Field survey, 2012

There was 3166 population in 624 households and the average population of a family is 5.07. The employment of woman with age group of 20-30, 30-40, 40-50, 50-60 and 60-70 is 95.37%, 80.31%, 86.19%, 81.05% and 69.06% respectively. Similarly, the employment of man with age group of 20-30, 30-40, 40-50, 50-60 and 60-70 is 90.91%, 94.38%, 82.56%, 73.97% and 67.74% respectively. After the age group of 70, they are busy in domestic and light work. The population is decreasing according to ascending order of age group. The females are 51.1% and males are 48.9% in the study area.

### Status of Economic Conditions of the Family

In the village area, people are mainly depended on agriculture either primary or secondary income source. The primary income source and the secondary income source of the family have been illustrated in table 4.5.

**Table 4.5**

#### The Primary Income Source and Secondary Income Source of the Family

| S.N | Occupation            | Main income source | Main income source (%) | Secondary income source | Secondary income source (%) |
|-----|-----------------------|--------------------|------------------------|-------------------------|-----------------------------|
| 1   | Agriculture/Livestock | 382                | 61.22%                 | 196                     | 31.41%                      |
| 2   | Service               | 71                 | 11.38%                 | 56                      | 8.96%                       |
| 3   | Labor work            | 24                 | 3.85%                  | 59                      | 9.56%                       |
| 4   | Business              | 84                 | 13.46%                 | 147                     | 23.56%                      |
| 5   | Overseas Employer     | 56                 | 8.97%                  | 155                     | 24.84%                      |
| 6   | Others                | 7                  | 1.12%                  | 11                      | 1.76%                       |
|     | Total                 | 624                | 100%                   | 624                     | 100%                        |

Source: Field survey, 2012

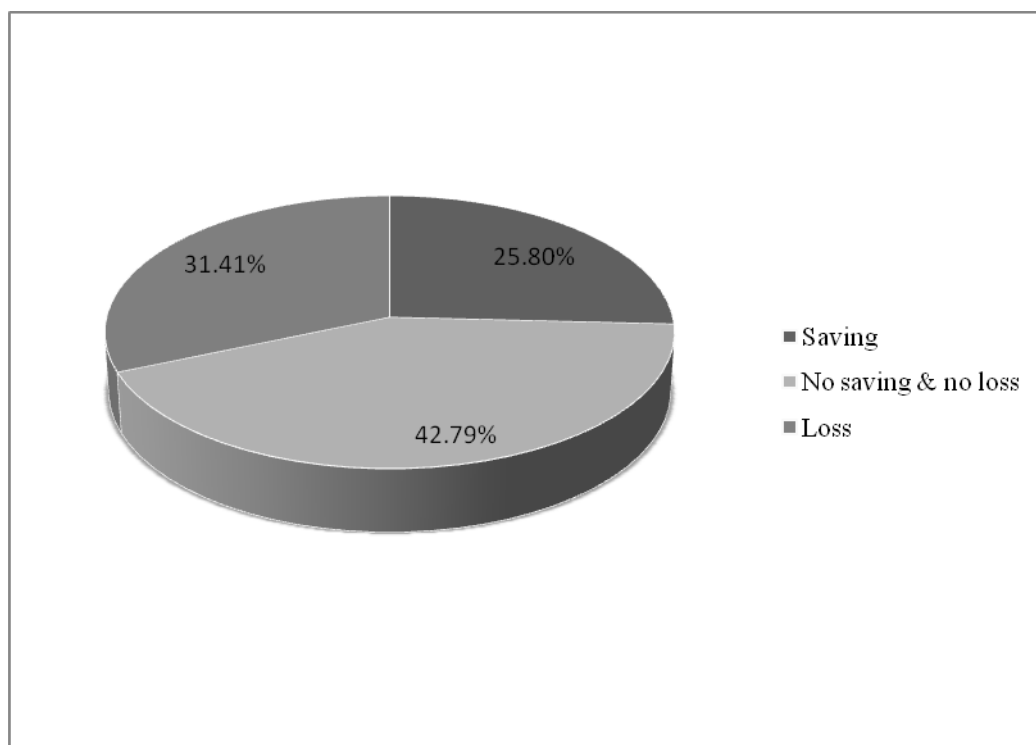
Out of 624 households, the main income source of 382 households that is 61.22 % was agriculture and secondary income source of 196 households that is 31.41% was also agriculture. The main income source of 11.38%, 3.85%, 13.46% and 8.97% of families is service, labor work, business and overseas employment respectively. Remaining 1.12% family's main income source is others like industry. The secondary income source of 8.94%, 9.56%, 23.56%, 24.84% families is service, labor work, business and overseas employment respectively. Remaining 1.17% family's main income source is others. More than 61% people are primarily depended on agriculture

and more than 31 % peoples are secondarily depended on agriculture. After agriculture, overseas employment is being good income source of the rural livelihood.

The income and expenditure indicates the real economic status of the family.

The status of income and expenditure of the family is illustrated in figure 4.2.

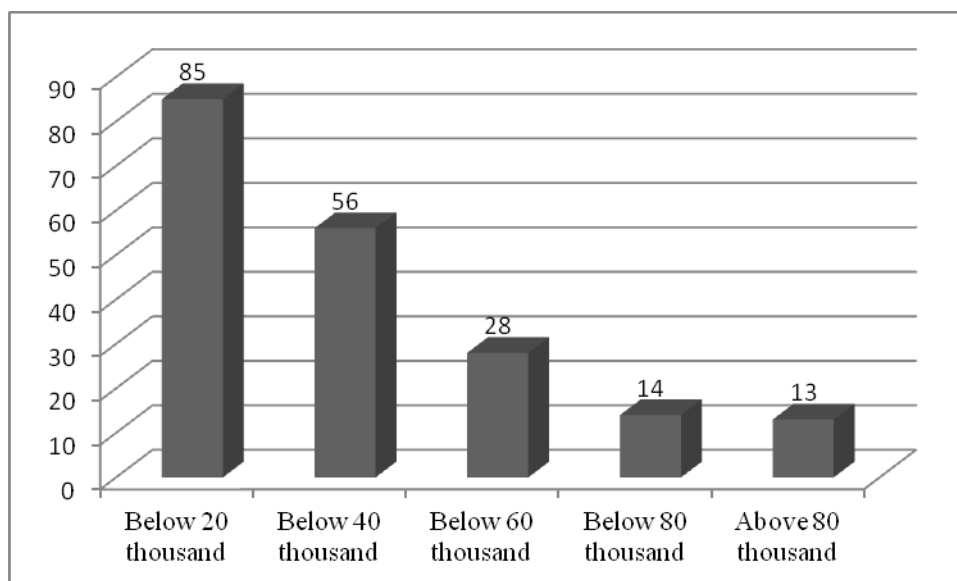
**Figure 4.2 The Status of Income and Expenditure of the Family**



Source: Field survey, 2012

Out of 624 households, 161 households that is 25.80 % said that they are able for saving their income and 267 household that is 42.79 % said that they neither save nor loss. The remaining 196 household that is 31.41 % said that they are living with loss; it means their lives are running very poorly. According to this study, more than 31% are under the poverty line.

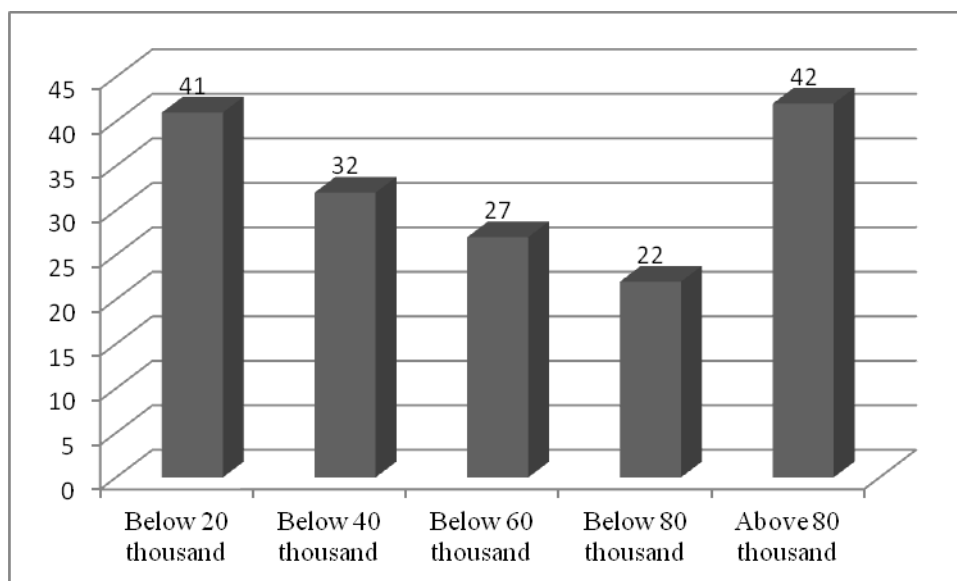
The families who are living in credit, they are in poverty trap. The more annual expenditure than income of the family has been illustrated on figure 4.3.

**Figure 4.3      The more annual Expenditure than Income**

Source: Field survey, 2012

Out of 624 households, 196 households are very poor family and they are in loss. 85 families that is 43.37 % of 196 poor family, they need below twenty thousand loan per year for to run their family. Similarly, 56 families that is 28.57 %, 28 families that is 14.28 % and 14 families that is 7.14% need below forty thousand, below sixty thousand and below eighty thousand loan per year respectively. The remaining 13 families that is 6.84 % need more than eighty thousand loan or additional fund to run their family. Big families are taking loan less than twenty thousand and less number of families is taking the loan more than eighty thousand.

More than 25 % households are annually saving and their live has been found better. The families are categorized into saving below 20 thousand, saving below 40 thousand, saving below 60 thousand, saving below 80 thousand and saving above 30 thousand. The annually saving status of households has been presented on figure 4.4.

**Figure 4.4      The annually Saving Status of Households**

Source: Field survey, 2012

There are 161 families out of 624 families save the money every year. Forty one families that is 25.47 % and 32 families that is 19.88 % save the money below twenty thousand, below forty thousand per year respectively. Similarly, 27 families that is 16.77 % and 22 families that is 13.66 % save the money below sixty thousand and below eighty thousand per year respectively. The remaining 42 families that is 26.09 % save more than eighty thousand. There is more number of families who are saving more than eighty thousand.

The study is focused to find Economic status of the families before 10 years ago, 5 years ago and this year. The economic status of the families is categorized into good, bad and significant different. The economic status of households at different interval of time has been illustrated in table 4.6.

**Table 4.6****The Trends of Economic Level of Households at Different Interval of Time**

| S.N | period       | Good | Good (%) | Bad | Bad (%) | No any different | No any difference (%) |
|-----|--------------|------|----------|-----|---------|------------------|-----------------------|
| 1   | 10 years ago | 257  | 41.19    | 238 | 38.14   | 129              | 20.67                 |
| 2   | 5 years ago  | 266  | 42.63    | 217 | 34.78   | 141              | 22.59                 |
| 3   | This year    | 285  | 45.67    | 211 | 33.38   | 128              | 20.51                 |

Source: Field survey, 2012

The economic status before 10 years has been seen changed. Out of 624 households, 257 households that is 41.19 % said that their economic condition was good.

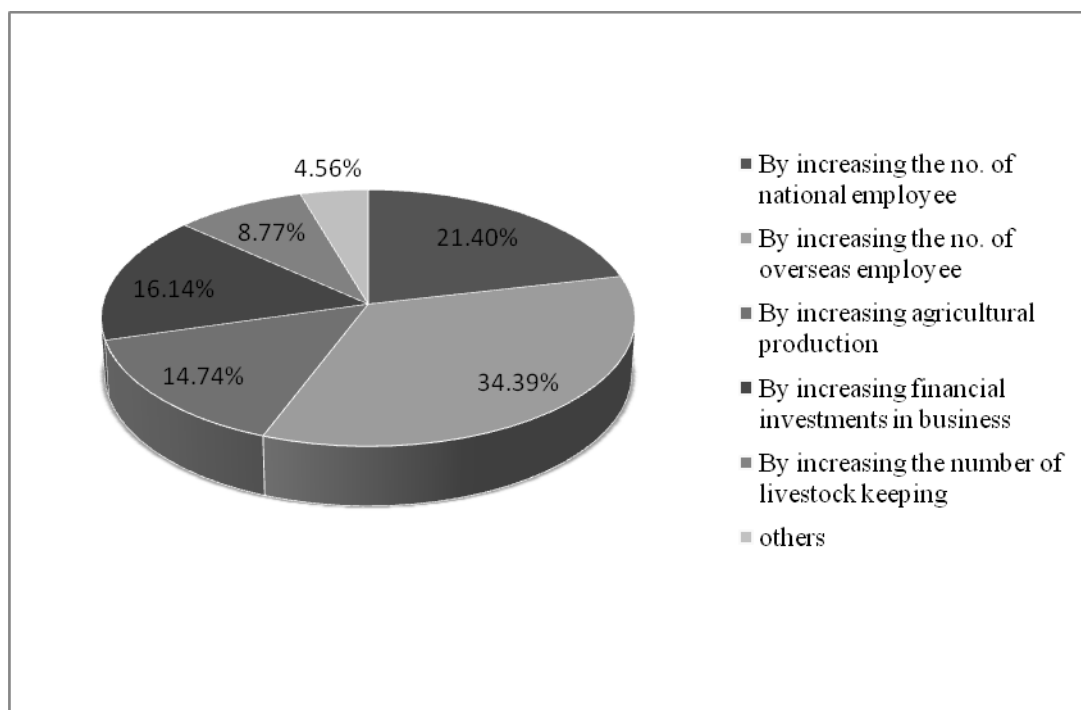
Similarly, 238 households that is 38.41 % said that their economic condition was bad and remaining 129 households that is 20.67 % said that there is no any difference.

The economic status before five years is also seemed some changes. Out of 624 households, 266 households that is 42.63 % said that their economic condition was good. Similarly, 217 households that is 34.78 % said that their economic condition was bad and remaining 141 households that is 22.59 % said that there is no any significant difference. At present, out of 624 households, 285 households that is 45.67 % said that their economic condition was good. Similarly, 211 households that is 33.38 % said that their economic condition was bad and remaining 128 participants that is 20.51 % said that there is no any significant difference. The economic status of the families was seen improving in condition and the families who answered as there is the no any different are nearly same.

Reasons for good economic status are categorized according to the increasing national and overseas employment, increasing agricultural production, increasing

financial investment in business and increasing in number of livestock keeping. The reasons for good economic Status of the households at present is shown in figure 4.5.

**Figure 4.5 The Reasons for Good Economic Status**



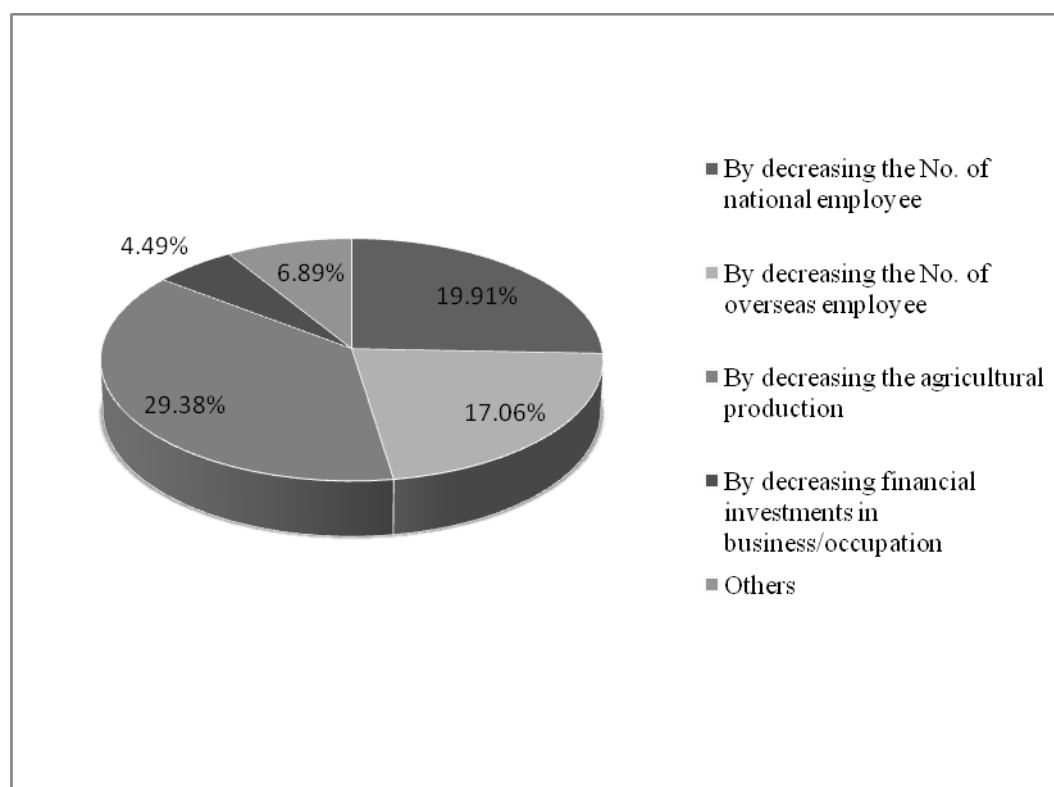
Source: Field survey, 2012

Out of 285 families 61 families that good economic condition of the family was the cause of increasing the number of national employee. Similarly, 98 families that is 34.39%, 42 families that is 14.74%, 46 families that is 16.14 % and 25 families that is 8.77 % said that the good economic condition of the families was the cause of increasing the number of overseas employee, increasing the agricultural production, increasing financial investments in business and increasing the livestock keeping respectively. The remaining 13 families that is 4.56 % said the other causes. The main reasons of improving the economic condition are due to increase of overseas and national employments.



The reasons for bad economic status are categorized according to decreasing national and overseas employment, decreasing agricultural production, decreasing financial investment in business and decreasing in number of livestock keeping. The reasons for bad economic status of the households at present is presented in figure 4.6.

**Figure 4.6 The Reasons for Poor Economic Status of the Households**



Source: Field survey, 2012

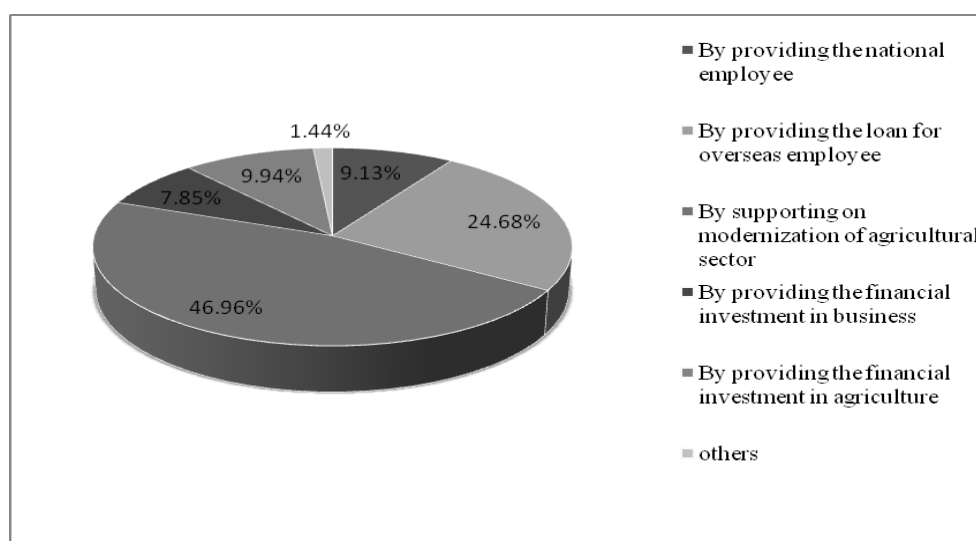
Out of 285 families, 42 families that is 19.91% and 36 families that is 17.06% said that the bad economic condition of the family was the cause of decreasing the number of national employee and cause of decreasing the number of overseas employee respectively. Similarly, 62 families that is 29.38 % and 28 families that is 4.49 % said that the bad economic condition of the families was the cause of decreasing the agricultural production and cause of decreasing financial investments in business

respectively. The remaining 43 families that is 6.89 % said the other causes like sick member of the family and investment in education of children.

The main reason of decreasing the economic condition is found due to decrease of agricultural production.

The Expectation of households for improvement of present economic status are to provide the national employment, to provide the loan for overseas employment, to support modernization of agricultural sector and to providing the financial support in agricultural and business sectors. The Expectation of households for improvement of present economic status is illustrated in figure 4.7.

**Figure 4.7 The Expectation for Improvement of Economic Status**



Source: Field survey, 2012

Out of 624 families, 57 families that is 9.13 %, 154 families that is 24.68 % and 293 families that is 46.96 % said that the expectation for improvement of their present economic status was to provide the national employee, to provide loan for overseas employee and to support on modernization of agricultural sector respectively.

Similarly, 49 families that is 7.85 % and 62 families that is 9.94 % said that the

expectation for improvement of their present economic status is to provide the financial investment in business and to provide the financial investment in agriculture respectively. The remaining nine families that is 1.44 % had expectation of supporting others like education, electricity, health and so on.

The expectation of large number of households nearly 47 % is to provide the support on modern agricultural sector. It means that the rural people want to improve the agriculture.

### **Agro-economic Situation**

The agro economic situation determines the real status of the rural livelihoods. The land owners are categorized as a large land owner, middle land owner, small land owner and landless families. The irrigation system, market, available of seeds, fertilizers and pesticides are also included in this section.

There are paddy field land owner and garden field land owners. Some families are landless families. The paddy field and garden field land owners are classified as a 0 -5 Ropani, 5 -10 Ropani, 10 -15 Ropani 15 -20 Ropani and above 20 Ropani. The status of land of households has been presented in table 4.7.

**Table 4.7****The Status of Land Distribution of the Households**

| S.N | Paddy field (Ropani) | No. of paddy field households | Paddy field households % | Garden field(Bari) (Ropani) | No. of garden field households | Garden field Households % |
|-----|----------------------|-------------------------------|--------------------------|-----------------------------|--------------------------------|---------------------------|
| 1   | 0 – 5                | 180                           | 28.85                    | 0 – 5                       | 117                            | 18.75                     |
| 2   | 5 – 10               | 118                           | 18.91                    | 5 – 10                      | 185                            | 29.65                     |
| 3   | 10 - 15              | 161                           | 25.80                    | 10 - 15                     | 152                            | 24.36                     |
| 4   | 15 - 20              | 81                            | 12.98                    | 15 - 20                     | 72                             | 11.54                     |
| 5   | Above 20             | 84                            | 13.46                    | Above 20                    | 98                             | 15.71                     |
|     | Total                | 624                           | 100                      | -                           | 624                            | 100                       |

Source: Field survey, 2012

Out of 624 households, 180 households that is 28.85 % had 0- 5 Ropani paddy field.

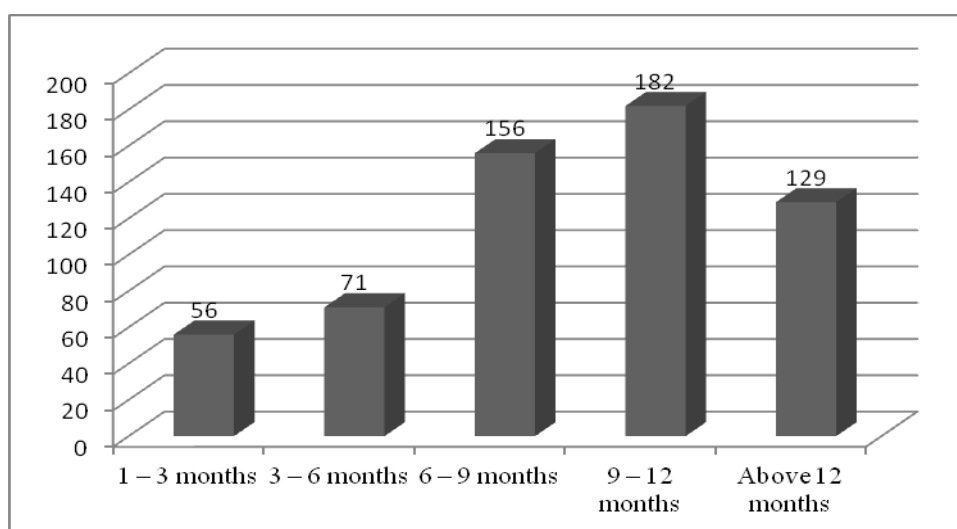
Similarly, 118 households that is 18.91% , 161 households that is 25.80% and 81 households that is 12.98 % had 5-10 Ropani, 10-15 Ropani and 15-20 Ropani paddy field respectively. Remaining 84 households that is 13.46 % had above 20 Ropani paddy field.

Out of 624 households, 117 households that is 18.75 % had 0- 5 Ropani garden field (Bari). Similarly, 185 households that is 29.65%, 152 households that is 24.36% and 72 households that is 11.54 % had 5-10 Ropani, 10-15 Ropani and 15-20 Ropani garden field respectively. Remaining 98 households that is 15.71 % had above 20 Ropani garden field. There were 18 landless households, 47 households had not garden field and 54 households had not paddy field.

The enough food for family from their production is categorized into 1-3 months, 3-6 months, 6-9 months, 9-12months and above 12 months. The yearly food

production status of household is presented in figure 4.8. That figure is only related to agricultural families.

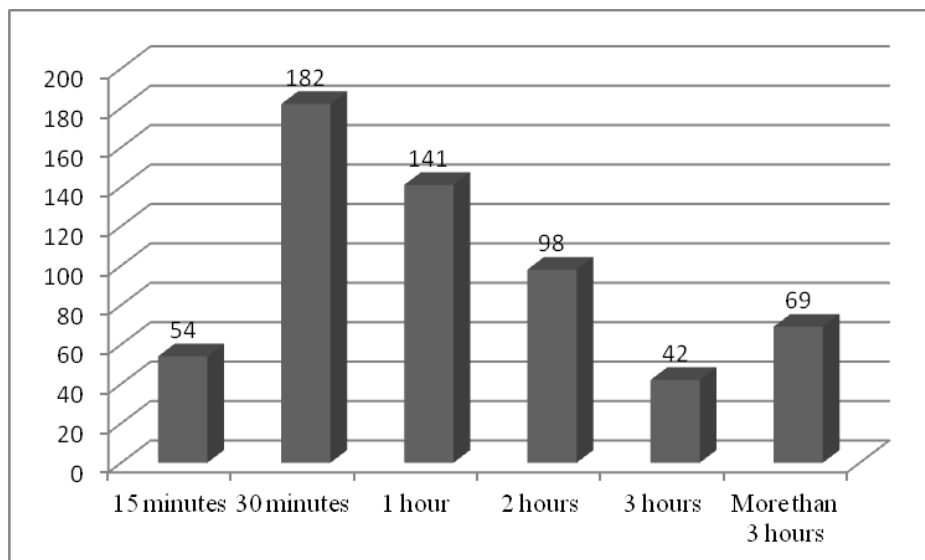
**Figure 4.8 The Yearly Food Production Status of Household**



Source: Field survey, 2012

Out of 624 families, only 578 families that is 92.63 % are fully or partially related to agriculture farming and 46 families that is 7.37 % are related to non-agriculture sectors. The agricultural production of 56 families that is 9.69 % and 71 families that is 12.28 % is available food only for 1 -3 months and 3 – 6 months respectively. Similarly, the agricultural production of 156 families that is 26.99% and 182 families that is 31.48 % is available food for 6 – 9 months, 9 - 12 months respectively. The remaining 129 families that is 22.32 % use the agricultural production as a food above twelve months. More than 49 % families are unable of food security more than nine months from their own production.

The distance of selling market of producing materials is classified according to 15 minutes, 30 minutes, 1 hour, 2 hours, 3 hours and more than three hours. The view of households, about the distance of selling market of producing materials has been illustrated in figure 4.9

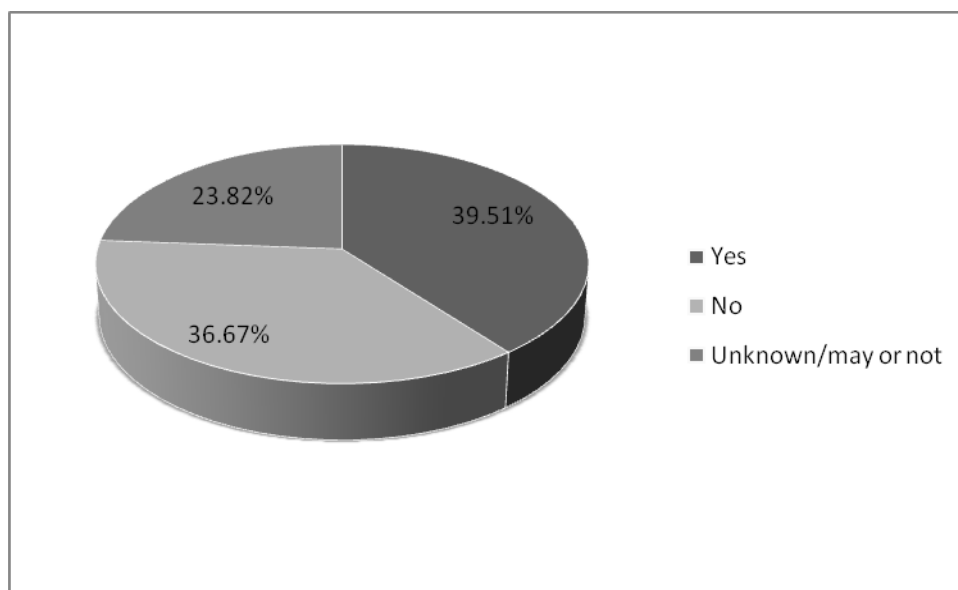
**Figure 4.9      The Distance of Selling Market**

Source: Field survey, 2012

Out of 586 households, 54 households that is 9.22 % and 182 households that is 31.06% said that there is 15 minutes and 30 minutes distance of selling markets respectively. Similarly, 141 households that is 24.06 %, 98 households that is 16.72% and 42 households that is 7.17% said that there is one hour, two hours and three hours distance of selling market respectively. Remaining 69 households that is 11.77 % said that there is more than three hours far of selling market. Generally, the selling market of most of the farmers is about 30 minutes and one hour.

The view of households about the possibility of additional production, if there is facility of the nearest selling market, is presented in figure 4.10. Their view of participants was taken as a yes, no or unknown.

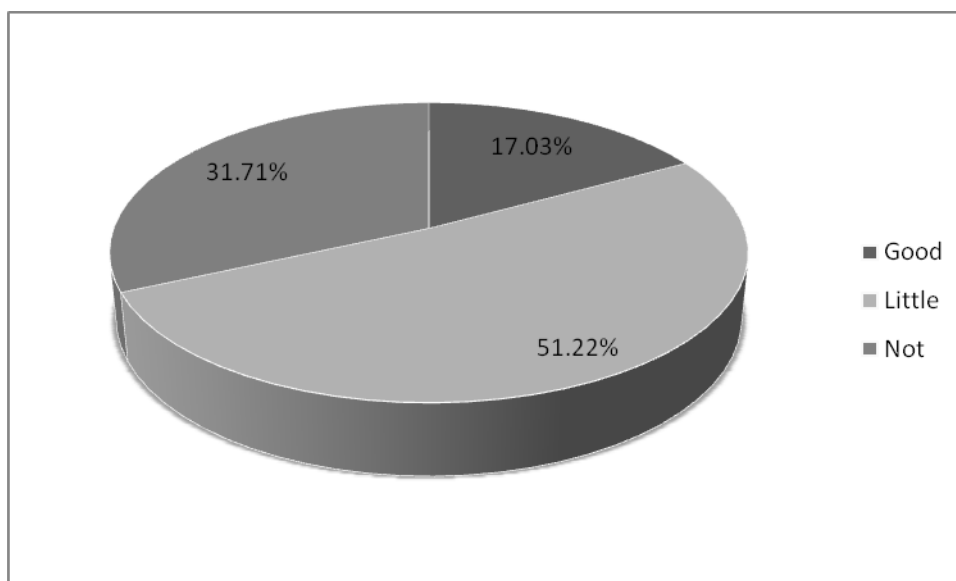
**Figure 4.10 The Possibility of Additional production**



Source: Field survey, 2012

Out of 529 households, 209 households that is 39.51 % said that there is possibility of additional production, if there will be facility of the nearest selling market and 194 households that is 36.67 %, said that there is not possibility of additional production. Remaining 126 households that is 23.82 % said that unknown about the additional production. The participants are looking intently near market for increasing the production. Large numbers of participants are unknown for additional production.

The irrigation facility in summer for farming sector is classified as a good, little and no. The view of households, about the irrigation facility in summer for farming sector has been presented in figure 4.11.

**Figure 4.11 The Irrigation Facility in Summer**

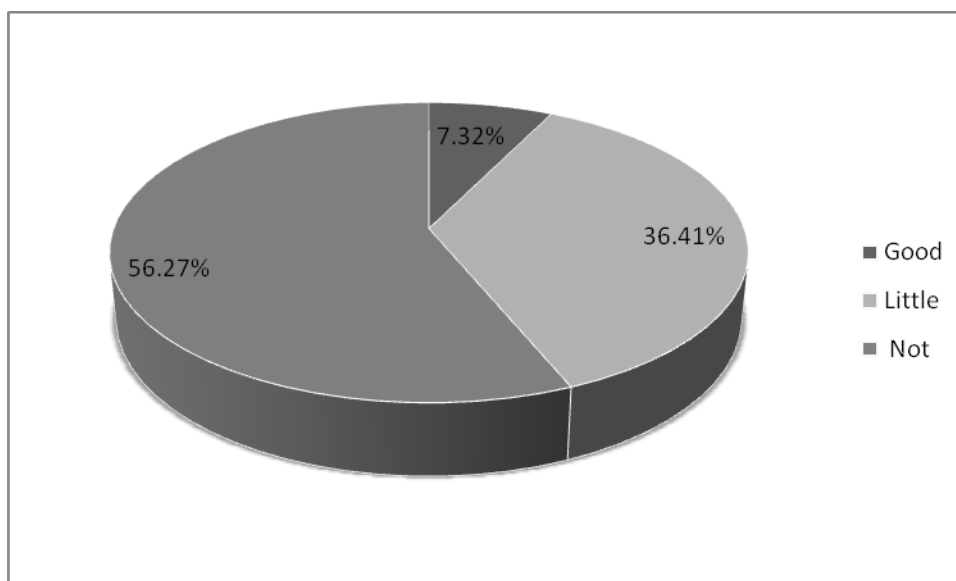
Source: Field survey, 2012

Out of 574 households, 98 households that is 17.03 % said that there is good facility of irrigation in summer. Similarly 294 households that is 51.22 %, said that there was little facility of irrigation and remaining 182 households that is 31.71 % said that there was not any facility of irrigation. More than 51 % farmers were totally depended on monsoon and their land became fully dry at winter season. Thus, they are only able to product on summer season.

The irrigation facility in winter for farming sector was classified into good, little and not decided. The view of households, about the irrigation facility in winter for farming sector is illustrated in figure 4.12.



**Figure 4.12 The Irrigation Facility in Winter**

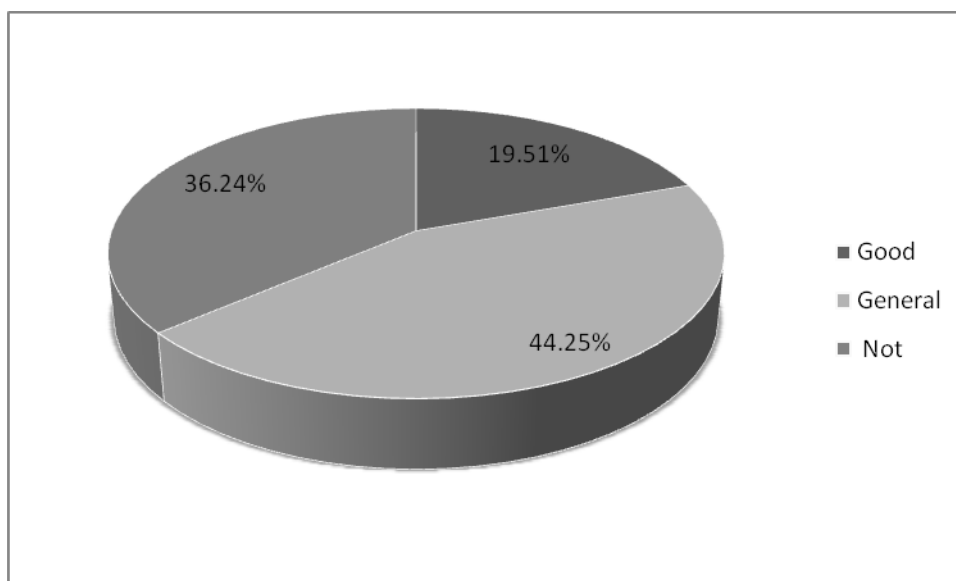


Source: Field survey, 2012

Out of 574 households, 42 households that is 7.32 % said that there is good facility of irrigation in winter. Similarly 209 households that is 36.41 %, said that there was little facility of irrigation and remaining 323 households that is 56.27 % said that there is not any facility of irrigation. More than 56 % farmers were not capable of the irrigation facility in winter season.

The question of available of seeds, fertilizer and pesticide in the nearest market has been classified according to good, general and no. The view of households, about the available of seeds, fertilizer and pesticide in the nearest has been presented in figure 4.13.

**Figure 4.13 The Available of Seeds, Fertilizer and Pesticide**



Source: Field survey, 2012

Out of 574 households, 112 households that is 19.51 % said that there is available of seeds, fertilizer and pesticide in the nearest market. Similarly, 254 households that is 44.25 %, said that there is general available of seeds, fertilizer and pesticide and remaining 206 households that is 36.24 % said that is not available. More than 63% farmers are benefited of seeds, fertilizer and pesticide and more than 36 % farmers are not getting such facility.

### **Cooperative Intervention for Livelihood Improvement**

In the interim constitution of Nepal, 2006, the cooperative is defined as the third pillar of economy. Mostly, cooperatives are established in urban and high-populated area. In village area, there are very few numbers of cooperatives.

The enrollment of households was organized with co-operative organizations or groups. The view of households, about the enrollment of households with co-operative organization or group is illustrated in figure 4.8.

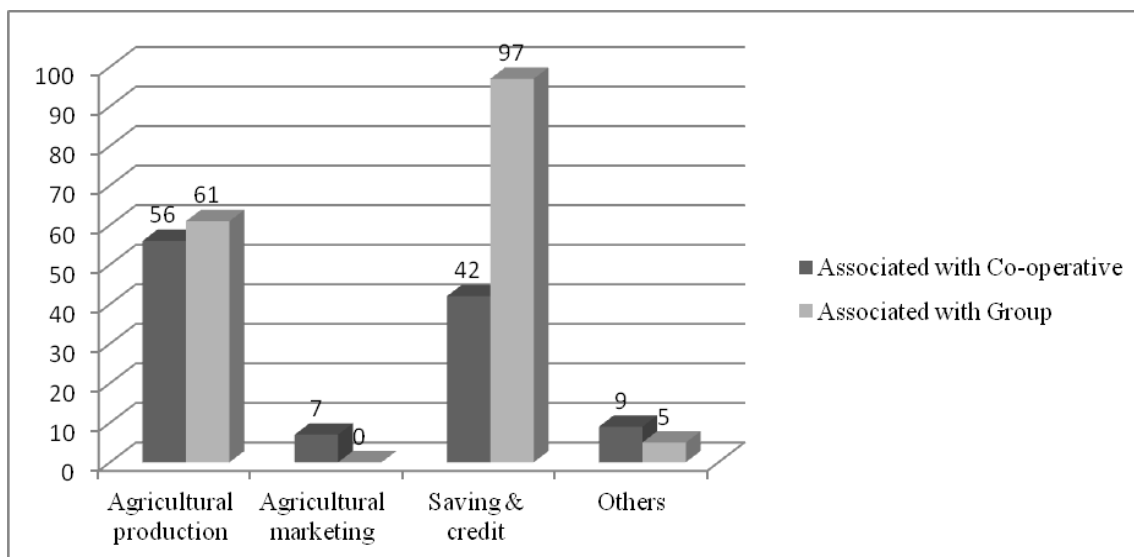
**Table 4.8****The Enrollment in Co-operatives or Group**

| S.N | Enrollment                | No. of households involved | No. of households involved (%) |
|-----|---------------------------|----------------------------|--------------------------------|
| 1   | Co-operative organization | 114                        | 18.27                          |
| 2   | Group                     | 163                        | 26.12                          |
|     | Total                     | 277                        | 44.39                          |

Source: Field survey, 2012

Out of 624 households, 114 households that is 18.27 % and 163 households that is 26.12 % said that they were enrollment with co-operative organization and group respectively. Remaining 347 households that is 55.61 % said they were not enrollment in co-operative and groups. Only 18.27 % of households were related to cooperatives but very few numbers were working actively. The groups were related to Mother group, Forest group, saving group and working group of NGOs.

The different types of cooperatives and groups were categorized according to agricultural production, marketing, saving and credit and others. The view of households, about the nature of co-operative organization or group has been presented in figure 4.14.

**Figure 4.14 The Nature of Co-operatives or Group**

Source: Field survey, 2012

Out of 277 households, 56 households that is 8.94 % and 61 households that is 22.1 % said that they were enrolling in the type of agricultural production co-operative and group respectively. Seven households that is 2.53 % said that they were enrolling in the type of agricultural marketing co-operative. Similarly, 42 households that is 15 % and 97 households that is 35.02 % said that they were enrolling in saving and credit co-operative and group respectively. Remaining nine households that is 3.25 % and five households that is 1.81 % said that they were enrolling in other types of co-operative and group respectively.

The groups were working smoothly than cooperatives. Mainly agricultural, saving and credit cooperatives and groups were working in the study area.

The advantages of co-operative and group was categorized according to increasing income, employment , opportunity of loan and save feeling. The view of

households about the advantages of co-operative and group has been illustrated in table 4.9.

**Table 4.9**

**The Advantages of Co-operatives or Group**

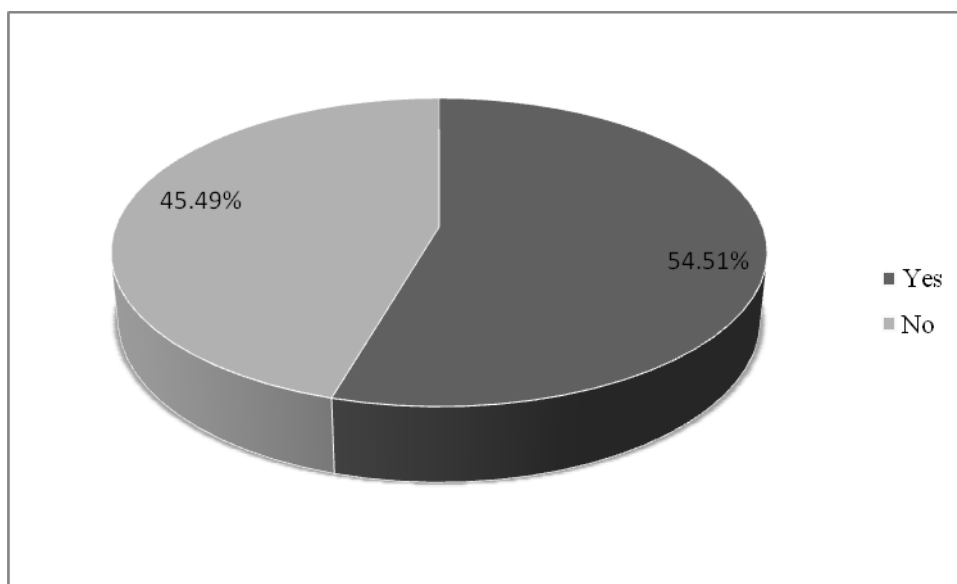
| S.N | Advantages                         | No. of households | No .of households % |
|-----|------------------------------------|-------------------|---------------------|
| 1   | Increasing the income              | 74                | 26.71%              |
| 2   | Employment                         | 22                | 7.94%               |
| 3   | Opportunity of loan                | 69                | 24.91%              |
| 4   | Saved feeling due to grouping work | 56                | 20.22%              |
| 5   | All above                          | 14                | 5.05%               |
| 6   | Neither advantage nor disadvantage | 42                | 15.16%              |
|     | Total                              | 277               | 100%                |

Source: Field survey, 2012

Out of 277 households, 74 households that is 26.71 % and 22 households that is 7.94 % said that there was advantage of co-operative member or group member by increasing the income and employment respectively. Similarly, 69 households that is 24.91 % and 56 households that is 20.22 % said that there were advantages of opportunity for easy loan and more saved feeling due to the grouping work respectively. Remaining 14 households that is 5.05 % said that there were all advantages as above maintained table and 42 households that is 15.16 % said that were neither advantages nor disadvantages from the joining of co-operative or group. Mainly, they were advantaged for saving, loan employment and raising income.

The supporting programs from organization to groups or co-operatives were classified as a yes or no. The view of households, about the supporting programs from any organization to group or co-operatives is presented in figure 4.15.

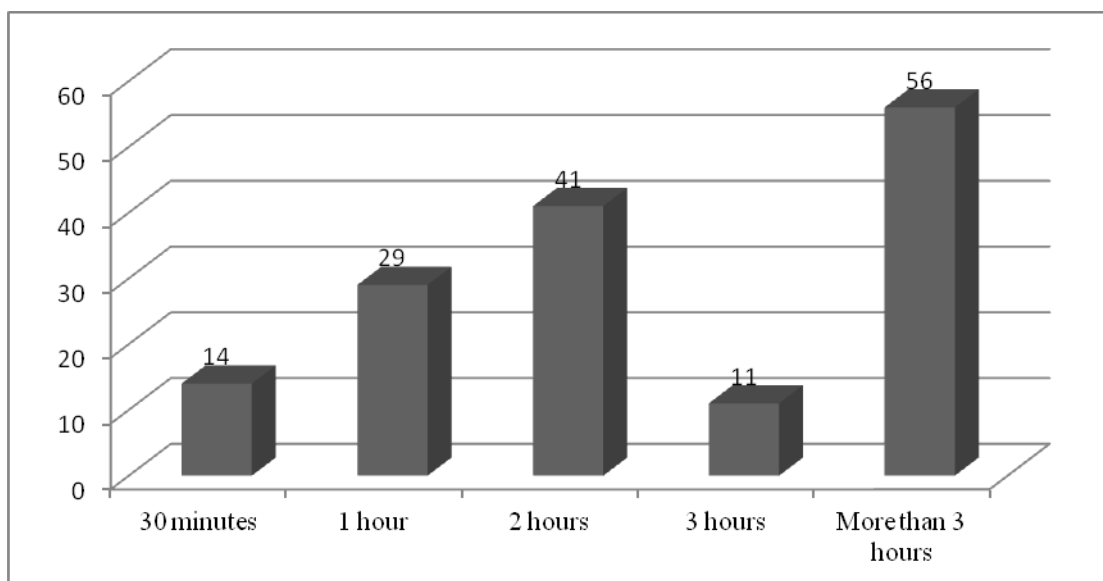
**Figure 4.15 The Support from other Organizations to Group or Co-operatives**



Source: Field survey, 2012

Out of 277 households, 151 households that is 54.51 % said that they were receiving the support from other organization through the co-operative and group. Remaining 126 households that is 45.49% said that they had not any supporting organization.

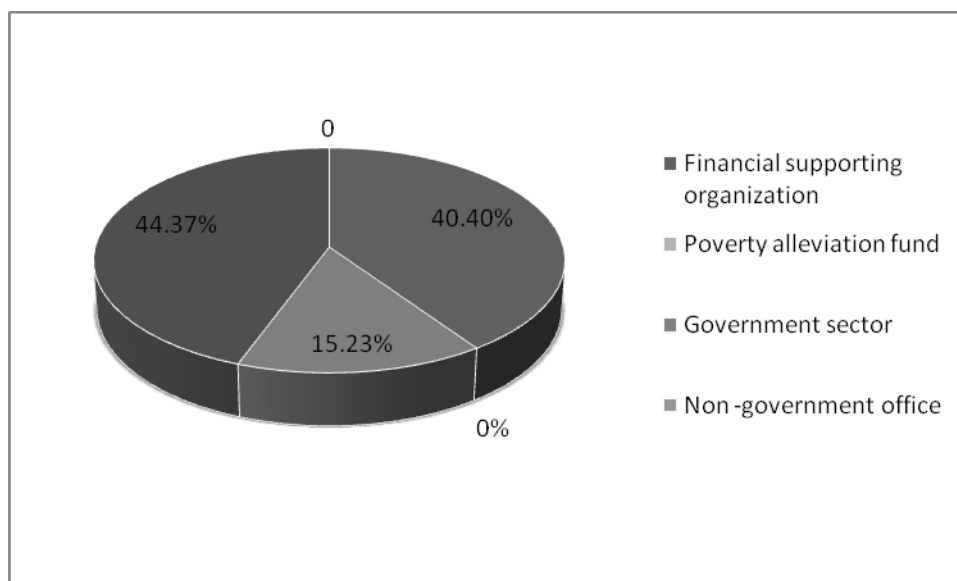
The distance of supporting organization from the households is categorized into 30 minutes, 1 hour, 2 hours, 3hours and more than three hours. The view of households, about the distance of supporting organization from the households is illustrated in figure 4.16

**Figure 4.16 The Distance of Supporting Organization from the Households**

Source: Field survey, 2012

Out of 151 households, 14 households that is 9.27 % and 29 households that is 19.21 % said that there was thirty minutes and one hour distance of supporting organization respectively. Similarly, 41 households that is 27.15 % and 11 households that is 7.28 % said that there were two hours and three hours distance of supporting organization respectively. Remaining 11 households that is 7.28 % and 56 households that is 37.09 % said that there was three hours and more than three hours distance of supporting organization respectively. The supporting organization of large number of participants was more than three hours. It means supporting organization working in scattering area.

Type of supporting organization to group or co-operative was categorized into financial supporting, poverty alleviation fund, governmental sector and non-governmental sector. The view of households, about the type of supporting organization to group or co-operative was presented in figure 4.17.

**Figure 4.17 Categories of Supporting Organization to Group or Co-operatives**

Source: Field survey, 2012

Out of 151 households, 61 households that is 40.40 % said that there was financial supporting organization to their co-operative and groups. There was not any support of poverty alleviation fund. Similarly, 23 households that is 15.23 % said that there was support of government sector. Remaining 67 households that is 44.37 % said that there was support of non-government sector. There is good support of NGOs in study area.

### **Response to Life Security and Quality of Life**

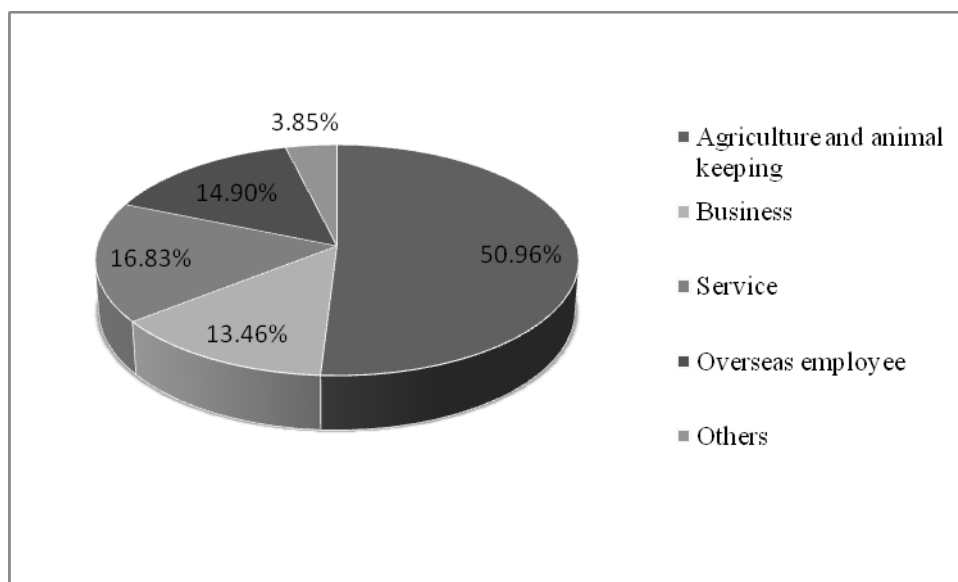
Secure and quantity life is important for sustainable livelihood. The future plan for secure life, basic infrastructure of occupational and employment sector and expectation for secure life are covered in it.

The future plan of households for their secure life was categorized according to agriculture and animal keeping, business, service, overseas employee and others.



The view of households, about the future plan of households for their secure life is presented in figure 4.18.

**Figure 4.18 The Future Plan for Secure Life**



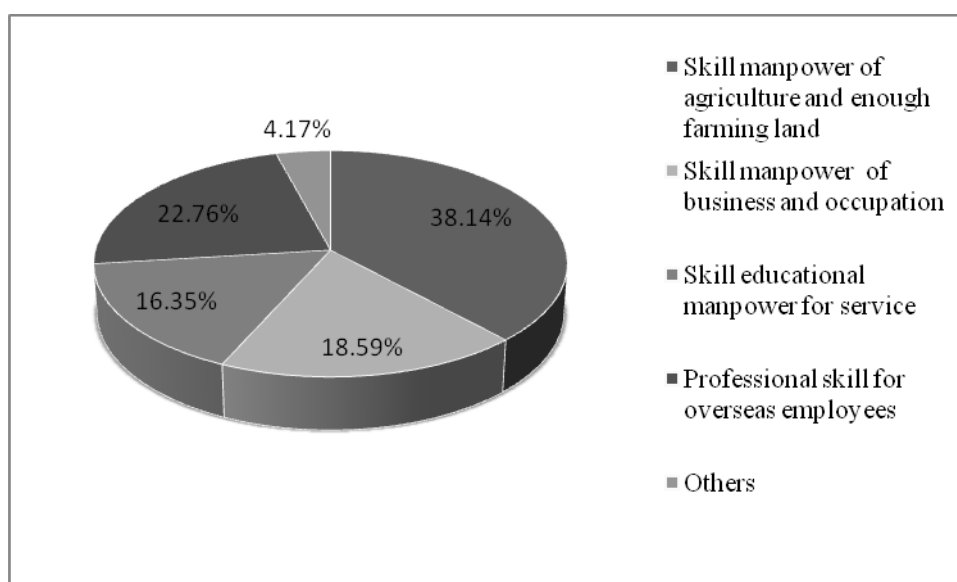
Source: Field survey, 2012

Out of 624 households, 318 households that is 50.96 % said that they were interested to develop the agriculture and animal keeping sector for their secure life. Similarly, 84 households that is 13.46 % and 105 households that is 16.83 % said that they were focused to promote the business and to increase the number of service holders respectively. Remaining 93 households that is 14.90 % and 24 households that is 3.85 % said that they were focused to increase the number of overseas employee and other sectors respectively. More than 50% households were focused for development of the agriculture sector.

The basic infrastructure of interested occupation and employment sectors of households are categorized to skill manpower of agriculture and enough farming land, skill manpower of business, skill manpower of service, manpower of overseas services and others. The view of households, about the basic infrastructure of

interested occupation and employment sectors of households has been presented in figure 4.19.

**Figure 4.19 The Skilled Human Resource and Occupation**



Source: Field survey, 2012

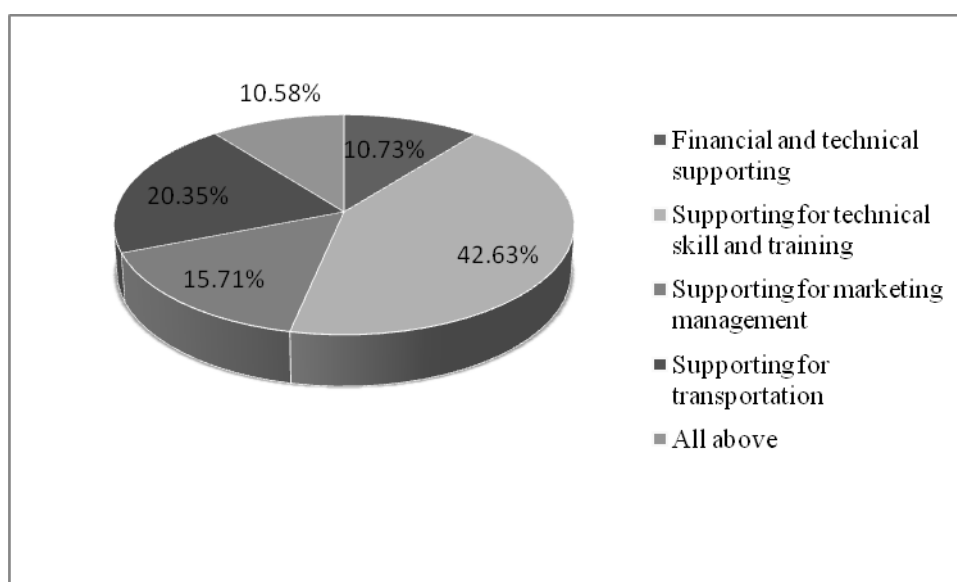
Out of 624 households, 238 households that is 38.14 % and 166 households that is 18.59 % said that they had skillful manpower of agricultural sector & enough farming land and skillful manpower of business & related occupation respectively. Similarly, 102 households that is 16.35 % and 142 households that is 22.76 % said that they had skill education man power for service and skilled manpower for overseas employees respectively. Remaining 26 households that is 4.17 % said that they had other skill manpower like industries, livestock.

More than 38 % households are interested to develop the agricultural sector due to the skill man power and enough farming land.

The expectations for supporting in their interested occupation and employment sectors of households were classified as a financial and technical supporting, skill and technical training, marketing management and transportation. The view of

households, about the expectations for supporting in their interested occupation and employment sectors of households has been illustrated in figure 4.20.

**Figure 4.20 The Occupational Expectations Households**



Source: Field survey, 2012

Out of 624 households, 67 households that is 10.73 % and 266 households that is 42.63 % said that they were expected financial & technical support and supporting for technical skill & training respectively. Similarly, 98 households that is 15.71 % and 127 households that is 20.35 % said that they were expected the supporting for marketing management and supporting for transportation respectively. Remaining 66 households that is 10.58 % said that they were expected all kinds of supporting as above table. More than 42 % participants expected the skill training for to develop their occupational sector.

### **Response to Climate Change with Respect to Livelihood**

Climate change directly and indirectly affected to the livelihoods. This heading covers the cautions and prevention from climate change. The view of participants on cautious

to the impacts of climate change in interested occupation and employment sectors was classified into yes and no. The view of households, about the cautious to the impacts of climate change in interested occupation and employment sectors has been illustrated in table 4.9.

**Table 4.10**

**The Awareness about Impacts of Climate Change**

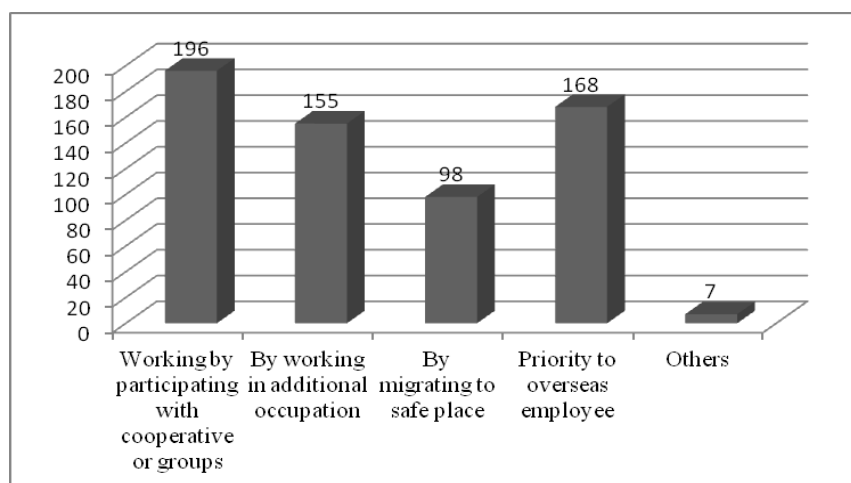
| S.N | Careful to the impacts of climate change | No. of Households | No. of Households % |
|-----|--|-------------------|---------------------|
| 1   | Yes                                      | 110               | 17.63               |
| 2   | No                                       | 514               | 82.37               |
|     | Total                                    | 624               | 100                 |

Source: Field survey, 2012

Out of 624 households, 110 households that is 17.63 % said that they were careful for cautions to the impacts of climate change in interested occupation and employment sectors and 514 households that is 82.37 % said that they were not careful about the impacts of climate change and they had not any cautions.

The cautions that should be applied to prevent from the impacts of Climate change were categorized into working by participating with group and cooperative, working in additional occupation, migrating to safe place, priority to overseas employee and others. The view of households, about the cautions that should be applied to prevent from the impacts of Climate change is presented in figure 4.21.

**Figure 4.21 The Precautions to be Applied against the Impacts of Climate Change**



Source: Field study, 2012

Out of 624 households, 196 households that is 31.41 % and 155 households that is 24.84 % said that they were working by participating with co-operative or groups and working in additional occupation respectively for to prevent from impact of climate change. The number households of 90 that is 15.71 % and 168 households that is 26.92 % said that they were interested to migrate in safe place and priority to overseas employee respectively. Participants were interested to work with joint effort to prevent from climate change impacts.

### **Chapter summary**

This chapter has presented the existing status of livelihood in detail, as well as nature and composition of the participants, educational and economic status of the households, cooperative intervention for livelihood improvement, response to life security and quality of life, response to climate change with respect to the livelihood. The next chapter presents the findings related to the climate change, its threat to everywhere in detail.

## CHAPTER V

### **CLIMATE CHANGE: THREAT TO EVERYWHERE**

The previous chapter included the existing status of the livelihood in detail that covered family background, education, land status, economic status, profession, and the entrepreneurial activities of the people with all family members in detail. This chapter presents the climate change and its threat to everywhere. The questions used for the inquiry covered impact of climate change in natural resources, bio-diversity, and agriculture, social and economic sectors. The study was focused in the deepest valley of the world named Arun Valley.

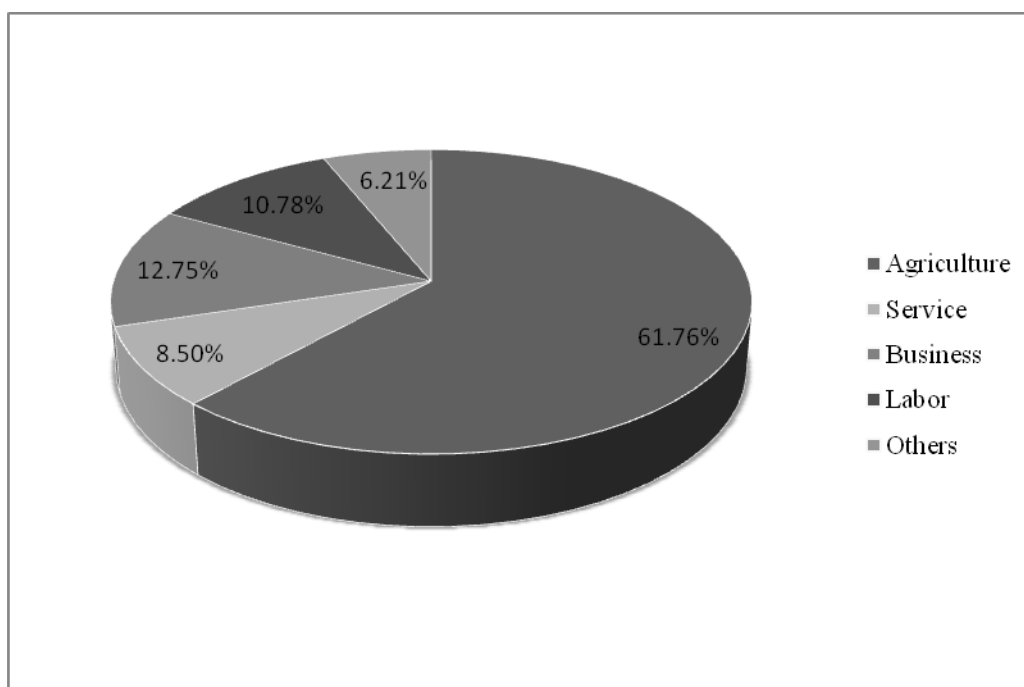
There were 306 respondents who participated in the research of assessing impacts of climate change in Arun valley. At that research area, along with the individual discussion, five group discussions were also carried out.

#### **Nature of Participants Responding Climate Change**

People participated in this study and discussed about their experiences of the impact of climate change. I had chosen the participants above the 45 years old, in order to meet the criteria of the question because they had experiences about the climate change during thirty years ago.

Occupational status of Participants was classified into agriculture, service, business, labour and others. Occupational status of Participants has been categorized in figure 5.1.

**Figure 5.1 Occupational Statuses of Participants**



Source: Field Survey, 2012

Among the 306 participants, 189 were local farmers; it meant 61.76 percentages participants were farmers. Service holders were mainly school and campus teachers, their participation was 8.5 percentages. Similarly, 12.75 percentage participants were local businessman, 10.78 percentage participants were local labors & porters and 6.21 percentage participants were other people like Pujari, Sadhu, old aged people of old aged house, industrial sectors, hotels etc.

The male and female participants of study has been divided on the basis of age group. The participants are categorized as the age group of male and female in table 5.1.

**Table 5.1****Age Specific Categorization of Male and Female Participants**

| S.N | Age of the participants | Participat ed Male | Participate d Male % | Participate d Female | Participa ted Female % | Total No. of Male & Female | participants % |
|-----|-------------------------|--------------------|----------------------|----------------------|------------------------|----------------------------|----------------|
| 1   | 40 – 50yrs              | 26                 | 44.06                | 33                   | 55.94                  | 59                         | 19.28          |
| 2   | 50 – 60yrs              | 32                 | 54.24                | 27                   | 45.76                  | 59                         | 19.28          |
| 3   | 60 – 70yrs              | 43                 | 57.33                | 32                   | 42.67                  | 75                         | 24.51          |
| 4   | 70 – 80yrs              | 54                 | 67.5                 | 26                   | 32.5                   | 80                         | 26.14          |
| 5   | 80 – 90yrs              | 10                 | 41.67                | 14                   | 58.33                  | 24                         | 7.85           |
| 6   | 90 – 100yrs             | 2                  | 22.22                | 7                    | 77.78                  | 9                          | 2.94           |
|     | Total                   | 167                | 55                   | 139                  | 45                     | 306                        | 100            |

Source: Field Survey, 2012

Out of 306 participants, 167 participants were male that is 55 % and 139 participants were female that is 45%. The percentage of participants of age group 40-50 years, 50-60 years and 60-70 years were 19.28%, 19.28% and 24.51% respectively. Similarly, the percentage of participants of age group 70-80 years, 80-90 years and 90-100 years were 26.14%, 7.85% and 2.94% respectively.

Male and female respondents were 55 percent and 45 percent respectively.

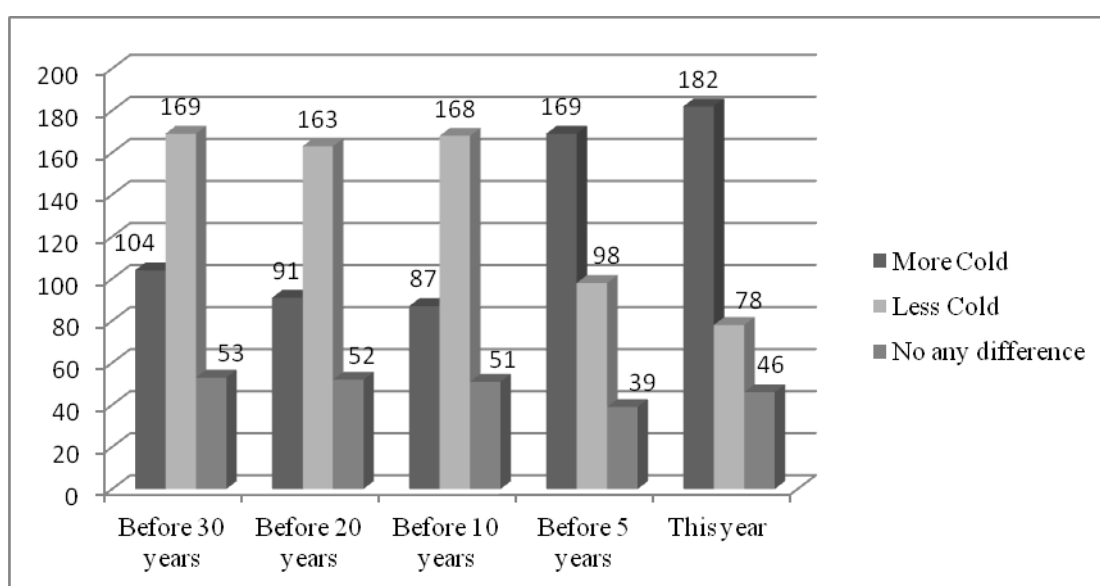
Fewer respondents were more than ninety years old and their experience was the best evidence of the climate change pattern. There were more female participants of the age of 40-50 due to the overseas employee of male and also it was seen that female participants were more of the age of 80-90 and 90-100 years, it means, females had long life than the males.



### The Sensation of Weather

The view of participants, about the sensation of cold in winter at the interval of thirty years past, twenty years past, ten years past, five years past and cold the running year are illustrate in figure 5.2. The sensation of cold in winter was sort out as more, less and not known.

**Figure 5.2 The Sensation of Cold in Winter**



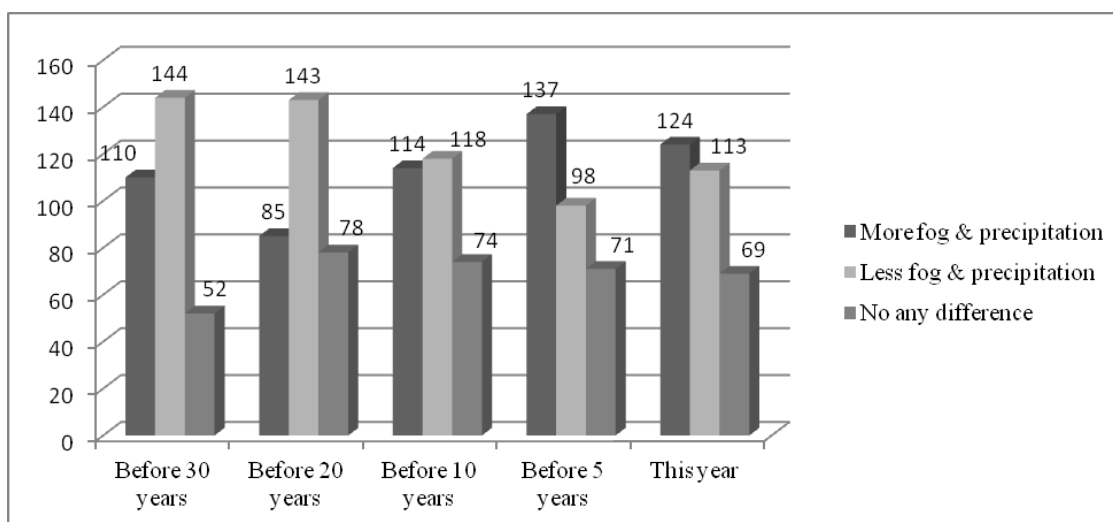
Source: Field survey, 2012

Before 30 years, out of 306 participants, 104 participants that is 33.99 % said that there used to be more cold in winter. Similarly, 169 participants that is 55.23 % said it has become less and remaining 53 participants that is 17.32 % said that there was no any difference. Before 20 years, out of 306 participants, 91 participants that is 29.73 % said that there used to be more cold in winter. Similarly, 163 participants that is 53.27 % said it has become less and remaining 52 participants that is 16.99 % said that there is no any difference. Before 10 years, out of 306 participants, 87 participants that is 28.43 % said that there used to be more cold in winter. Similarly,

168 participants that is 54.90 % said It had become less and remaining 51 participants that is 16.67 % said that there was no any difference. Before 5 years, out of 306 participants, 169 participants that is 55.23 % said that there used to be more cold in winter. Similarly, 98 participants that is 32.03 % said it had become less and remaining 39 participants that is 12.75 % said that there was no any difference. In the running year, out of 306 participants, only 182 participants that is 59.48 % said that there was more cold in winter. Similarly, 78 participants that is 25.49 % said that it had become less and 46 participants that is 15.03 % said that there was no any difference. Before thirty years to ten years ago, there was not different of cold rate in winter but cold was increasing from last five years ago.

The view of participants, about the quantity of fog and precipitation in winter in the interval of thirty years ago, twenty years ago, ten years ago, five years ago and the running year were shown in figure 5.3. The quantity of fog and precipitation in winter has been categorized into more, less and no any difference.

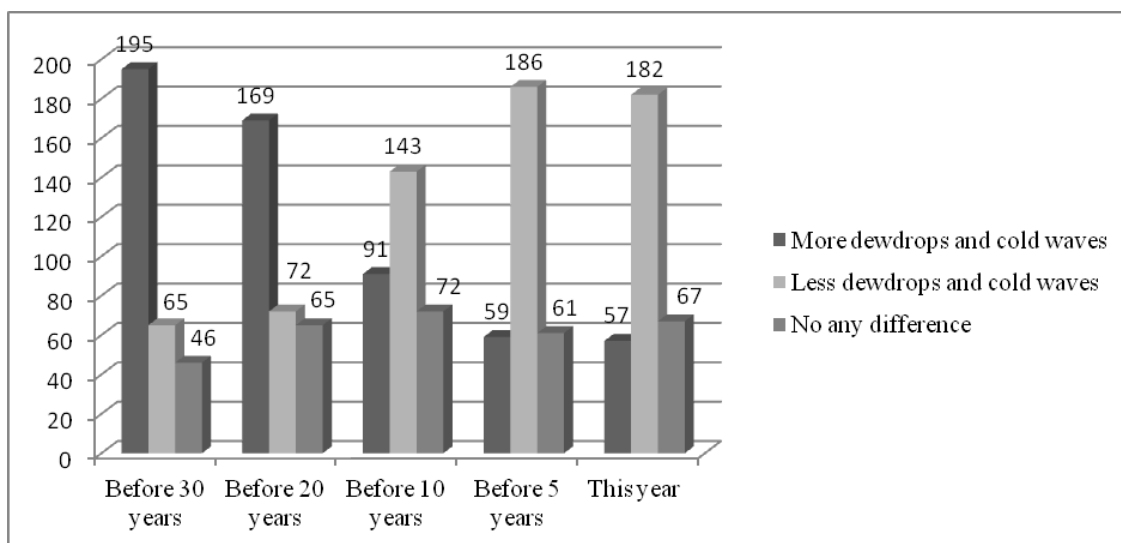
**Figure 5.3 The Quantity of Fog and Precipitation in Winter**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 110 participants that is 35.95 % said that there used to be more fog and precipitation in winter. Similarly, 144 participants that is 47.06 % said it had become less and remaining 52 participants that is 16.99 % said that there was no any difference. Before 20 years, out of 306 participants, 85 participants that is 27.78 % said that there used to be more fog and precipitation in winter. Similarly, 143 participants that is 46.73 % said it had become less and remaining 78 participants that is 25.49 % said that there was no any difference. Before 10 years, out of 306 participants, 114 participants that is 37.25 % said that there used to be more fog and precipitation in winter. Similarly, 118 participants that is 38.56 % said it had become less and remaining 74 participants that is 24.18 % said that there was no any difference. Before 5 years, out of 306 participants, 137 participants that is 44.77 % said that there used to be more fog and precipitation in winter. Similarly, 98 participants that is 32.03 % said it had become less and remaining 71 participants that is 23.20 % said that there was no any difference. In the running year, out of 306 participants, 124 participants that is 40.52 % said that there is more fog and precipitation in winter. Similarly, 113 participants that is 36.93 % said that it had become less and 69 participants that is 22.55 % said that there was no any difference. The quantity of fog and precipitation in winter was generally constant before ten years ago but more before five years ago. Now a day the fog and precipitation was being high.

The view of participants, about the state of dewdrops fall and cold waves in winter in the interval of thirty years, twenty years, ten years, five years and the running year are categorized in figure 5.4. The state of dewdrops fall and cold waves in winter was sort out in to more, less and no any difference.

**Figure 5.4 The State of Dewdrops Fall and Cold Waves in Winter**

Source: Field survey, 2012

Before 30 years, out of 306 participants, 195 participants that is 63.73 % said that there used to be more dewdrops and cold waves in winter. Similarly, 65 participants that is 21.24 % said it had become less and remaining 46 participants that is 15.03 % said that there was no any difference. Before 20 years, out of 306 participants, 169 participants that is 55.23 % said that there used to be more dewdrops and cold waves in winter. Similarly, 72 participants that is 23.53 % said it had become less and remaining 65 participants that is 21.24 % said that there was no any difference. Before 10 years, out of 306 participants, 91 participants that is 29.74 % said that there used to be more dewdrops and cold waves in winter. Similarly, 143 participants that is 46.73 % said it had become less and remaining 72 participants that is 23.53 % said that there was no any difference. Before 5 years, out of 306 participants, 59 participants that is 19.28 % said that there used to be more dewdrops and cold waves in winter. Similarly, 186 participants that is 60.78 % said it had become less and remaining 61 participants that is 19.93 % said that there was no any difference. In the running year,

out of 306 participants, 57 participants that is 18.63 % said that there was more dewdrops and cold waves in winter. Similarly, 182 participants that is 59.48 % said that it had become less and 67 participants that is 21.89 % said that there was no any difference.

The dewdrops and cold waves in winter were constant before twenty years ago and the rate of dewdrops and cold waves are decreasing from twenty years ago. At present, monsoon was being late.

The view of participants, about the quantity of heat haze on the sky in the interval of thirty years, twenty years, ten years, five years and the running year are illustrated in table 5.2. The quantity of heat haze on the sky is classified into more, less and no any difference.

**Table 5.2**

**The Quantity of Heat Haze on the Sky**

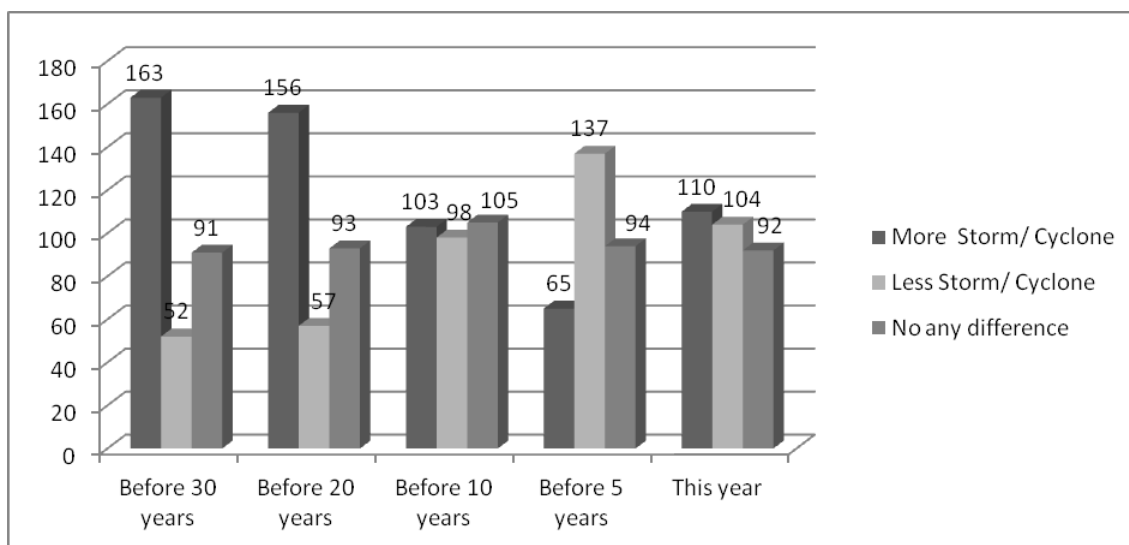
| S.N | Interval of time | More Heat haze | More Heat haze (%) | Less Heat haze | Less Heat haze (%) | No any difference | No any difference (%) |
|-----|------------------|----------------|--------------------|----------------|--------------------|-------------------|-----------------------|
| 1   | Before 30 years  | 117            | 38.24              | 111            | 36.27              | 78                | 25.49                 |
| 2   | Before 20 years  | 110            | 35.95              | 107            | 34.97              | 89                | 29.08                 |
| 3   | Before 10 years  | 124            | 40.52              | 90             | 29.41              | 92                | 30.07                 |
| 4   | Before 5 years   | 131            | 52.81              | 91             | 29.74              | 94                | 30.72                 |
| 5   | This year        | 108            | 35.29              | 113            | 36.93              | 85                | 27.78                 |

Source: Field survey, 2012

Before 30 years, out of 306 participants, 117 participants that is 38.24 % said that there used to be more heat haze. Similarly, 111 participants that is 36.27 % said it had become less and remaining 78 participants that is 25.49 % said that there was no any

difference. Before 20 years, out of 306 participants, 110 participants that is 35.95 % said that there used to be more heat haze. Similarly, 107 participants that is 34.97 % said it had become less and remaining 89 participants that is 29.08 % said that there was no any difference. Before 10 years, out of 306 participants, 124 participants that is 40.52 % said that there used to be more heat haze. Similarly, 90 participants that is 29.41 % said it had become less and remaining 92 participants that is 30.07 % said that there was no any difference. Before 5 years, out of 306 participants, 131 participants that is 52.81 % said that there used to be more heat haze. Similarly, 91 participants that is 29.74 % said it had become less and remaining 94 participants that is 30.72 % said that there was no any difference. In the running year, out of 306 participants, 108 participants that is 35.29 % said that there is more heat haze. Similarly, 113 participants that is 36.93 % said that it had become less and 85 participants that is 27.78 % said that there was no any difference. The quantity of heat haze before ten years and this year was similar and before twenty to ten years ago, heat haze was higher.

The view of participants, about the strength of blow of storm/ cyclone in the interval of thirty years, twenty years, ten years, five years and the running year are shown in figure 5.5. The strength of blow of storm/ cyclone is classified into more, less and no any difference.

**Figure 5.5 The Strength of Blow of Storm/ Cyclone**

Source: Field survey, 2012

Before 30 years, out of 306 participants, 163 participants that is 52.27 % said that there used to be more strength of blow of storm/ cyclone. Similarly, 52 participants that is 16.99 % said it had become less and remaining 91 participants that is 29.74 % said that there was no any difference. Before 20 years, out of 306 participants, 156 participants that is 50.98 % said that there used to be more strength of blow of storm/ cyclone. Similarly, 57 participants that is 18.63 % said it had become less and remaining 93 participants that is 30.39 % said that there was no any difference. Before 10 years, out of 306 participants, 103 participants that is 33.66 % said that there used to be more strength of blow of storm/ cyclone. Similarly, 98 participants that is 32.03 % said it had become less and remaining 105 participants that is 34.31 % said that there was no any difference. Before 5 years, out of 306 participants, 65 participants that is 21.24 % said that there used to be more strength of blow of storm/ cyclone. Similarly, 137 participants that is 44.77 % said it had become less and remaining 94 participants that is 30.72 % said that there was no any difference. In the running year, out of 306 participants, 110 participants that is 35.95 % said that there is more

strength of blow of storm/ cyclone. Similarly, 104 participants that is 33.98 % said that it had become less and 92 participants that is 30.07 % said that there was no any difference. The strength of blow of storm/ cyclone before twenty years ago was higher and blowing rate is decreasing before twenty years ago.

The view of participants, about the sensation of warm in summer in the interval of thirty years, twenty years, ten years, five years and the running year are Illustrated in table 5.3. The sensation of warm in summer was categorized into more, less and no any difference.

**Table 5.3**

**The Sensation of Warm in Summer**

| S.N | Interval of Time | More warm | More warm (%) | Less warm | Less warm (%) | No any difference | No any difference (%) |
|-----|------------------|-----------|---------------|-----------|---------------|-------------------|-----------------------|
| 1   | Before 30 years  | 52        | 16.99         | 169       | 55.23         | 85                | 27.78                 |
| 2   | Before 20 years  | 69        | 22.55         | 156       | 50.98         | 81                | 26.47                 |
| 3   | Before 10 years  | 201       | 65.69         | 16        | 5.23          | 89                | 29.08                 |
| 4   | Before 5 years   | 166       | 54.25         | 48        | 15.69         | 92                | 30.07                 |
| 5   | This year        | 176       | 57.52         | 33        | 10.78         | 97                | 31.7                  |

Source: Field survey, 2012

Before 30 years, out of 306 participants, 52 participants that is 16.99 % said that there used to be more warm in summer. Similarly, 169 participants that is 55.23 % said it had become less and remaining 85 participants that is 27.78 % said that there was no any difference. Before 20 years, out of 306 participants, 69 participants that is 22.55% said that there used to be more warm in summer. Similarly, 156 participants that is 50.98 % said it had become less and remaining 81 participants that is 26.47 % said that there was no any difference. Before 10 years, out of 306 participants, 201

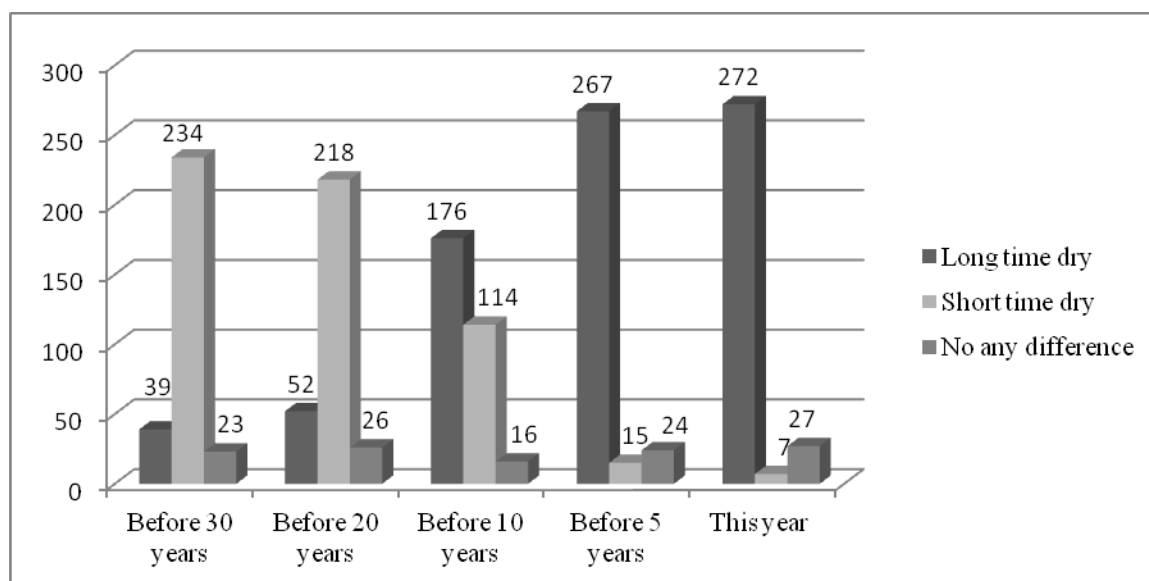


participants that is 65.69 % said that there used to be warmer in summer. Similarly, 16 participants that is 5.23 % said it had become less and remaining 89 participants that is 29.08 % said that there was no any difference. Before 5 years, out of 306 participants, 166 participants that is 54.25 % said that there used to be more warm in summer. Similarly, 48 participants that is 15.69 % said it had become less and remaining 92 participants that is 30.07 % said that there was no any difference.

In the running year, out of 306 participants, 176 participants that is 57.52 % said that there was more warm in summer. Similarly, 33 participants that is 10.78 % said that it had become less and 97 participants that is 31.70 % said that they did not know. The pattern of warm in summer was constant before twenty years ago but it was raised after ten years ago.

The view of participants, about the duration of dryness in the interval of thirty years, twenty years, ten years, five years and the running year were shown in figure 5.6. Options for participants were long time dry, short time dry and not know.

**Figure 5.6 The Duration of Dryness in the Interval of Thirty Years**



Source: Field survey, 2012

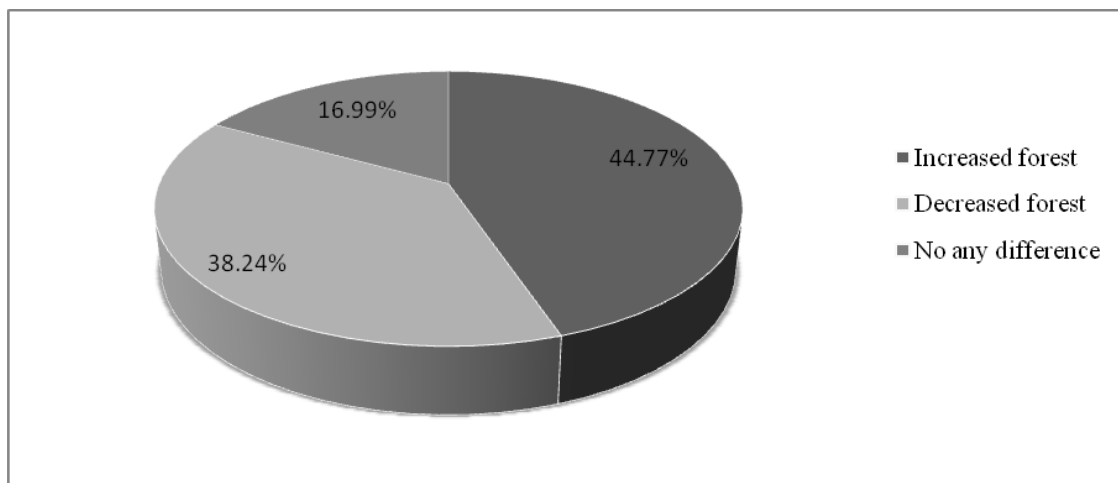
Before 30 years, out of 306 participants, 39 participants that is 12.75 % said that there used to be more dryness. Similarly, 234 participants that is 76.47 % said it had become less and remaining 23 participants that is 7.52% said that there was no any difference. Before 20 years, out of 306 participants, 52 participants that is 16.99 % said that there used to be more dryness. Similarly, 218 participants that is 71.24 % said it had become less and remaining 26 participants that is 8.5% said that there was no any difference. Before 10 years, out of 306 participants, 176 participants that is 57.52 % said that there used to be more dryness. Similarly, 114 participants that is 37.25 % said it had become less and remaining 16 participants that is 5.23% said that there was no any difference. Before 5 years, out of 306 participants, 267 participants that is 87.25 % said that there used to be more dryness. Similarly, 15 participants that is 4.90 % said it had become less and remaining 24 participants that is 7.84% said that there was no any difference. In the running, out of 306 participants, 272 participants that is 88.89% said that there is more dryness. Similarly, seven participants that is 2.29 % said that it had become less and 27 participants that is 8.82 % said that there was no any difference.

The dryness time in winter was being long every year after thirty years ago.

### **Trends of Green Coverage**

This topic dealt about the status of green coverage situation of the study area.

The views of participant, about change in the status of forest or green coverage as compare to past few years are categorized in figure 5.7. The status of forest or green coverage was classified into increase the forest, decrease the forest and not know.

**Figure 5.7 Change in the Status of Green Coverage**

Source: Field survey, 2012

Out of 306 participants, 137 participants that is percentage of 44.77 said that there was increased green coverage due the community forest, forest groups in community, plantation, protection of trees in the fields of farmers for grass to domestic animals and fire wood purpose, controlling of foreign etc. 117 participants that is percentage of 38.24 said that there was decreased forest or green coverage now a days than 10 to 20 years ago due to its usage for fire wood, building , furniture, farming, uncontrolled firing, deforestation for roads etc. Similarly, remaining 52 participants that is percentage of 16.99 said that there was not any difference about the green coverage in past and present. The green coverage was increased after few years due to the development of community forest and planting the trees for wire wood, furniture, planting annual & biannual grasses & trees for cattle. Farmers were also farming of the fruits' trees, Cardamom, Rudraksha etc. It helps to increase the green coverage at that area. Few respondents view was that the forest or green coverage was now a days than 10 to 20 years ago due to the use for fire wood, building , furniture, farming, uncontrolled firing, deforestation for roads etc.

The views of participant, about reasons for increase in the forest or green coverage as compare to past years were shown in figure 5.4. The reasons to increase in the forest or green coverage was categorized into decreased farming, controlled of deforestation, development of community forest, increased even green farming and others.

**Table 5.4**

**Reasons for Increasing the Green Coverage**

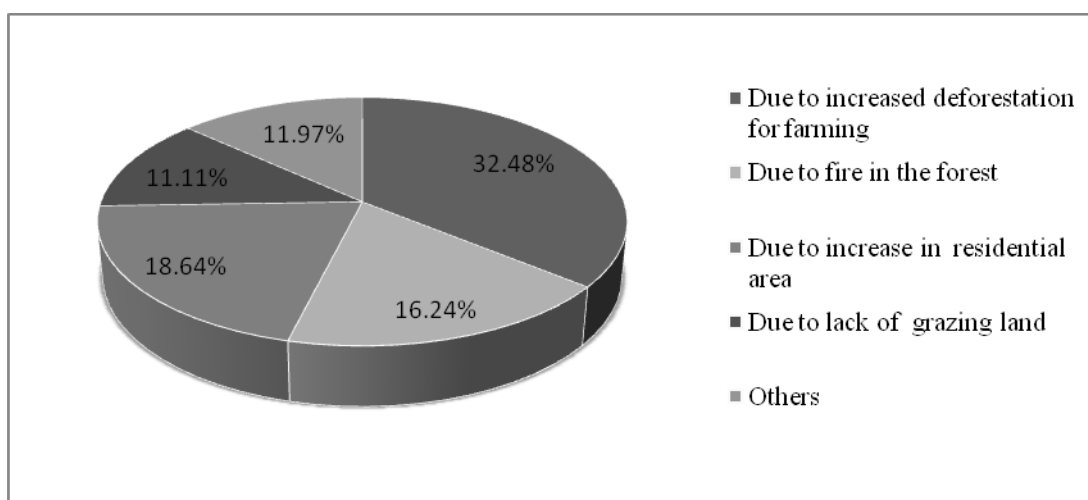
| S.N | Reasons for increasing                 | No. of Agreed participants | No. of Agreed participants (%) |
|-----|--|----------------------------|--------------------------------|
| 1   | Due to decreased in farming            | 19                         | 13.87%                         |
| 2   | Due to controlled of deforestation     | 46                         | 33.57%                         |
| 3   | Due to Development of community forest | 58                         | 42.34%                         |
| 4   | Due to increase in evergreen farming   | 7                          | 5.11%                          |
| 5   | Others                                 | 6                          | 4.38%                          |
|     | Total                                  | 137                        | 100%                           |

Source: Field survey, 2012

There were different views on the reasons behind the increase in the forest or green coverage. Out of 137 participants, 58 participants that is 42.34 percent said that it was due to the development of community forest in the recent years. Similarly, 46 participant that is 33.57 percentage, 19 participants that is 13.87 percentage and 7 participants that is 5.11 percentage said that it was due to controlling of deforestation, decrease in farming and increase in even green farming respectively. 6 participants that is 4.38 percentage said that it was due to the help of governmental and non-governmental sectors on protecting trees in farming for grass and fire wood, supporting for plantation of trees and fruits etc.

The views of participant, about reasons for decreasing the forest or green coverage as compare to past years are illustrate in figure 5.8. The reasons for decreasing the forest or green coverage was categorized as increased deforestation, due to fire in the forest, due to increase in residential area, due to lack of grazing land and others.

**Figure 5.8 Reasons for Decreasing the Green Coverage**



Source: Field survey, 2012

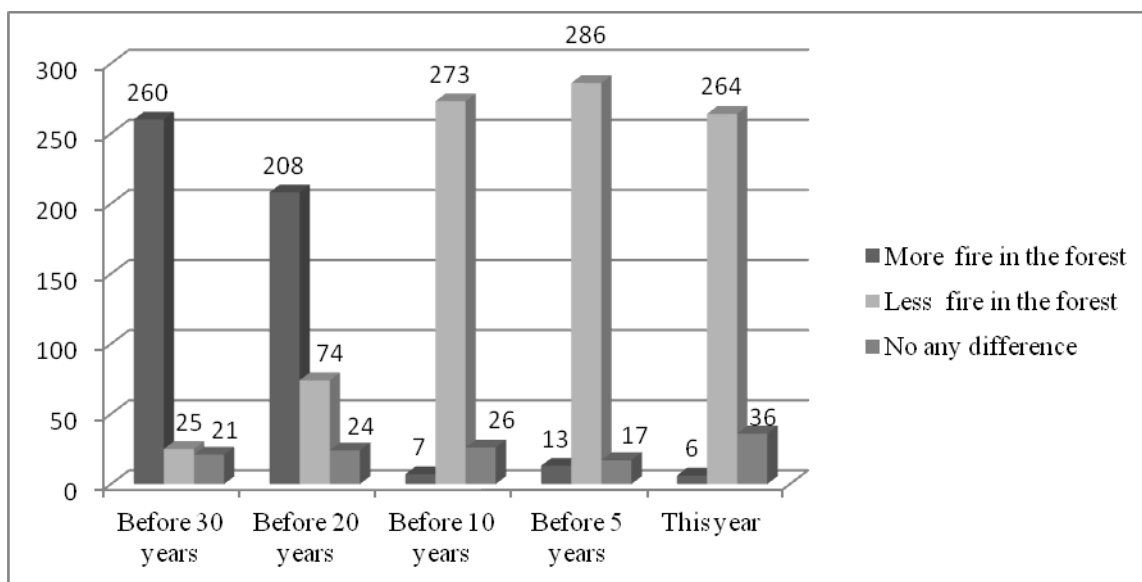
There are different views on the reason behind the decrease in the forest or green coverage.

Out of 117 participants, 38 participants that is percentage of 32.48 said that it was due to the increase in deforestation for farming. Similarly, 33 participants that is 18.64 percent, 19 participants that is 16.24 percentage and 13 participants that is 11.11 percentage said that it was due to the increase in the residential area, uncontrolled fire and cause of lack of grazing land respectively. 14 participants that is 11.97 percent said it was due to the other reasons like constructing building, road etc.

The view of participants, about the rate of fire in the forest in the interval of thirty years, twenty years, ten years, five years and the running year are illustrated in

table 5.9. The rate of fire in the forest was categorized into more fire in the forest, less fire in the forest and not knows.

**Figure 5.9 The Rate of Occurrence of Fire in the Forest**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 260 participants that is 84.97 % said that there used to be more firing in the forest. Similarly, 25 participants that is 8.17 % said it had become less and remaining 21 participants that is 6.86 % said that there was no any difference. Before 20 years, out of 306 participants, 208 participants that is 67.97 % said that there used to be more firing in the forest. Similarly, 74 participants that is 24.18 % said it had become less and remaining 24 participants that is 7.83 % said that there was no any difference. Before 10 years, out of 306 participants, 7 participants that is 2.29 % said that there used to be more firing in the forest. Similarly, 273 participants that is 89.23 % said it had become less and remaining 26 participants that is 8.5 % said that there was no any difference. Before 5 years, out of 306 participants, 13 participants that is 4.25 % said that there used to be more firing in the forest. Similarly, 286 participants that is 93.46 % said it had become less and remaining 17

participants that is 5.56 % said that there was no any difference. In the running year, out of 306 participants, only 6 participants that is 1.96 % said that there was more firing in the forest. Similarly, 264 participants that is 86.27 % said that it had become less and 36 participants that is 11.76 % said that there was no any difference. The pattern of firing in the forest was decreasing before ten years ago due to the community forest.

The view of participants, about the quantity of wild animals & birds around the field and forest with comparing past years are illustrated in table 5.5. The quantity of wild animals & birds around the field and forest was categorized into increased the number, decreased the number and not known.

**Table 5.5**

**The Quantity of Wild Animals & Birds around the Field and Forest**

| S.N | Quantity of wild animals & birds | No. of participants | Percentage |
|-----|----------------------------------|---------------------|------------|
| 1   | Increased the number             | 52                  | 16.99 %    |
| 2   | Decreased the number             | 208                 | 67.97 %    |
| 3   | No any different                 | 46                  | 15.03 %    |
|     | Total                            | 306                 | 100 %      |

Source: Field survey, 2012

Out of 306 participants, 52 participants that is 16.99 % said that there was more quantity of wild animals & birds around the field and forest than past years due to protection of green coverage. Similarly, 208 participants that is 67.97 % said that there was less wild animals & birds around the field and forest due to the

deforestation, illegal hunters etc. and 46 participants that is 15.03 % said that there was no any difference.

Majority respondents said that there were less wild animals & birds around the field and forest due to the deforestation, illegal hunters. In addition, there are few new coming of wild animals & birds around the field and forest due to protection of green coverage than past years.

The view of participants, about the new coming wild animals & birds around the field and forest with comparing past years are shown in table 5.6. The new coming wild animals & birds around the field and forest were classified as yes and no.

**Table 5.6**

**The Wild Animals & Birds around the Field and Forests**

| S.N | New coming wild animals & birds | No. of participants | Percentage |
|-----|---------------------------------|---------------------|------------|
| 1   | Yes                             | 137                 | 44.77 %    |
| 2   | No                              | 169                 | 55.23 %    |
|     | Total                           | 306                 | 100 % %    |

Source: Field survey, 2012

Out of 306 participants, 137 participants that is 44.77 % said that there were new coming of wild animals & birds around the field and forest than past years due to protection of green coverage. Similarly, 169 participants that is 55.23 % said that there were not new wild animals & birds around the field and forest due to the deforestation, illegal hunters etc. Name of new comer animals were Monkey, deer, Dumshi, Dhadu, wild cat, Gandro, Malshapro and Ghoral. Name of new comer birds are Crow, white headed bird, Luiche, black long tailed bird, Kalej and koili.



The view of participants, about the extinct wild animals & birds around the field and forest with comparing past years are shown in able 5.7. The extinct wild animals & birds around the field and forest were categorized into yes and no.

**Table 5.7**

**The Extinct Wild Animals & Birds around the Field and Forest**

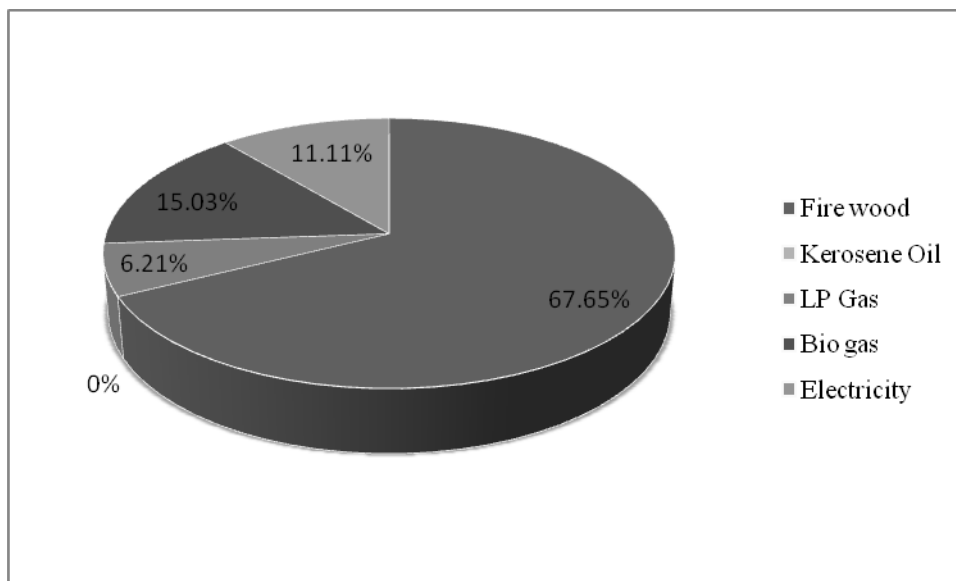
| S.N | Extinct animals and birds | No. of participants | Percentage |
|-----|---------------------------|---------------------|------------|
| 1   | Yes                       | 254                 | 83 %       |
| 2   | No                        | 52                  | 17 %       |
|     | Total                     | 306                 | 100 %      |

Source: Field survey, 2012

Out of 306 participants, 254 participants that is 83 % said that there were extinct wild animals & birds around the field and forest than past years due to deforestation , illegal hunters etc. Similarly, 52 participants that is 17 % said that there were not extinct wild animals & birds around the field and forest.

Name of extinct animals recorded were Jackal, tiger, Bear, Nigale, and Chituwa. Name of extinct birdswere Eagle, chibe, Thaula, BhakkuR, Hutitau, Maina, Long tailed bird, koili, gauthali, sparrow, Rupi, Kukku, Queen bird Karangkurung, Bakula, dove, peacock, Chil, Biu chara, Ke kasto chha, Kaphal pako and Jhiljhile.

The views of participants, about the fuel that was usually used for cooking purpose are shown in figure 5.10. The fuel that is usually used for cooking purpose was categorized as firewood, kerosene oil, LP gas and electricity.

**Figure 5.10 Fuel Used for Cooking Purpose**

Source: Field survey, 2012

Almost all households were using the firewood for cooking purpose. Out of 306 households, 207 households were totally depending on firewood, it means 67.65 percentage families of the study area were using the firewood for cooking purpose. Biogas, electricity and LP gas were used to some extent by 15.03 percentages, 11.11 percentages and 6.21 percentages households respectively along with the firewood as a supporting fuel.

More than 67 percent families were using the firewood for cooking purpose. Biogas, electricity and LP gas were partially used by rest families as a supporter of firewood. None of them uses the kerosene oil as a cooking fuel. Now biogas was being popular due to the governmental and non-governmental support.

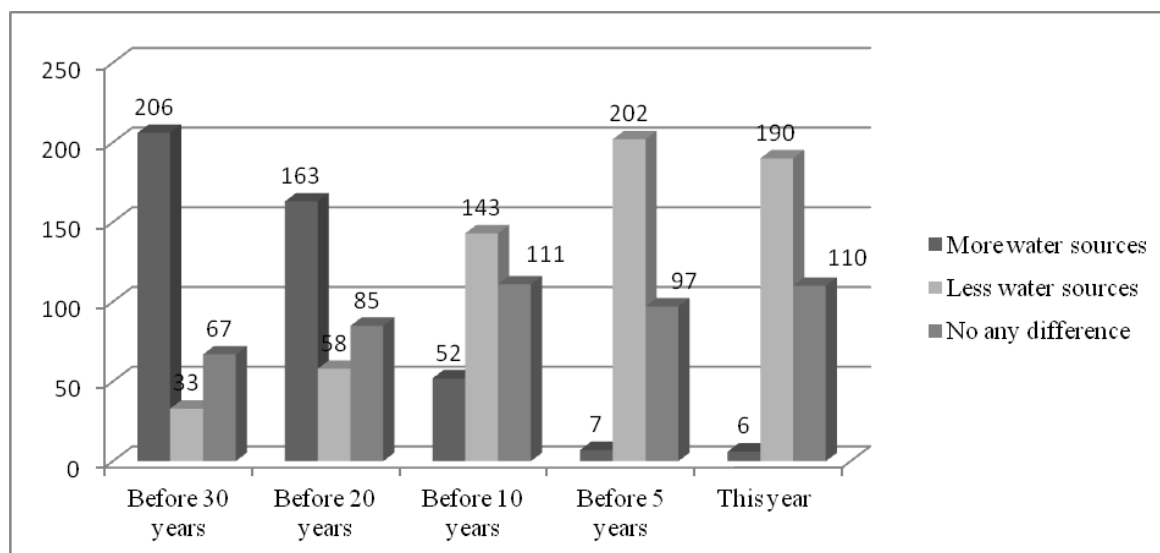
#### **Availability of Water Sources**

The status of water resources has been described in this topic.

The view of participants, about the amount of water in sources of water in the interval of thirty years, twenty years, ten years, five years and the running year were

illustrated in figure 5.11. The amounts of water in sources were categorized as more, less and no any difference.

**Figure 5.11 Amount of Water in Sources**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 206 participants that is 67.32 % said that there used to be more amount of water in sources of water. Similarly, 33 participants that is 10.78 % said it had become less and remaining 67 participants that is 21.90 % said that there was no any difference. Before 20 years, out of 306 participants, 163 participants that is 67.32 % said that there used to be more amount of water in sources of water. Similarly, 58 participants that is 18.95 % said it had become less and remaining 85 participants that is 27.78 % said that there was no any difference. Before 10 years, out of 306 participants, 52 participants that is 17 % said that there used to be more amount of water in sources of water. Similarly, 143 participants that is 46.73 % said it had become less and remaining 111 participants that is 36.27 % said that there was no any difference. Before 5 years, out of 306 participants, 7 participants that is 2.29 % said that there used to be more amount of water in sources of water. Similarly,

202 participants that is 66.01 % said it had become less and remaining 97 participants that is 31.7 % said that there was no any difference. In the running year, out of 306 participants, only 6 participants that is 1.96 % said that there is more amount of water in sources of water. Similarly, 190 participants that is 62.09 % said that it had become less and remaining 110 participants that is 35.95 % said that there was no any difference. The quantity of water in sources of water was decreasing continuously from last thirty years ago.

The view of participants, about the quantity of snow on mountain in the interval of thirty years, twenty years, ten years, five years and the running year are illustrated in table 5.8. The quantity of snow on mountain was categorized into more, less and don't know.

**Table 5.8**

**Quantity of Snow on Mountain**

| S.N | Interval of time | More Snow | More Snow ( %) | Less snow | Less snow (%) | No any difference | No any difference % |
|-----|------------------|-----------|----------------|-----------|---------------|-------------------|---------------------|
| 1   | Before 30 years  | 254       | 83.01          | 18        | 5.88          | 34                | 11.11               |
| 2   | Before 20 years  | 208       | 67.97          | 46        | 15.03         | 52                | 17                  |
| 3   | Before 10 years  | 59        | 19.28          | 221       | 72.22         | 26                | 8.5                 |
| 4   | Before 5 years   | 26        | 8.5            | 254       | 83            | 26                | 8.5                 |
| 5   | This year        | 13        | 4.25           | 268       | 87.58         | 25                | 8.17                |

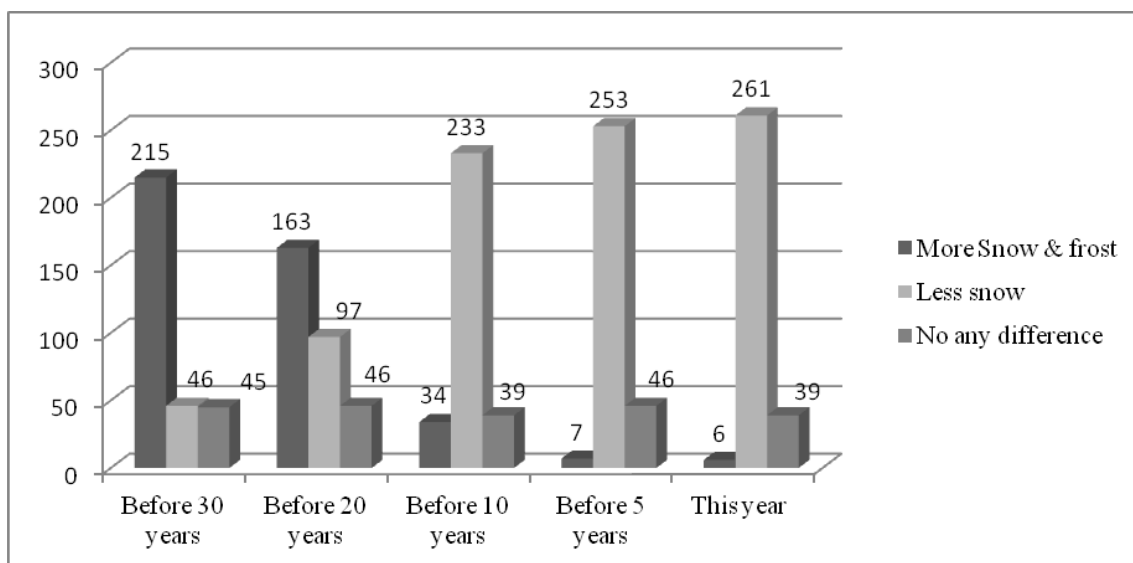
Source: Field survey, 2012

Before 30 years, out of 306 participants, 254 participants that is 83.01 % said that there used to be more quantity of snow on mountain. Similarly, 18 participants that is 5.88 % said it had become less and remaining 34 participants that is 11.11 % said that

there was no any difference. Before 20 years, out of 306 participants, 208 participants that is 67.97 % said that there used to be more quantity of snow on mountain.

Similarly, 46 participants that is 15.03 % said it had become less and remaining 52 participants that is 17 % said that there was no any difference. Before 10 years, out of 306 participants, 59 participants that is 19.28 % said that there used to be more quantity of snow on mountain. Similarly, 221 participants that is 72.22 % said it had become less and remaining 26 participants that is 8.5 % said that there was no any difference. Before 5 years, out of 306 participants, 26 participants that is 8.5 % said that there used to be more quantity of snow on mountain. Similarly, 254 participants that is 83 % said it had become less and remaining 26 participants that is 8.5 % said that there was no any difference. In the running year, out of 306 participants, only 13 participants that is 4.25 % said that there is more quantity of snow on mountain. Similarly, 268 participants that is 87.58 % said that it had become less and 25 participants that is 8.17% said that there was no any difference. The quantity of snow on mountain and snow line was sharply decreasing every year and snow & frost falling rate and snow falling area was also decreasing.

The view of participants, about the quantity of Snow & frost fall pattern in winter in the interval of thirty years, twenty years, ten years, five years and the running year are shown in figure 5.12. The quantities of Snow & frost fall pattern in winter were categorized into more, less and not know.

**Figure 5.12 The Quantity of Snow & Frost Fall Pattern in Winter**

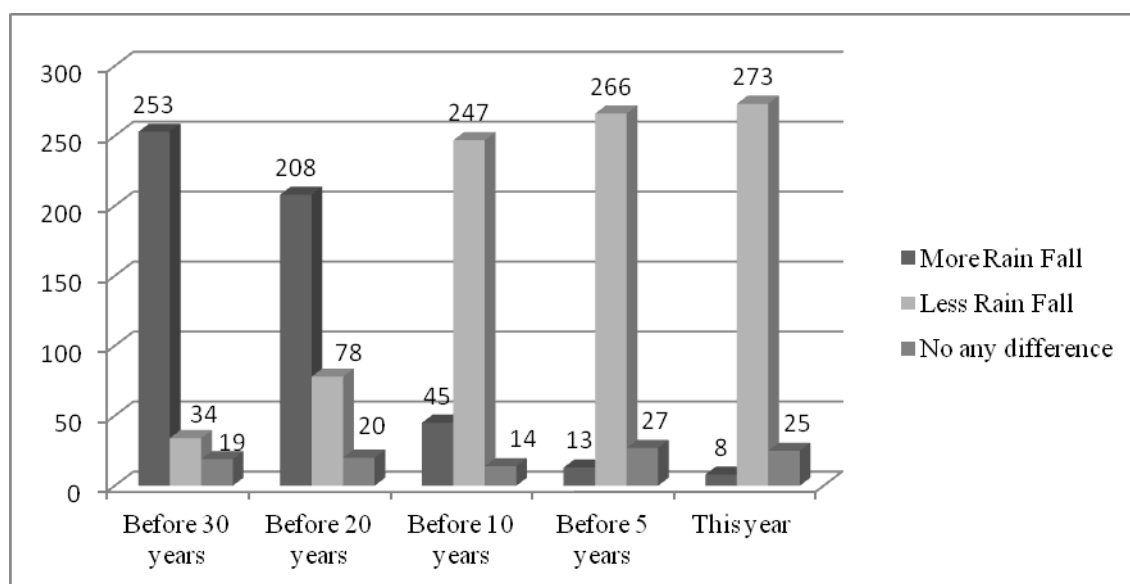
Source: Field survey, 2012

Before 30 years, out of 306 participants, 215 participants that is 70.26 % said that there used to be more quantity of Snow & frost fall in winter on mountain. Similarly, 46 participants that is 15.03 % said it had become less and remaining 45 participants that is 14.71 % said that there was no any difference. Before 20 years, out of 306 participants, 163 participants that is 53.27 % said that there used to be more quantity of Snow & frost fall in winter on mountain. Similarly, 97 participants that is 31.70 % said it had become less and remaining 46 participants that was 15.03 % said that there is no any difference. Before 10 years, out of 306 participants, 34 participants that is 11.11% said that there used to be more quantity of Snow & frost fall in winter on mountain. Similarly, 233 participants that is 76.14 % said it had become less and remaining 39 participants that is 12.75 % said that there was no any difference. Before 5 years, out of 306 participants, seven participants that is 2.29 % said that there used to be more quantity of Snow & frost fall in winter on mountain. Similarly, 253 participants that is 82.68 % said it had become less and remaining 46 participants that

was 15.03 % said that there is no any difference. In the running year, out of 306 participants, only 6 participants that is 1.96 % said that there is more quantity of Snow & frost fall in winter. Similarly, 253 participants that is 85.29 % said that it had become less and 261 participants that is 12.75% said that there was no any difference. The quantity of snow on mountain and snow line was sharply decreasing every year and snow & frost falling rate and snow falling area was also decreasing.

The view of participants, about the quantity of rain fall in winter in the duration of thirty years, twenty years, ten years, five years and the running year were shown in figure 5.13. The quantity of rain fall in winter was categorized into more, less and not known.

**Figure 5.13 Quantity of Rain Fall in Winter in the Interval of Thirty Years**



Source: Field survey, 2012

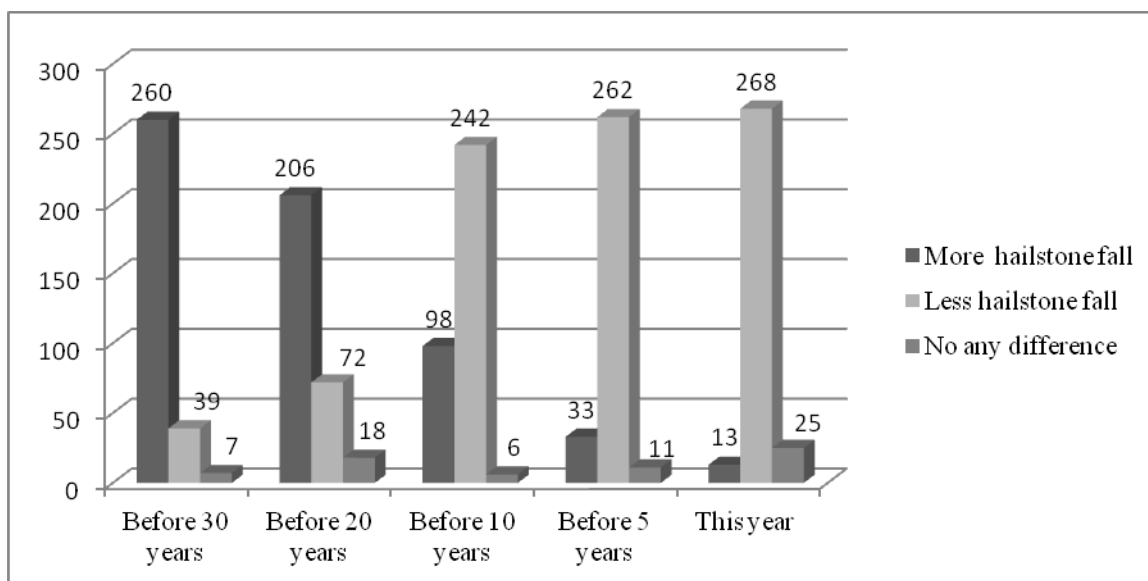
Before 30 years, out of 306 participants, 253 participants that is 82.68 % said that there used to be more quantity of rain fall in winter. Similarly, 34 participants that is 11.11 % said it had become less and remaining 19 participants that is 6.21 % said that there was no any difference. Before 20 years, out of 306 participants, 208 participants

that is 67.97 % said that there used to be more quantity of rain fall in winter. Similarly, 78 participants that is 25.49 % said it had become less and remaining 20 participants that is 6.54% said that there was no any difference. Before 10 years, out of 306 participants, 45 participants that is 14.71 % said that there used to be more quantity of rain fall in winter. Similarly, 247 participants that is 80.72 % said it had become less and remaining 14 participants that is 4.58 % said that there was no any difference. Before 5 years, out of 306 participants, 13 participants that is 4.25 % said that there used to be more quantity of rain fall in winter. Similarly, 266 participants that is 86.93 % said it had become less and remaining 27 participants that is 8.82 % said that there was no any difference. In the running year, out of 306 participants, only 8 participants that is 2.61 % said that there is more quantity of rain fall in winter. Similarly, 273 participants that is 89.22 % said that it had become less and 25 participants that is 8.17 % said that there was no any difference.

The quantity of rainfall in winter in the different interval of thirty years was decreasing; especially the rainfall in winter was sharply decreased from last ten years and winter season becoming drier.

The view of participants, about the quantity of hailstone fall along with rain in the interval of thirty years ago, twenty years ago, ten years ago, five years ago and the running year are illustrated in figure 5.14. The quantity of hailstone fall along with rain is categorized as more, less and not known.



**Figure 5.14 The Quantity of Hailstone Fall along with Rain**

Source: Field survey, 2012

Before 30 years, out of 306 participants, 260 participants that is 84.97 % said that there used to be more hailstone fall along with rain. Similarly, 39 participants that is 12.75 % said it had become less and remaining 7 participants that is 2.29 % said that there was no any difference. Before 20 years, out of 306 participants, 206 participants that is 67.32 % said that there used to be more hailstone fall along with rain.

Similarly, 72 participants that is 23.53 % said it had become less and remaining 18 participants that is 5.88 % said that there was no any difference. Before 10 years, out of 306 participants, 98 participants that is 32.03 % said that there used to be more hailstone fall along with rain. Similarly, 242 participants that is 79.08 % said it had become less and remaining 6 participants that is 1.96 % said that there was no any difference. Before 5 years, out of 306 participants, 33 participants that is 10.78 % said that there used to be more hailstone fall along with rain. Similarly, 262 participants that is 85.62 % said it had become less and remaining 11 participants that is 3.6 % said that there was no any difference. In the running year, out of 306 participants, only

13 participants that is 4.25 % said that there is more hailstone fall along with rain. Similarly, 268 participants that is 87.58 % said that it had become less and 25 participants that is 8.17 % said that there was no any difference. The pattern of hailstone falling rate was sharply decreasing before thirty years ago but some time it falls not imagined quantity and destroys the farming and wild animals and birds.

The view of participants, about the quantity of monsoon in the interval of thirty years, twenty years, ten years, five years and the running year were shown in table 5.9. The quantity of monsoon was categorized into more, less and not known.

**Table 5.9**

**The Quantity of Monsoon**

| S.N | Pattern of monsoon | More monsoon | More monsoons (%) | Fewer monsoon | Fewer monsoons (%) | No any difference | No any difference (%) |
|-----|--------------------|--------------|-------------------|---------------|--------------------|-------------------|-----------------------|
| 1   | Before 30 years    | 254          | 83.01             | 13            | 4.25               | 39                | 12.75                 |
| 2   | Before 20 years    | 241          | 78.76             | 38            | 12.42              | 27                | 8.82                  |
| 3   | Before 10 years    | 53           | 17.32             | 218           | 71.24              | 35                | 11.44                 |
| 4   | Before 5 years     | 26           | 8.5               | 243           | 79.41              | 37                | 12.09                 |
| 5   | This year          | 12           | 3.92              | 248           | 81.05              | 26                | 8.5                   |

Source: Field survey, 2012

Before 30 years, out of 306 participants, 254 participants that is 83.01 % said that there used to be more quantity of monsoon fall in summer. Similarly, 13 participants that is 4.25 % said it had become less and remaining 39 participants that is 12.75 % said that there was no any difference. Before 20 years, out of 306 participants, 241 participants that is 78.76 % said that there used to be more quantity of monsoon fall in

summer. Similarly, 38 participants that is 12.42 % said it had become less and remaining 27 participants that is 8.82 % said that there was no any difference. Before 10 years, out of 306 participants, 53 participants that is 17.32 % said that there used to be more quantity of monsoon fall in summer. Similarly, 218 participants that is 71.24 % said it had become less and remaining 35 participants that is 11.44 % said that there was no any difference. Before 5 years, Out of 306 participants, 26 participants that is 8.5 % said that there used to be more quantity of monsoon fall in summer. Similarly, 243 participants that is 79.41 % said it had become less and remaining 37 participants that is 12.09 % said that there was no any difference. In the running year, out of 306 participants, 12 participants that is 3.92 % said that there is more quantity of monsoon fall in summer. Similarly, 248 participants that is 81.05 % said that it had become less and 26 participants that is 8.5 % said that there was no any difference. The quantity of monsoon fall in summer was sharply decreased before ten years ago. Respondent said that monsoon was come for seven days to fifteen days continuously but now a day that became history.

The view of participants, about the depth of ponds and lakes with comparing past years were illustrated in table 5.10. The depth of ponds and lakes was categorized as more, less and don't know.

**Table 5.10**

**The Depth of Ponds and Lakes with Comparing Past Years**

| S.N | Depth of ponds and lakes | No. of participants | Percentage |
|-----|--------------------------|---------------------|------------|
| 1   | More depth than past     | 7                   | 2.29 %     |
| 2   | Less depth than past     | 202                 | 66.01 %    |
| 3   | No any different         | 97                  | 31.70 %    |
|     | Total                    | 306                 | 100 %      |

Source: Field survey, 2012

Out of 306 participants, seven participants that is 2.29 % said that there was more depth than past years due to care of sources. Similarly, 202 participants that is 60.01 % said that there was less depth than past due to the less rain fall and deposition of sand, clay etc. and 97 participants that is 31.70 % said that there was no any difference. There is less depth of lake and pond than past due to the less rain fall and deposition of sand and clay

The view of participants, about the quantity of water in streams and rivers with comparing past years were illustrated in table 5.11. The quantity of water in streams and rivers was categorized into more, less and not known.

**Table 5.11**  
**The Quantity of Water in Streams and Rivers**

| S.N | Quantity of water in streams and rivers | No. of participants | Percentage |
|-----|---|---------------------|------------|
| 1   | More water than past                    | 14                  | 4.58 %     |
| 2   | Less water than past                    | 149                 | 48.69 %    |
| 3   | No any difference                       | 143                 | 46.73 %    |
|     | Total                                   | 306                 | 100 %      |

Source: Field survey, 2012

Out of 306 participants, 14 participants that is 4.58 % said that there was more quantity of water in streams and rivers than past years due to protection of green coverage. Similarly, 149 participants that is 48.69 % said that there was less quantity than past due to the less rain fall and sources of water being regularly decreasing and 143 participants that is 46.73 % said that there was no any difference because it was dependant on rain fall.

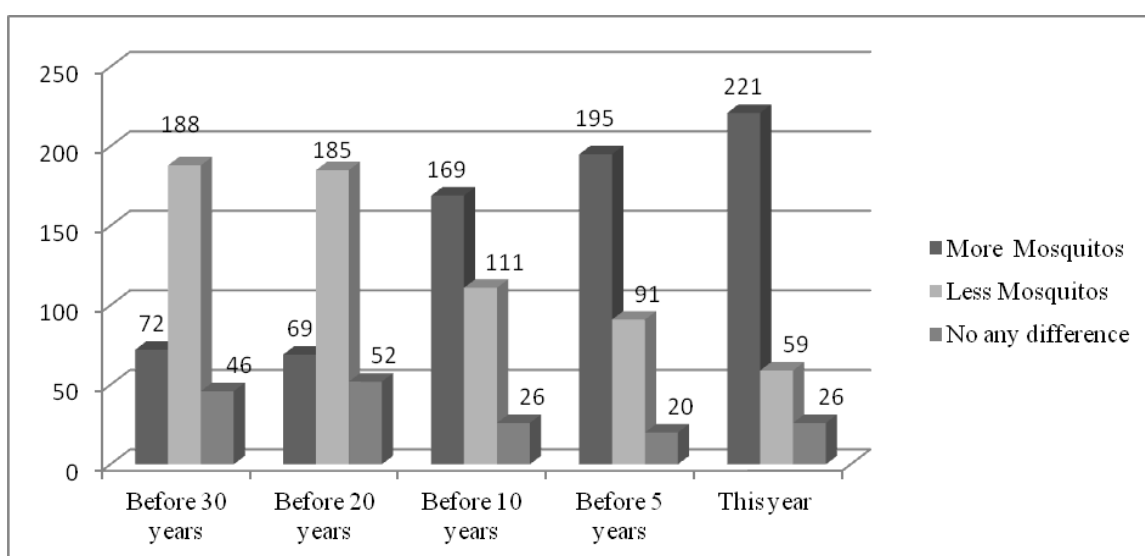
More than 49 percent participants said that there was less quantity of water in streams and rivers than past due to the less rain fall and decreasing sources of water. Some participants were surprising because of decreasing the water level in Arun river.

Man crossed the Arun River in winter of this year through the water which they did not have imagined in their life.

### Consequences in Insect Adaptation

The view of participants, about the number of mosquitoes in the interval of thirty years, twenty years, ten years, five years and the running year were shown in figure 5.15. The number of mosquitoes was categorized into more, less and not known.

**Figure 5.15 The Number of Mosquitoes in the Interval of Thirty Years**

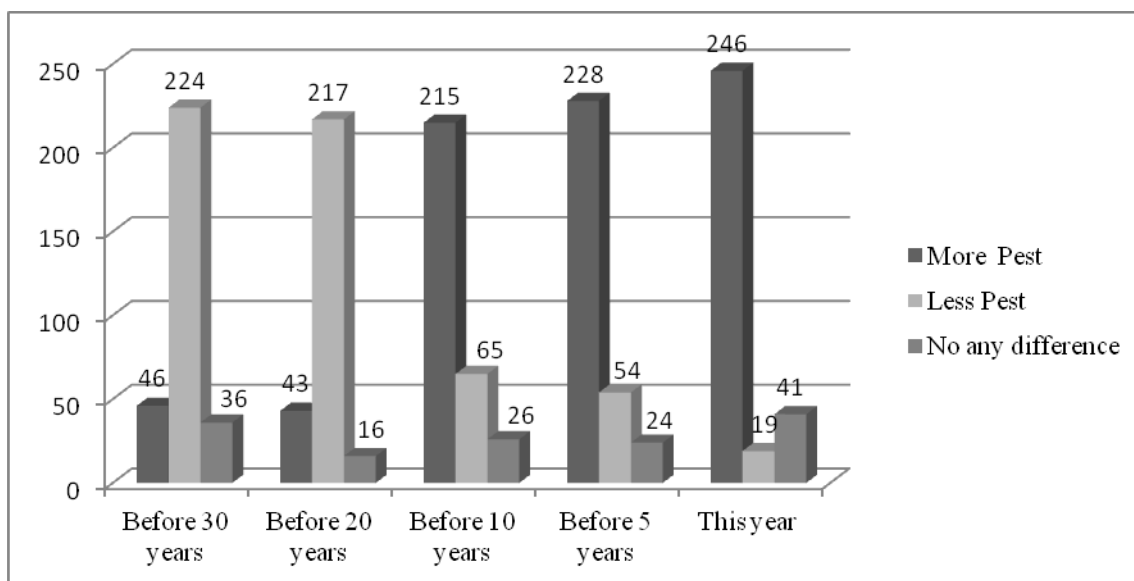


Source: Field survey, 2012

Before 30 years, out of 306 participants, 72 participants that is 23.53 % said that there used to be more number of mosquitoes in summer. Similarly, 188 participants that is 61.44 % said it had become less and remaining 46 participants that is 15.03 % said that there was no any difference. Before 20 years, out of 306 participants, 69 participants that is 22.55 % said that there used to be more number of mosquitoes in summer. Similarly, 185 participants that is 60.46 % said it had become less and remaining 52 participants that is 16.99 % said that there was no any difference. Before

10 years, out of 306 participants, 169 participants that is 55.23 % said that there used to be more number of mosquitoes in summer. Similarly, 111 participants that is 36.27 % said it had become less and remaining 26 participants that is 8.5 % said that there was no any difference. Before 5 years, Out of 306 participants, 195 participants that is 63.73 % said that there used to be more number of mosquitoes in summer. Similarly, 91 participants that is 29.74 % said it had become less and remaining 20 participants that is 6.54 % said that there was no any difference In the running year, out of 306 participants, 221 participants that is 72.22 % said that there is more number of mosquitoes in summer. Similarly, 59 participants that is 19.28 % said that it had become less and 26 participants that is 8.5 % said that there was no any difference. The number of mosquitoes was continuously increasing from last ten years. The quantity of pest was highly increasing from last ten years ago

The view of participants, about the number of pest in harvests in the interval of thirty years .ago, twenty years ago, ten years ago, five years ago and the running year are shown in figure 5.16. The number of pest in harvests is categorized as more, less and not known.

**Figure 5.16 The Number of Pest in Harvests**

Source: Field survey, 2012

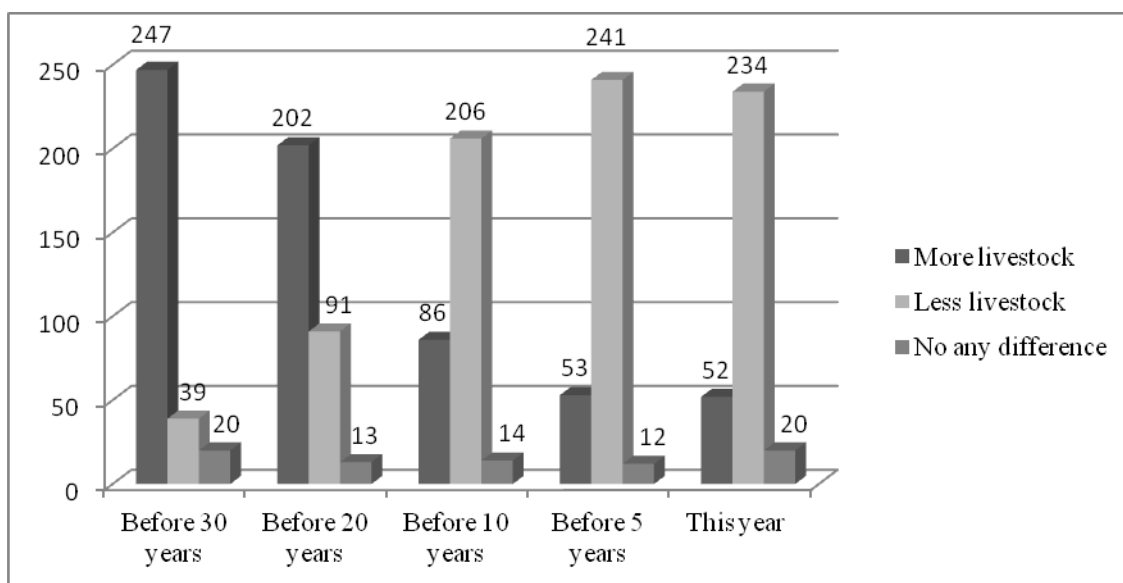
Before 30 years, out of 306 participants, 46 participants that is 15.03 % said that there used to be more number of pest in the harvest. Similarly, 224 participants that is 73.20 % said it had become less and remaining 36 participants that is 11.74 % said that there was no any difference. Before 20 years, out of 306 participants, 43 participants that is 14.05 % said that there used to be more number of pest in the harvest. Similarly, 217 participants that is 70.92 % said it has become less and remaining 16 participants that is 5.23 % said that there is no any difference. Before 10 years ago, out of 306 participants, 215 participants that is 70.26 % said that there used to be more number of pest in the harvest. Similarly, 65 participants that is 21.24 % said it had become less and remaining 26 participants that is 8.5 % said that there was no any difference. Before 5 years, out of 306 participants, 228 participants that is 74.51 % said that there used to be more number of pest in the harvest. Similarly, 54 participants that is 17.65 % said it had become less and remaining 24 participants that is 7.84 % said that there was no any difference. In the running year, out of 306 participants, 246 participants

that is 80.39 % said that there is more number of pest in harvests. Similarly, 19 participants that is 6.21 % said that it had become less and 41 participants that is 13.40 % said that there was no any difference.

### **Trends of Livestock Farming and Uses of Chemical Fertilizer and Pesticides**

The view of participants, about the number of livestock keeping in the interval of thirty years, twenty years, ten years, five years and the running year are shown in figure 5.17. The number of livestock keeping was categorized into more, less and not known.

**Figure 5.17 The Number of Livestock Keeping in the Interval of Thirty Years**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 247 participants that is 80.72 % said that there used to be more quantity of livestock keeping. Similarly, 39 participants that is 12.75 % said it had become less and remaining 20 participants that is 6.54 % said that there was no any difference. Before 20 years, out of 306 participants, 202 participants that is 66.01 % said that there used to be more quantity of livestock keeping.



Similarly, 91 participants that is 29.74 % said it had become less and remaining 13 participants that is 4.25 % said that there was no any difference. Before 10 years, out of 306 participants, 86 participants that is 28.10 % said that there used to be more quantity of livestock keeping. Similarly, 206 participants that is 67.32 % said it had become less and remaining 14 participants that is 4.58 % said that there was no any difference. Before 5 year, out of 306 participants, 53 participants that is 7.32 % said that there used to be more quantity of livestock keeping. Similarly, 241 participants that is 78.76 % said it had become less and remaining 12 participants that is 3.92 % said that there was no any difference. In the running year, out of 306 participants, 52 participants that is 17 % said that there is more quantity of livestock keeping. Similarly, 234 participants that is 76.47 % said that it had become less and 20 participants that is 6.54 % said that there was no any difference. The quantity of livestock farming trend was sharply decreasing after thirty years ago and production of crops was interrelated with farming of the cattle.

The view of participants, about the rate of occurrence of diseases in livestock and human in the interval of thirty years ago, twenty years ago, ten years ago, five years ago and the running year were illustrated in table 5.12. The rate of occurrence of diseases in livestock and human was categorized as more, less and not known.

**Table 5.12****The Rate of Occurrence of Disease in Livestock and Human**

| S.N | Pest in harvesting | More disease | More disease (%) | Less disease | Less disease (%) | No any difference | No any difference (%) |
|-----|--------------------|--------------|------------------|--------------|------------------|-------------------|-----------------------|
| 1   | Before 30 years    | 34           | 11.11            | 110          | 35.95            | 162               | 52.94                 |
| 2   | Before 20 years    | 25           | 8.17             | 124          | 40.52            | 167               | 54.58                 |
| 3   | Before 10 years    | 72           | 23.53            | 65           | 21.24            | 169               | 55.41                 |
| 4   | Before 5 years     | 116          | 37.91            | 34           | 11.11            | 156               | 50.98                 |
| 5   | This year          | 123          | 40.20            | 18           | 5.88             | 165               | 53.92                 |

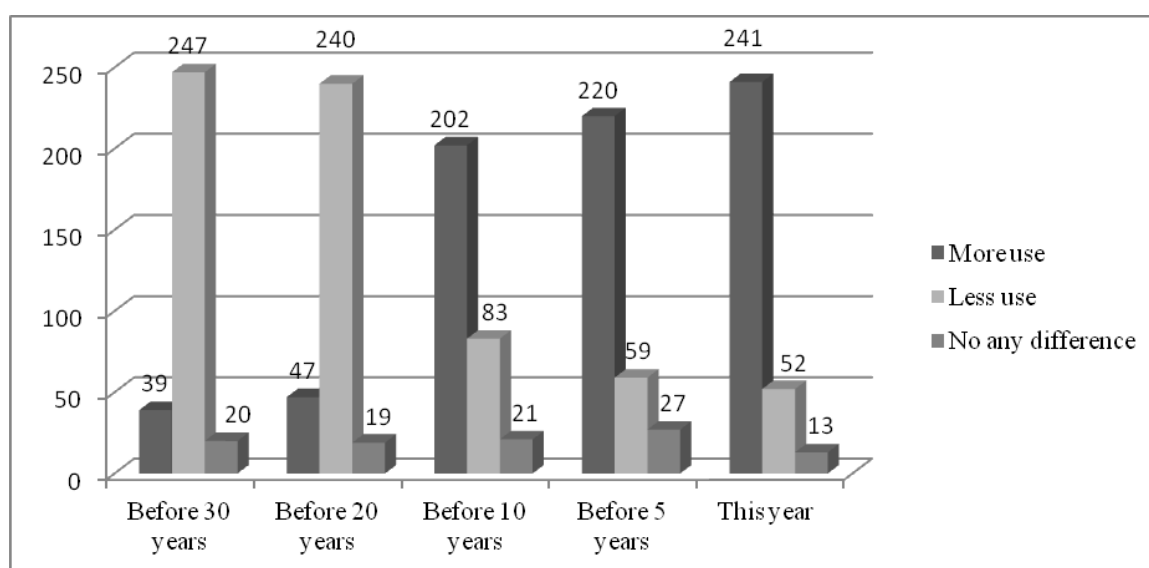
Source: Field survey, 2012

Before 30 years, out of 306 participants, 34 participants that is 11.11 % said that there used to be more diseases in livestock and human. Similarly, 110 participants that is 35.95 % said it had become less and remaining 162 participants that is 52.94 % said that there was no any difference. Before 20 years, out of 306 participants, 25 participants that is 8.17 % said that there used to be more diseases in livestock and human. Similarly, 124 participants that is 40.52 % said it had become less and remaining 167 participants that is 54.58 % said that there was no any difference. Before 10 years Out of 306 participants, 72 participants that is 23.53 % said that there used to be more diseases in livestock and human. Similarly, 65 participants that is 21.24 % said it had become less and remaining 169 participants that is 55.41 % said that there was no any difference. Before 5 years, out of 306 participants, 116 participants that is 37.91 % said that there used to be more diseases in livestock and

human. Similarly, 34 participants that is 11.11 % said it had become less and remaining 156 participants that is 50.98% said that there was no any difference. In the running year, out of 306 participants, 123 participants that is 40.20 % said that there is more diseases in livestock and human. Similarly, 18 participants that is 5.88 % said that it had become less and 165 participants that is 53.92 % said that there was no any difference. There was continuously increasing diseases in plants, livestock and human before twenty years ago.

The view of participants, about the rate of usage of using the chemical fertilizer and pesticides in the interval of thirty years ago, twenty years ago, ten years ago, five years ago and the running year were illustrated in figure 5.18. The rate of usage of using the chemical fertilizer and pesticides was presented as more, less and not known.

**Figure 5.18 The Rate of Usage of Using the Chemical Fertilizer and Pesticides**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 39 participants that is 12.75 % said that there used to be more use of the chemical fertilizer and pesticides. Similarly, 247

participants that is 80.72 % said its usage had become less and remaining 20 participants that is 6.54% said that there was no any difference. Before 20 years, out of 306 participants, 47 participants that is 15.36 % said that there used to be more use of the chemical fertilizer and pesticides. Similarly, 240 participants that is 78.53 % said its usage had become less and remaining 19 participants that is 6.21% said that there was no any difference. Before 10 years, out of 306 participants, 202 participants that is 66.01 % said that there used to be more use of the chemical fertilizer and pesticides. Similarly, 83 participants that is 27.12 % said its usage had become less and remaining 21 participants that is 6.86% said that there was no any difference. Before 5 years, out of 306 participants, 220 participants that is 71.90 % said that there used to be more use of the chemical fertilizer and pesticides. Similarly, 59 participants that is 19.28 % said it usage had become less and remaining 27 participants that is 8.82% said that there was no any difference. In the running year, out of 306 participants, 241 participants that is 78.76% said that there used to be more use of the chemical fertilizer and pesticides. Similarly, 52 participants that is 16.99 % said that its usage had become less and 13 participants that is 4.25 % said that there was no any difference. The chemical fertilizer and pesticides were highly used from twenty years ago. Nearly 80% households were using the chemical fertilizer and pesticides. The new danger diseases like Bird flu and Swine flu were repeating every year that was not known in past years. In addition, there were so many new pests, which attract the crops, and crops were reduced.

### Flowering and Fruiting in Plants

The view of participants, about the flowering and fruiting time of plants with comparing past few years were shown in table 5.13. The flowering and fruiting time of plants was categorized into faster, slower and unknown.

**Table 5.13**

#### The Flowering and Fruiting Time of Plants with Comparing Past few Years

| S.N | Flowering and fruiting time | No. of participants | Percentage |
|-----|-----------------------------|---------------------|------------|
| 1   | Faster than past            | 52                  | 17.00 %    |
| 2   | Slower than past            | 33                  | 10.78 %    |
| 3   | Don't know                  | 221                 | 72.22 %    |
|     | Total                       | 306                 | 100%       |

Source: Field survey, 2012

Out of 306 participants, 52 participants that is 17 % said that there was faster flowering and fruiting than past due to start the warm soon. Similarly, 33 participants that is 10.78 % said that there was later than past due to the late pattern of rain fall at present and 221 participants that is 72.22 % could not respond in yes or no. More than 72 percent respondents were unknown of fast and late flowering and fruiting time but 17 percent respondents said that there was faster flowering and fruiting than past due to fast starting the warm. Similarly, few respondents said that there was later than past due to the late pattern of rain fall.

The view of participants, about the ripping time of fruits with comparing to past years was presented in table 5.14. The ripping time of fruits was sort out into faster, later and not known.

**Table 5.14****The Ripping Time of Fruits with Comparing to Past Years**

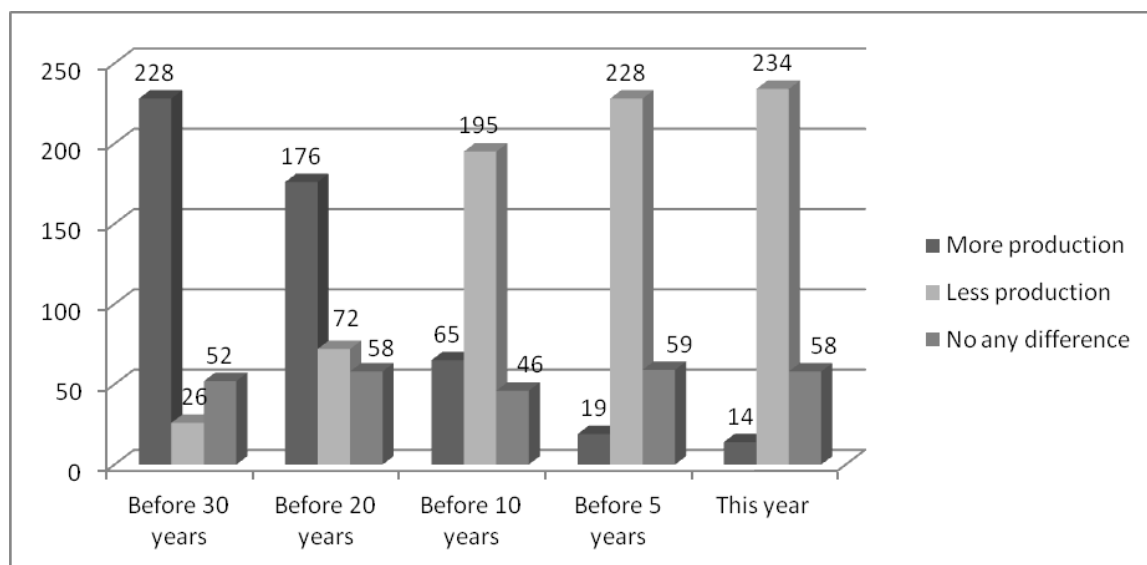
| S.N | Ripping time of fruits | No. of participants in particular heading | Percentage |
|-----|------------------------|---|------------|
| 1   | Faster than past       | 78  | 25.49%     |
| 2   | Later than past        | 20  | 6.54%      |
| 3   | Don't Know             | 208                                       | 67.97%     |
|     | Total                  | 306                                       | 100%       |

Source: Field survey, 2012

Out of 306 participants, 78 participants that is 25.49 % said that there was faster ripping the fruits than past due to start the warm soon. Similarly, 20 participants that is 6.54 % said that there was later than past due to the late pattern of rail fall now a days and 208 participants that is 67.97 % said that there was no any difference. More than 68 percent respondents are unknown of rapping time of the fruits. Similarly, more than 26 percent respondents said that there was faster rapping than past due to start the warm soon. Fewer respondents said that there was later than past due to the late pattern of rail fall now a day.

### **Trends of Production of Crops**

The view of participants, about the quantity of crop production in the interval of thirty years, twenty years, ten years, five years and the running year were shown in figure 5.19. The quantity of crop production was sort out into more, less and not known.

**Figure 5.19 The Quantity of Crop Production in the Interval of Thirty Years**

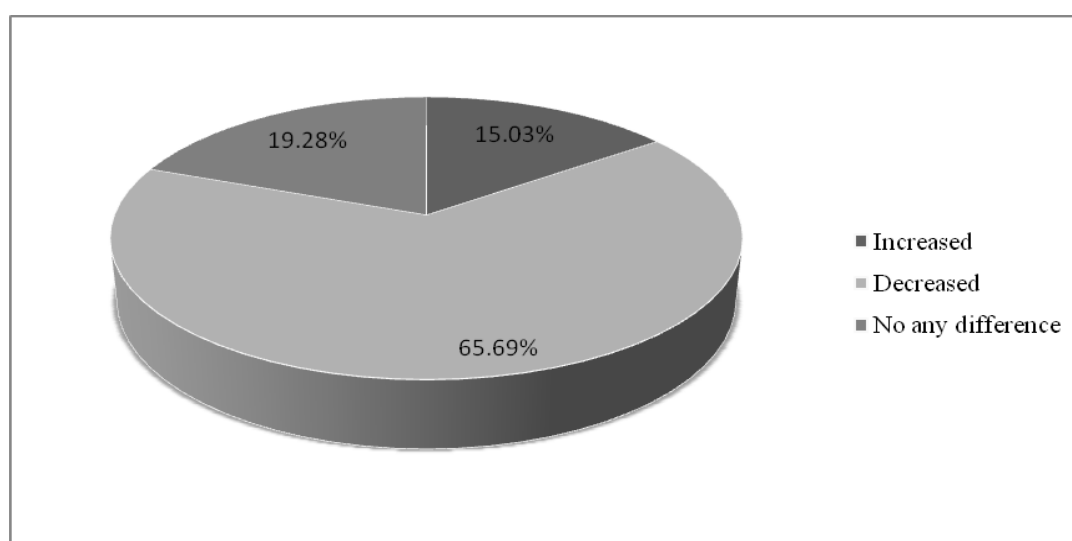
Source: Field survey, 2012

Before 30 years, out of 306 participants, 228 participants that is 74.51 % said that there used to be more quantity of crop production. Similarly, 26 participants that is 8.5 % said it had become less and remaining 52 participants that is 17% said that there was no any difference. Before 20 years, out of 306 participants, 176 participants that is 57.52 % said that there used to be more quantity of crop production. Similarly, 72 participants that is 23.53 % said it had become less and remaining 58 participants that is 18.95% said that there was no any difference. Before 10 years, out of 306 participants, 65 participants that is 21.24 % said that there used to be more quantity of crop production. Similarly, 195 participants that is 63.73 % said it had become less and remaining 46 participants that is 15.03% said that there was no any difference. Before 5 years, out of 306 participants, 19 participants that is 6.21 % said that there used to be more quantity of crop production. Similarly, 228 participants that is 74.51 % said it had become less and remaining 59 participants that is 19.34% said that there was no any difference. In the running year, out of 306 participants, 14 participants

that is 4.58 % said that there was more quantity of crop production. Similarly, 234 participants that is 76.47 % said that it had become less and 58 participants that is 18.95 % said that there was no any difference. There were more female participants of the age of 40-50 due to the overseas employee of male and that cause affects to decrease the agro-production. The quantity of crop production was continuously decreasing after thirty years ago. Majority respondents said that there was less production of crops due to the irregular rain fall pattern, lack of fertilizer, quality seeds, irrigation etc. Few respondents said that there was increased production of crops due to use of high quality of seeds, facilities of good irrigation and use of chemical & organic fertilizers, and pesticides.

The view of participants, about the Production of crops due to the change pattern of weather, rain and temperature with comparing past years were shown in figure 5.20. The Production of crops due to the change pattern of weather, rain and temperature was categorized into increased, decreased and do not know.

**Figure 5.20 The Production of Crops due to the Change Pattern of Weather, Rain and Temperature etc. with Comparing Past Years**



Source: Field survey, 2012



Out of 306 participants, 46 participants that were 15.03 % said that there is increased the production of crops. Similarly, 201 participants that is 65.69 % said that there was less production of crops due to the irregular rain fall pattern and remaining 59 participants that is 19.28 % said that there was no any difference.

The views of participants, about reasons for increased crop production with comparing past years were illustrated on table 5.15. The reasons for increased crop production were categorized into use of fertilizer and pesticide, use of high quality seed, good irrigation and favor of climate change.

**Table 5.15**

**The Reasons for Increased Crop Production**

| S.N | Reasons for increased production | No. of participants | Percentage |
|-----|----------------------------------|---------------------|------------|
| 1   | Use of fertilizers and pesticide | 13                  | 28.26      |
| 2   | Use of high quality seeds        | 19                  | 41.30      |
| 3   | Good irrigation                  | 14                  | 30.44      |
| 4   | Favors of climate change         | 0                   | 0          |
| 5   | All of the above                 | 0                   | 0          |
|     | Total                            | 46                  | 100        |

Source: Field survey, 2012

Out of 46 participants, 13 participants that is 28.26 % said that there was increased the production of crops due to use of chemical & organic fertilizers and pesticides.

Similarly, 19 participants that is 41.30 % said that there was increased production of crops due to use of high quality of seeds and remaining 14 participants that is 30.44 % said that there was increased production of crops due to the facilities of good irrigation. There was not any one participant on the favor of climate change for good

production. There was not any one participant on the favor of climate change for good production.

The views of participants about the alternative income and food to recover the decreased production were illustrated on table 5.16. The alternative income and food for to recover the decreased production was classified into working as a labour, service, overseas employment, keeping cattle and others.

**Table 5.16**

**The Alternative Sources of Income and Food against Deficit**

| S.N | Alternative income & food | No. of participants | Percentage |
|-----|---------------------------|---------------------|------------|
| 1   | By working as a labor     | 72                  | 35.82 %    |
| 2   | Service                   | 18                  | 8.96 %     |
| 3   | Overseas employment       | 71                  | 35.32 %    |
| 4   | By keeping cattle         | 26                  | 12.94 %    |
| 5   | Others                    | 14                  | 6.96 %     |
|     | Total                     | 201                 | 100 %      |

Source: Field survey, 2012

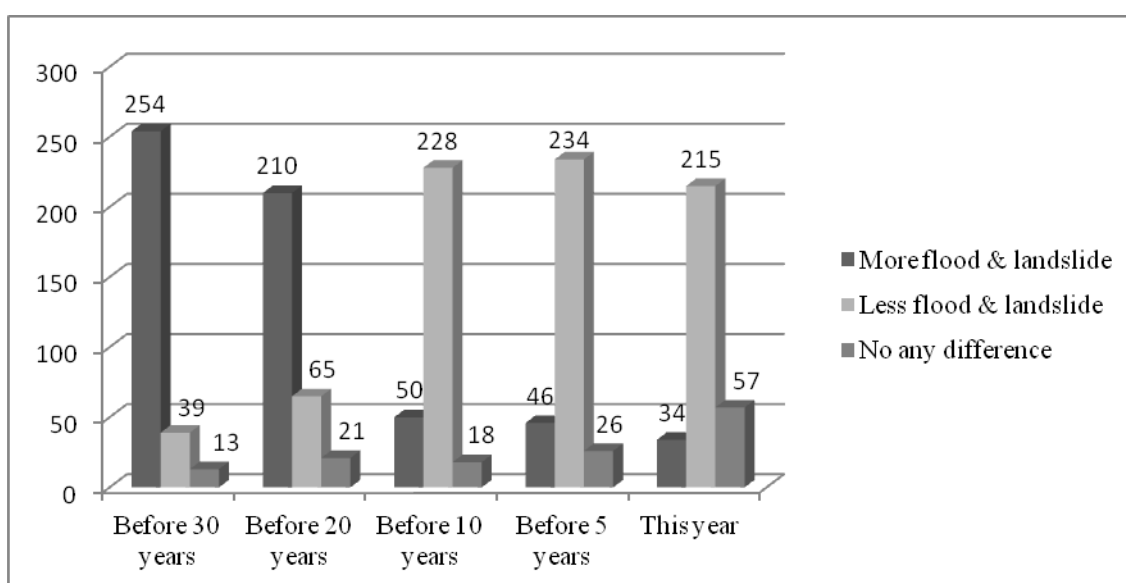
Out of 201 participants, 72 participants that is 35.82 % said that there was alternative income by working as a labor to recover the decreased production. Similarly, 18 participants that is 8.96 % said that there was alternative income from service, 71 participants that is 35.32 said there was alternative income from overseas employment and 26 participants that is 12.94% said that there was alternative income by keeping the cattle and remaining 14 participants that is 6.96 % said that there was alternative income from other sources like small business. More than 36 percent respondents said that there was alternative income by working as a labor to recover the decreased production and 35.32 percent said there was alternative income from overseas

employment. Similarly, other participants said that there is alternative income by keeping the cattle and small business.

### Consequences of Disasters

The views of participants, about the rate of occurrence of draught, flood and landslide in the interval of thirty years, twenty years, ten years, five years and the running year were shown in figure 5.21. The rate of occurrence of draught, flood and landslide was categorized into more, less and not known.

**Figure 5.21 The Rate of Occurrence of draught, Flood and Landslide in the Interval of Thirty Years**



Source: Field survey, 2012

Before 30 years, out of 306 participants, 254 participants that is 83.01 % said that there used to be more flood and landslide. Similarly, 39 participants that is 12.75 % said it has become less and remaining 13 participants that is 4.25% said that there was no any difference. Before 20 years, out of 306 participants, 210 participants that is 68.63 % said that there used to be more flood and landslide. Similarly, 65 participants

that is 21.24 % said it had become less and remaining 21 participants that is 6.86% said that there was no any difference. Before 10 years, out of 306 participants, 50 participants that is 16.34 % said that there used to be more flood and landslide. Similarly, 228 participants that is 74.51 % said it had become less and remaining 28 participants that is 9.15 % said that there was no any difference. Before 5 years, out of 306 participants, 46 participants that is 15.03 % said that there used to be more flood and landslide. Similarly, 234 participants that is 76.47 % said it has become less and remaining 26 participants that is 8.5% said that there is no any difference. In the running year, out of 306 participants, 34 participants that is 11.11% said that there is more flood and landslide. Similarly, 215 participants that is 70.26 % said that it had become less and 57 participants that is 18.63 % said that there was no any difference. The flood and landslide was higher before twenty years ago but the flood and landslide was sharply decreased after twenty years ago because of fewer monsoons.

### **Pattern of Migration**

The views of participants, about the migration pattern in Arun Valley area were shown on table below. The migration pattern in Arun Valley was categorized into more, less, equal number.

**Table 5.17**

#### **The Migration Pattern in Arun Valley**

| S.N | Migration status                               | No. of participants | Percentage(%) |
|-----|--|---------------------|---------------|
| 1   | More Migration in village                      | 46                  | 15.03         |
| 2   | More Migration from village                    | 156                 | 50.98         |
| 3   | Generally equal numbers either going or coming | 104                 | 33.99         |
|     | Total  | 306                 | 100           |

Source: Field survey, 2012

Out of 306 participants, 46 participants that is 15.03 % said that there was more people coming as a migrated. Similarly, 156 participants that is 50.98 % said that there was more people going from village as a migrated and remaining 104 participants that is 33.99 % said that there was equal numbers either going or coming. The migration from study area was higher than migration to that area. There were reasons for migrating due to the facilities of education, service, health, transportation and drinking water. The views of participants, about the reasons for migration pattern in Arun valley were shown on table below. The reasons for migration pattern in Arun valley was presented as urbanization, fertile land and facilities of education, health, transportation, drinking water etc.

**Table 5.18**

**The Reasons for Migration in Arun Valley Area**

| S.N | Reasons for migrating   | No. of Participants | Percentage (%) |
|-----|---|---------------------|----------------|
| 1   | Due to the urbanization   | 13                  | 28.26          |
| 2   | Due to the fertile land   | 7                   | 15.22          |
| 3   | Due to the facilities of education, health, transportation, drinking water etc. | 26                  | 56.52          |
|     | Total   | 46                  | 100            |

Source: Field survey, 2012

Out of 46 participants, 13 participants that is 28.26 % said that there was a reason for migrating pattern in Arun valley due to the development of urban. Similarly, seven participants that is 15.22 % said that there was a reason for migrating due to the fertile land and remaining 26 participants that is 56.52 % said that there were reasons for migrating due to the facilities of education, health, transportation, drinking water etc.

There was other reason for migrating pattern from Arun valley to other places especially to terai reason due to poverty.

The views of participants, about the reasons for migrating pattern from Arun valley area were illustrated in table 5.19. The reasons for migrating pattern from Arun valley area was categorized into poverty, being rich, lack of farming land and The problems of education, health, drinking water, transportation etc.

**Table 5.19**

**The Reasons for Migrating from Arun Valley Area**

| S.N | Reasons for migrating  | No. of participants | Percentage (%) |
|-----|--|---------------------|----------------|
| 1   | Poverty  | 34                  | 21.74 %        |
| 2   | Being rich   | 69                  | 44.23 %        |
| 2   | Lack of farming land   | 27                  | 13.31 %        |
| 3   | The problems of education, health, drinking water, transportation etc. | 26                  | 16.67 %        |
|     | Total  | 156                 | 100 %          |

Source: Field survey, 2012

Out of 156 participants, 34 participants that is 21.74 % said that there was a reason for migrating pattern from Arun valley due to poverty. Similarly, 69 participants that is 44.23 % said that there was a reason for migrating due to lack of farming land and remaining 26 participants that is 16.67 % said that there were reasons for migrating due to the problem of education, health, drinking water, transportation etc.

The views of participants, about the ways for sustainable livelihood of poor and excluded people by protecting from impact of climate change were conservation of forest by using the alternative resource of cooking purpose like electricity, bio gas solar energy, by applying the modern technology on agriculture sectors according to

changing climate, focus on fruit farming, ever green farming, biannual plants like cardamom, tea, Kiwi, herbals , control the deforestation and High light and support for forestation through the governmental and non- governmental sectors, model irrigation system should develop in farming area as a irrigation is the right of land, alternative crops should be referred to farmers according to changing climate by NARC, support to farmers by providing the best quality of plastics for tunnel house in the vegetables field, herbals, provide attractive package to people through the government or non-government offices for planting at least five to ten plants every house of village area, rule of community forest should be favor of poor and excluded people, by providing the awareness programs about the climate change and possible sustainable programs to withstand with climate change and focus for alternative additional professional like farming, trade, handcrafts, animals keeping, bee keeping, silk keeping etc.

### **People's Experience about Impacts of Climate Change**

People from the research site expressed that rainfall pattern has been changed. It means there is no regular rainfall as in past years. Monsoon has been being late. Some sources of water are totally dried and the quantity of water of some sources have been decreasing. There is no existence of more snow in Mt. Makalu as in past years and also snow line has been diminishing. Large black spots can be seen on Makalu. Flood of snow in Arun river has been increasing from few years ago. The water level of Arun river has been down and man could cross through the river in dry season. Production has been decreasing and temperature has also increasing. Especially animals like tiger, jackals, bear and birds like eagle are disappeared from this study

area. Fog covers long time, which had been seen since five years ago. Fruits and crops are highly affected by insects.

### **Chapter Summary**

This chapter has described the climate change and its thereat to everywhere. The questions used for the inquiry covered impact of climate change in natural resources, bio-diversity, and agriculture, social and economic sectors.

The next chapter presents the findings related to the cooperatives: The means of sustainable livelihood.



## CHAPTER VI

### **COOPERATIVES: THE MEANS OF SUSTAINING LIVELIHOOD**

The previous chapter has described the data presentation and analysis of climate change. This chapter deals access of excluded communities in cooperatives, moving ahead: from group to primary cooperative versus micro-cooperative, primary cooperative (Micro-cooperative) management, future cooperative model: alternative plate form for primary poverty alleviation and beyond the existing cooperative for poverty alleviation.

Participants were associated to members of co-operative, consumers of co-operative, personnel of governmental and non-governmental who were related to co-operative movement, co-operative organization of different natures, authors about the co-operative, publics who were concerned to co-operative sector etc.

#### **Access of Excluded Communities in Cooperatives**

Participation of excluded communities in cooperatives, benefits from cooperatives and poverty alleviation of them through cooperative movements are included in it.

The participation of Dalit, marginal, excluded poor people in cooperative organizations is categorized as an active, moderate, few, rare and nil. The view of participants, about the participation of Dalit, marginal, excluded poor people in cooperative organizations of Nepal is shown on table 6.1.

**Table 6.1**

**The participation of Dalit, Marginal and Excluded People in Co-operative Organizations**

| S.N | Participation          | No. of participation | No. of participation (%) |
|-----|------------------------|----------------------|--------------------------|
| 1   | Active (More than 50%) | 24                   | 7.55                     |
| 2   | Moderate (20% - 50%)   | 89                   | 27.99                    |
| 3   | Few (10% - 20%)        | 152                  | 47.79                    |
| 4   | Rare (5% - 10%)        | 49                   | 15.41                    |
| 5   | Nil                    | 4                    | 1.26                     |
|     | Total                  | 318                  | 100                      |

Source: Field survey, 2012

Out of 318 participants, 24 participants that is 7.55 % and 89 participants that is 27.99 % said that there was active participation and moderate participation of Dalit, marginal, excluded poor people in cooperative organizations of Nepal respectively. Similarly, 152 participants that is 47.79 % and 49 participants that is 15.41 % said that there was few participation and rare participation in cooperative movement respectively. Remaining four participants that is 1.26 % said that there was zero participation of Dalit, marginal, excluded poor people in cooperative. Only few numbers of members were benefited from cooperatives.

The advantages that had been receiving by Dalit, marginal, excluded and poor people due to the participation of cooperatives was presented into active, common, few, rare and nill. The view of participants, about the advantages that had been receiving by Dalit, marginal, excluded and poor people due to the participation of cooperatives has been illustrated in table 6.2.

**Table 6.2****The Level of Benefits from Cooperatives by Dalits, Excluded and Poor People**

| S.N | Advantages | No. of participation | No. of participation (%) |
|-----|------------|----------------------|--------------------------|
| 1   | Good       | 32                   | 10.06                    |
| 2   | Common     | 96                   | 30.19                    |
| 3   | Few        | 151                  | 47.48                    |
| 4   | Rare       | 36                   | 11.32                    |
| 5   | Nil        | 3                    | 0.94                     |
|     | Total      | 318                  | 100                      |

Source: Field survey, 2012

Out of 318 participants, 32 participants that is 10.06 % and 96 participants that is 30.19 % said that there is good and common advantages that had been receiving by Dalit, marginal, excluded and poor people due to the participation of cooperatives respectively. Similarly, 151 participants that is 47.48 % and 36 participants that is 11.32 % said that there was few and rare advantages that had been receiving by them in cooperative respectively. Remaining 3 participants that is 0.94 % said that there was zero advantages that have been receiving by Dalit, marginal, excluded poor people from cooperative. Few numbers of these communities were benefited from cooperatives.

The effective action and plans in order to alleviate the poverty of Dalit, Marginal, excluded and poor people through co-operative movement was categorized into formation of small groups, increasing the speed of cooperative and others. The view of participants, about the effective action and plans in order to alleviate the poverty of Dalit, Marginal, excluded and poor people through co-operative movement is presented in table 6.3.

**Table 6.3**

**The effective action plan for Poverty Alleviation through Co-operative Movement**

| S.N | Out comes                           | No. of participation | No. of participation (%) |
|-----|-------------------------------------|----------------------|--------------------------|
| 1   | Formation of small groups           | 229                  | 72.01                    |
| 2   | Increasing the speed of cooperative | 62                   | 19.50                    |
| 3   | Others                              | 27                   | 8.49                     |
|     | Total                               | 318                  | 100                      |

Source: Field survey, 2012

Out of 318 participants, 229 participants that is 72.01 % said that there was the effective action and plans in order to alleviate the poverty of Dalit, Marginal, excluded and poor people through co-operative movement by forming the small groups with based on value and norms of co-operative to provide the co-operative education. Similarly, 62 participants that is 19.50 % said that there is the effective action and plan to alleviate the poverty by increasing the speed of present co-operative movement for to involve in Co-operative. Remaining 27 participants that is 8.49 % said that there were other programs like poverty alleviation fund; NGOs/INGOs. High majority's view is to form the small groups with the based on value and norms of cooperative to provide the cooperative education.

The view of participants, about the suggestion for to increase the participation of the Dalits, marginal, excluded and poor people in co-operative movement was to provide the co-operative education to the targeted people like the Dalits, marginal, excluded and poor people, to provide the awareness programs through the workshop and training, to provide the facility of visiting to successful co-operatives, to

providing the subsidies and aids to the targeted co-operatives of the Dalits, marginal, excluded and poor people for certain years, to provide the compulsory literacy classes for illiteracy members of co-operative, that helped to improve the awareness and sustainability life of the co-operative members.

### **Moving Ahead: From Group to Primary Cooperative Versus Micro Cooperative**

The development of group for poor and excluded group to encourage the cooperative movement to change pattern of primary cooperative of small number of members.

The view of participants, about the poor and excluded people were united as a small group with principle, value and norms of cooperative for to involve in cooperative movement is shown on table 6.4. The view was categorized into increase the value of cooperative, decrease the value of cooperative and don't know.

**Table 6.4**

#### **The Poor and Excluded People's Involvement in Co-operative Movement through Small Groups**

| S.N | Outcome                        | No. of Participants | Total participants (%) |
|-----|--------------------------------|---------------------|------------------------|
| 1   | Increased value of cooperative | 221                 | 69.50                  |
| 2   | Decreased value of cooperative | 52                  | 16.35                  |
| 3   | Don't know                     | 45                  | 14.15                  |
|     | Total                          | 318                 | 100                    |

Source: Field survey, 2012

Out of 318 participants, 221 participants that is 69.50 % said that there is good facilitated to increase the value of co-operative by uniting the poor and excluded people as a small group with principle, value and norms of cooperative to involve in cooperative movement. Similarly, 52 participants that is 16.35 % said that, that

supports to decrease the value of cooperative and remaining 45 participants that is 14.15 % said that there was not any difference by uniting the poor and excluded people as a small group with principle, value and norms of cooperative to involve in cooperative movement.

The view of participants, about the poor and excluded people are united as a small group with the principle, values and norms of cooperative to involve in cooperative movement that would be effective and the small groups are possible to name as a primary cooperative has been presented in table 6.5.

**Table 6.5**

**Response towards Primary Co-operative**

| S.N | Response   | No. of Participants | Total No. of participants (%) |
|-----|------------|---------------------|-------------------------------|
| 1   | Good       | 211                 | 66.35                         |
| 2   | Not good   | 68                  | 21.39                         |
| 3   | Don't Know | 39                  | 12.26                         |
|     | Total      | 318                 | 100                           |

Source: Field survey, 2012

Out of 318 participants, 211 participants that is 66.35 % said that, that was good to name as a primary cooperative. Similarly, 68 participants that is 21.39 % said that, that was not good to name as a primary cooperative and remaining 39 participants that is 12.26 % said that not known. High majority was in the favor of primary cooperative.

If cooperatives were not possible to form, the view of participants, about the position of these small groups to provide the primary values of co-operative might be either coordination of working among the group members as a cooperative value, or

development of new organization for the group or cooperative education plate form for the group which have been shown in table 5.6.

**Table 6.6**

**Alternative Views for Groups rather than Cooperatives**

| S.N | Outcome   | No. of Participants | Total No. of participants (%) |
|-----|---|---------------------|-------------------------------|
| 1   | Co-ordination of working among the group members as a co-operative value. | 24                  | 35.29                         |
| 2   | Development of new organization for these groups                          | 3                   | 4.41                          |
| 3   | Co-operative education plate form for these groups                        | 41                  | 60.29                         |
|     | Total   | 68                  | 100                           |

Source: Field survey, 2012

Out of 68 participants, 24 participants that is 35.29 % said that, that was good to coordinate for working among the group members as a co-operative value. Similarly, three participants that is 4.41 % said that, that was good to develop new organization for these groups and remaining 41 participants that is 60.29 % said that to develop the co-operative education plate form for these groups.

The view of participants, about the alternative naming of the primary co-operative has been illustrated in table 6.7. The alternative naming of the primary co-operative was categorized according to micro-cooperative organization, only primary cooperative organization and not known.

**Table 6.7****The Alternative Naming of the Primary Co-operative**

| S.N | Name                                   | No. of Participants | Total No. of participants (%) |
|-----|--|---------------------|-------------------------------|
| 1   | Micro- cooperative organization        | 138                 | 62.44                         |
| 2   | Only primary co-operative organization | 49                  | 22.17                         |
| 3   | Don't know                             | 24                  | 10.86                         |
|     | Total                                  | 221                 | 100                           |

Source: Field survey, 2012

Out of 221 participants, 138 participants that is 62.44 % said that the name of primary co-operative was good as a name of micro- cooperative organization and 49 participants that is 22.17 % said that, the name of primary co-operative was the best only primary co-operative organization. Remaining 24 participants that is 10.86 % said that there was not any difference either alternative name or same name. More than 62 percent participants were agreed to name micro-cooperative organization.

### **Primary Co-operative (Micro-cooperative) Management**

The views of participants about the management of primary cooperative (Micro-cooperative) have been included in this topic.

The view of participants, about the minimum required members for registration of the primary co-operative, if small groups were recognized as a primary co-operative has been shown on table 6.8.



**Table 6.8****The Minimum Required Members for Registration of the Primary Co-operative**

| S.N | Minimum Required Members | No. of Participants | No. of participants (%) |
|-----|--------------------------|---------------------|-------------------------|
| 1   | At least 3 members       | 0                   | 0                       |
| 2   | At least 5 members       | 37                  | 17.54                   |
| 3   | At least 7 members       | 93                  | 44.08                   |
| 4   | At least 9 members       | 24                  | 11.37                   |
| 5   | At least 11 members      | 57                  | 27.01                   |
|     | Total                    | 211                 | 100                     |

Source: Field survey, 2012

Out of 211 participants, 37 participants that is 17.54 % said that minimum five members were required for registration of the primary co-operative. Similarly, 93 participants that is 44.08 % and 24 participants that is 11.37 % said that minimum seven members and minimum nine members are required for registration of the primary co-operative respectively. Remaining 57 participants that is 27.01 % said that there was minimum eleven members were required for registration of the primary co-operative. According to participants, seven members and eleven members were good number for registration of primary cooperative.

The view of participants, about the registration office of primary co-operative has been illustrated in table 6.9. The registration office of primary co-operative was projected as local bodies VDC/ Municipality, constitution level, district level and present provision.

**Table 6.9****The Opinion towards the Registration Office of Primary Co-operative**

| S.N | Registration office            | No. of Participants | Total No. of participants (%) |
|-----|--------------------------------|---------------------|-------------------------------|
| 1   | Local bodies VDC/ municipality | 102                 | 48.34                         |
| 2   | Constituency level             | 59                  | 27.96                         |
| 3   | District level                 | 42                  | 19.91                         |
| 4   | Present provision              | 8                   | 3.79                          |
|     | Total                          | 221                 | 100                           |

Source: Field survey, 2012

Out of 211 participants, 102 participants that is 48.34 % said that the registration office of primary co-operative was good to establish in local level like VDC/NP.

Similarly, 59 participants that is 27.96 % and 42 participants that is 19.91 % said that the registration office of primary co-operative was good for establishing in constituency level and district level respectively. Remaining eight participants that is 3.79 % said that the registration office of primary co-operative was good to establish as a present provision. According to participants' view, registration office is best in local bodies VDC/municipality.

The view of participants, about the development of micro-cooperative organization or secondary cooperative from the primary micro-cooperatives of same nature has been shown in table 6.10. The development of cooperative organization from the primary micro-cooperatives of same nature was categorized as good, not good and not known.

**Table 6.10****Colonization of the Primary Co-operatives of Same Nature**

| S.N | Outcome    | No. of Participants | No. of participants (%) |
|-----|------------|---------------------|-------------------------|
| 1   | Good       | 143                 | 64.71                   |
| 2   | Not Good   | 52                  | 23.53                   |
| 3   | Don't know | 26                  | 11.76                   |
|     | Total      | 221                 | 100                     |

Source: Field survey, 2012

Out of 221 participants, 143 participants that is 64.71 % said that, that was good to convert the primary co-operatives into co-operative organization. Similarly, 52 participants that is 23.53 % said that, that isn't good to convert the primary co-operatives into co-operative organization and remaining 26 participants that is 11.76 % said that they not known. More than 60 percent participants were agreed for formation of cooperative organization and secondary cooperative.

The view of participants, about the process for development of cooperative organization or secondary cooperative from the primary co-operatives of same nature has been shown in table 6.11. The process for development of cooperative organization or secondary cooperative from the primary co-operatives of same nature were classified as 25 members of single, two, three, four, five primary cooperatives or all options.

**Table 6.11****The Size of Co-operative Organization/ the Secondary Co-operatives**

| S.N | Process for development of cooperative organization | No. of Participants | No. of participants (%) |
|-----|---|---------------------|-------------------------|
| 1   | At least 25 members of single primary co-operative  | 5                   | 4.90                    |
| 2   | At least 25 members of two primary co-operatives    | 7                   | 6.86                    |
| 3   | At least 25 members of three primary co-operatives  | 11                  | 10.78                   |
| 4   | At least 25 members of four primary co-operatives   | 6                   | 5.88                    |
| 5   | At least 25 members of five primary co-operatives   | 9                   | 8.82                    |
| 6   | All above alternatives should be opened             | 64                  | 62.75                   |
|     | Total   | 102                 | 100                     |

Source: Field survey, 2012

Out of 102 participants, five participants that is 4.90 % and seven participants that is 6.86 % said that the co-operative organization could be developed with 25 members of single primary co-operatives and 25 members of two primary co-operatives respectively. Similarly, eleven participants that is 10.78 % and six participants that is 5.88 % said that the co-operative organization could be developed with 25 members of three primary co-operatives and 25 members of four primary co-operatives respectively. Remaining nine participants that is 8.82 % and 64 participants that is 62.75 % said that the co-operative organization could be developed with 25 members of five primary co-operatives and 25 members of all alternatives of the above table

respectively. The highest majority of the participants were all alternatives of the above table.

The options for division from cooperative organization into the primary co-operatives were classified into allowing the fraction right, not allowing the fraction right and others. The view of participants, about the options for division from cooperative organization into the primary co-operatives has been shown on table below.

**Table 6.12**

**The Merging and Resizing the Secondary Cooperatives**

| S.N | Options for fraction from cooperative | No. of Participants | Total No. of participants (%) |
|-----|---------------------------------------|---------------------|-------------------------------|
| 1   | By allowing fraction right            | 60                  | 58.82                         |
| 2   | Not allowing the fraction             | 31                  | 30.40                         |
| 3   | Others                                | 11                  | 10.78                         |
|     | Total                                 | 102                 | 100                           |

Source: Field survey, 2012

Out of 102 participants, 60 participants that is 58.82 % said, that was good to provide the options for fraction from cooperative organization and 31 participants that is 30.40 % said that, it was not allowing the fraction from co-operative organization.

Remaining eleven participants that is 10.78 % said that there was no any difference either allowing or not. Majority persons agreed for fractional right.

**Future Cooperative Model: Alternative Platform for Poverty Alleviation**

The view of participants, about the suggestions for to reform the present co-operative system as a basic platform of poverty alleviation was to provide the educational support for children of co-operative members, to provides the support for family

health insurance, livestock insurance and crops insurance, to provide the identity card for purchasing daily required materials with cheapest price through the co-operative shop for co-operative families, to provide the subsidy for co-operative shops, to provide the facility of registration of co-operative in local level without any problem, to change the rule of registration members from 25 members to small number of single digit.

The view of participants, about the Suitable co-operative model for alleviating the poverty was to focus on agricultural based co-operative and to provide the modern agricultural equipment and economic supports for them through the governmental and non-governmental sector, to focus on employment generated co-operatives with based of local resources. Government should provide the staff of co-operative in local level for registration, supervision, monitoring and to provide the essential suggestion, training of management, accounting system, marketing, and by providing the soft loan to the member of cooperative through the government, micro finances, co-operative banks, other commercial banks etc. Poverty Alleviation Fund (PAF) might help to co-operative members for to alleviate the poverty, PAF might develop the network in local level to support the agricultural based, employment generated and income generated professional co-operatives.

The views of households about the suggestion for sustainable livelihood of poor and excluded people through the co-operative movement were that co-operatives might be on the favor of poor and excluded people, co-operatives need to focus on agriculture and base of local level resources, public land should use in contact base for poor and excluded people through the co-operative base, forest was needed to use as a co-operative model like community forest and government should receive the

cost of carbon from the rich and industrial countries for to develop the green revolution, the life of poor and excluded family should make easy through the new model of micro co-operative and small groups.

The view of participants, about the options for any organizational poverty alleviation models except the co-operative model has been shown in table 6.13. The options for any organizational poverty alleviation models except the co-operative model were categorized as a yes and no.

**Table 6.13**

**The Options for Poverty Alleviation Models rather than Co-operative Model**

| S.N | Options for poverty alleviation models | No. of Participants | Total No. of participants (%) |
|-----|--|---------------------|-------------------------------|
| 1   | Yes                                    | 196                 | 61.64                         |
| 2   | No                                     | 122                 | 38.36                         |
|     | Total                                  | 318                 | 100                           |

Source: Field survey, 2012

Out of 318 participants, 196 participants that is 61.64 % said that there were also other alternative models for poverty alleviation like poverty alleviation fund, NGOs, INGOs model, especial poverty alleviation model of and so on.

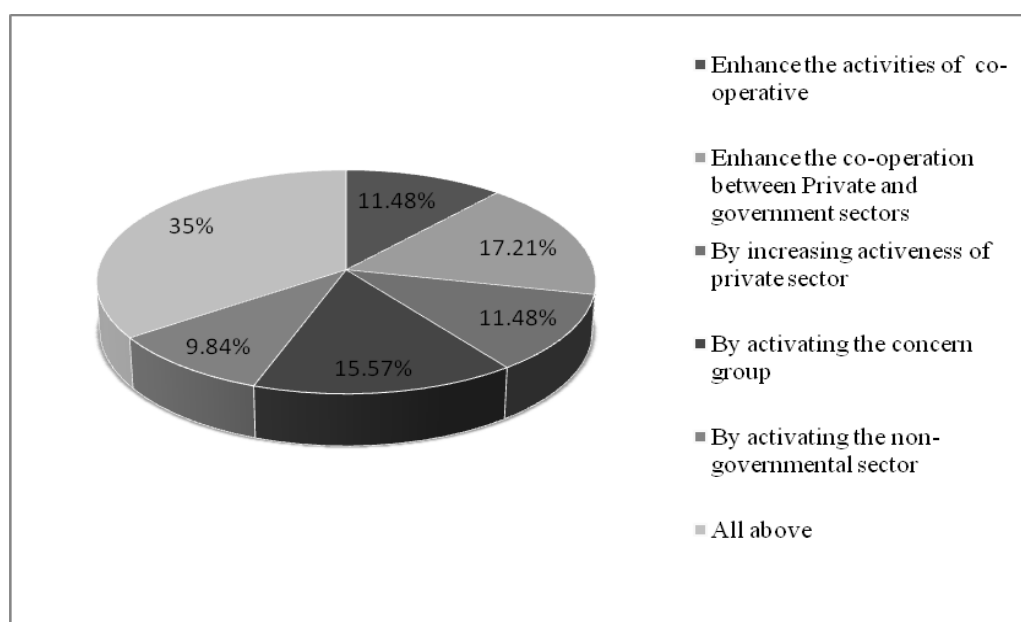
The view of participants, about the opinions of organizational poverty alleviation models for poverty alleviation except the co-operative model are the network of Poverty Alleviation Fund would be work national wide in local level likes VDC and NP for poverty alleviation, co-operative can work one sectors for poverty alleviation, thus different programs were needed apply from governmental and non-governmental sectors, the cost of carbon could be used for poverty alleviation program which comes from rich and industrial countries, governmental and non-

governmental sectors needs to invest in income generated sectors and solving the problem of employment, governmental and non-governmental sectors should focus on education right of all people, vocational training, technical education etc, governmental and non-governmental sectors should encourage the poor people in production sectors.

### **Beyond the Existing Cooperatives for Poverty Alleviation**

The views of participants, about the ways to extend the co-operative activities for poverty alleviation were shown in figure 6.1. The ways to extend the co-operative activities for poverty alleviation were categorized into enhance the activities of cooperative, enhance the cooperation between private and government sectors, increasing activeness of private sector and activating the non-governmental sector.

**Figure 6.1     The Ways to Extend the Co-operative Activities for Poverty Alleviation**



Source: Field survey, 2012



Out of 122 participants, 14 participants that is 11.48 % said that to enhance the activities of co-operative to extend the co-operative activities for poverty alleviation. 21 participants that is 17.21 % and 14 participants that is 11.48 % said that the co-operation could be enhanced between Private & government sectors and to raise activeness of private sector. Similarly, 19 participants that is 15.57 % and 12 participants that is 9.84 % said that the concern groups could activate and to activate the non-governmental sector respectively. Remaining 42 participants that is 35.00 % said that, all options of above table should apply to extend the co-operative activities for poverty alleviation.

The views of participants, about the additional suggestions for poverty alleviation were as good governance was the best key for poverty alleviation; government needed focusing to solve the problem of poverty with special three to five years programs, request for special fund for special poverty alleviation program from international donor agencies and private, public and cooperative partnership programs felt necessary to be developed.

### **Chapter Summary**

This chapter has described the access of excluded communities in cooperatives, moving ahead: from group to primary cooperative versus micro-cooperative, primary cooperative (Micro-cooperative) management, future cooperative model: alternative platform for primary poverty alleviation and beyond the existing cooperative for poverty alleviation.

The next chapter has dealt about the discussion of the findings from the chapters four, five and six and has illustrated the new emerging themes from the grounded settings.

## **CHAPTER VII**

### **DISCUSSION AND NEW GROUNDED SETTINGS**

The previous chapters have described the data presentation and analysis of livelihood, climate change and cooperative movement. This chapter deals about the discussion of the findings from the chapters four, five and six and have illustrated the new emerging themes from the grounded settings.

It covers the diversity in family composition, education as a lever for promoting employment, raising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement, declination of quality life and climate change. This section has also informed about shift in season, weather change, variation in green coverage, declination in water sources, changing pattern of insect adaption, changing time of flowering and ripping fruits, declining crops production, over rainfall, drought, and people's feeling about climate change. The cooperative movement has also raised issues regarding the inclusion of the excluded groups in cooperatives, poverty alleviation versus cooperative movement, with, without and beyond cooperatives, and micro-cooperatives as an alternative platform of being together.

#### **Diversity in Family Composition**

The households were found economically rich, middle, and poor class family; landless family and socially woman headed family. That represents the socio-economic status of Nepalese people in general. The size of the family determined the

source of income, expenditure and saving in a family. The size of the family in marginalized group was bigger than in the other groups. The nature of family based on the family size gave the information about the livelihood status. The household of family with four members were the largest found in the study area. It means families were being mostly nuclear family. There were also joint families and the families were found weak in economic condition. The family composition varied based on the numbers of members in the family and majorities were having four, five and six respectively. The population of the male was less than female in adult but less than four-year children were found with more boys. It demonstrated that people gave priority for son and involved on abortion of girls child. The population was found decreasing according to ascending order of age group.

### **Education as a Lever for Promoting Employment**

The education is the main weapon to alleviate the poverty. The educated families of the study area were getting good opportunity for jobs either domestic or overseas and their economic status has been seen well than the illiterate families. The illiterate families were found below the absolute poverty line. Still there was the problem of awareness of families for education. The literacy rate of woman and man were found to be 59.40 percent and 70.9 percent respectively. The male literacy rate was higher in male than in female. It means females were seemed in backward in education sectors and mostly engaged in the household work. Males were more employed at the age of twenty to forty years of age mainly in the overseas employment. Specially, females were found active in domestic work. In my study area, most of the school-going

children of poor and excluded families left the school without completing the school level courses.

### **Rising Trends of Saving**

The people were found mainly dependant on agriculture as their primary or secondary sources of income. It means more than 61percent people were primarily dependant on agriculture and more than 31percent people dependant on other professions than agricultures and takes agriculture as secondary source of income. After agriculture, overseas employment was another good income source of the rural livelihood at present. Majority of the household were found neither in the condition having neither in credit nor in saving. The saving status of the families was in ascending order from low to high saving amount based on their economic status from poor to rich. More than 31percent were found under the poverty line because of their credit life as they fell on vicious circle of poverty. Among the families who were in credit, large group of families were found receiving less loan. Majority of the families having credit, were taking loan less than twenty thousand and few number of families was taking the loan more than eighty thousand. There was large number of families who were saving more than eighty thousand and rests saving families were found decreasing in order according to increasing the saving. The economic status of the families is improving day by day before ten years and nearly, 21 percent of the families had no change in their economic status. The agro production was declining but overseas employment and national employment were found increasing, and economic status was found better in the families. The expectation of large number of households, about 47 percent, was to get the support on modern agriculture from governmental or non-

governmental sectors. It means that the rural people demanded to improve the agriculture and there is rising trend of saving in general.

### **Crisis of Food Security and Agro- production**

The agro economic situation determines the real status of the rural livelihoods. The landowners were categorized as a large, middle and small landowner, and landless families. There were 2.88 percent of landless households, 7.6 percent households had not have vegetable field and 8.7 percentage households had not have paddy field. Most of the people had small quantity of land and few people had in large quantity. The land distribution was not in the favor of poor and excluded people. The enough food for family from their production was categorized into 1-3 months, 3-6 months, 6-9 months, 9-12 months and above 12 months. More than 49 percent families were unable to secure food more than 9 months from their own production. Nearly 32 percent families had food available for 9 - 12 months and 22.32 percent families used their own agricultural products as food more than twelve months. The agro production was decreasing pattern and crisis of food security were found high. Generally, the market of most of the farmers was from 30 minutes to 1 hours distance. Due to the problem of market and transportation, farmers were unable to sell and purchase the agro-production easily. There were no good facilities for irrigation. More than 51 percent farmers were totally depended on monsoon at summer and their land remains dry in winter season. They were found able to produce crops only on summer season. More than 56 percent farmers were not capable of to get the irrigation facility in winter season at paddy field but almost dry at vegetable field. Farmers were also in

problem of availability of quality seed, chemical fertilizers, and pesticides in time.

There is in fact crisis in agro production and food security.

### **Co-operative Movement for Livelihood Improvement**

In the interim constitution of Nepal (2006), the cooperative has been considered as the third pillar of economy. Mostly, cooperatives were established in urban and highly populated area and, there were very few numbers of cooperatives in rural areas in Nepal. Small number of households was related to cooperatives and very few numbers were found working actively in the study area. There were also other groups like mothers' groups, Forest user groups, saving groups and working groups of NGOs. The groups were working smoothly and finally converted into cooperatives. Mainly agricultural, saving and credit cooperatives and the groups were functional in the study area. Mainly, they were receiving the benefits for saving, taking loans, opportunities of employment and raising income. The people who were working as a group member, they were found energetic and happy than others not involved. Supporting organizations were working properly and they were found confused in the function of cooperatives and groups. The supporting organizations of large number of participants were supporting by coming from more than two to three hours far. It means supporting organizations were working in scattered areas and these cooperatives and groups were unable to handle groups and get very less chance of proper guidance. At the study area, NGOs were working in grouping system and people felt more safe and confidence. The people involved in the group, cooperatives were found more active, and livelihood had been improved.

### **Declination of Quality Life**

Secure and quality life is important for sustainable livelihood. Specially, farmers were found interested to develop the agriculture and animal keeping sectors for their secure life. Their expectation was in line towards the support to modern agriculture system and soft loan for agriculture sector. Also farmers were interested to overseas employment and they wanted to get soft loan and governmental agencies to support them. There was also lack of transportation for marketing purpose. The agricultural production was found decreasing day by day due to the lack of irrigation, fertilizer, quality seeds and pesticides. Small sources of water were supplied for drinking purpose and also for irrigation in the field. More than 38 percent households were interested to develop the agricultural sector due to availability of the skill manpower and enough farming land. Agriculture based people were unable to run their family smoothly and they were interested to change their profession for secure livelihood. Farmers were not successful to improve their life due to the problems of agricultural sector. Small farmers were working for just to live and they were being poor and poor.

### **Climate Change: Thereat to Livelihood**

Change in Climate directly or indirectly affected the existing livelihoods. More than 82 percent participants were not aware about the impacts of climate change and they had not followed any cautions. They were applying prevention unknowingly to save from the impacts of Climate change by participating with group and cooperative, working in additional occupation, migrating to safe place, priority to overseas

employee and others. Few persons were careful about the impact of climate change and they were either shifting from agricultural sector to other sectors or shifting to modernization in farming. Due to the impacts of climate change, water sources were decreasing and that directly affected to livelihood. The rainfall pattern was found sharply changing and that affected in agro-production. The poor people were being vulnerable and they had to face to shocks of natural events like floods, droughts, and health of the family members, health of livestock, economic uncertainty, conflict, violence, deaths and so on. It means the impacts of climate change directly and indirectly threatened to livelihood.

### **Shift in Season**

The pattern of warm in summer was found consistent before twenty years but it was found raised after ten years. The time of dryness in winter was being long every year from thirty years then. Few respondents were saying no any difference of dryness period. Before thirty years to ten years from the time of inquiry, there was not any significant difference in cold in winter but people responded that coldness was increasing from last five years. The quantity of fog and precipitation in winter was generally constant before ten years ago but more in amount before five years. At the time of data collection, the fog and precipitation was high. The dewdrops and cold waves in winter were constant before twenty years ago and the rate of dewdrops and cold waves were decreasing after twenty years. The monsoon was also being late in the year of the data collection.



### **Weather Change: Rise and Fall**

The quantity of heat haze before ten years and this year is similar and before twenty to ten years, it was found higher. The strength of blow of storm/ cyclone before twenty years was higher and blowing rate was decreasing before twenty years. The pattern of hailstone falling rate was sharply decreasing before thirty years but some times it fell in such a way that huge amount of hail appeared and damaged the crops and wild animals. The quantity of rainfall in winter in the different interval of thirty years was in decreasing trend; especially the rainfall in winter was sharply decreased from last ten years and winter season becoming drier. The global impact of climate change could be also seen as there occurred over rainfall in some years and draught in some years. The rise and fall of temperature and weather change had correlation with the global warming.

### **Variation in Green Coverage**

More than 67 percent families were using the firewood for cooking purpose. Biogas, electricity and LP gas were partially used by rest families as a supporter of fire wood. More respondents said that the green coverage was found increased after few years due to the development of community forest and planting the trees for fire wood, furniture, planting annual & biannual grasses & trees for cattle. Farmers were also engaged in horticulture planting the trees like nuts, Rudraksha, etc. It helps to increase the green coverage at that area. Nearly 39 percent of respondents said that the green coverage was decreasing at the time of data collection than 10 to 20 years ago due to the use for fire wood, building, furniture, farming, uncontrolled firing, deforestation for roads construction. The views of participants gave the reasons for increasing the

forest or green coverage was the development of community forest in the recent years, controlling the deforestation, decreasing farming and increasing even green farming. Few respondents answered that there was increasing of the residential area due to not controlling the fire, being lack of grazing land and newly constructed roads. The pattern of firing in the forest was decreasing before ten years due to the community forest.

More than 67 percent respondents said that there were less wild animals & birds around the field and forest due to the deforestation, and illegal hunters. Also, there were few new coming of wild animals & birds around the fields and forests due to protection of green coverage than in past years. Name of newcomer animals were reported as monkey, deer, porcupine, Langur, wildcat, Gandro, Malshapro and Ghoral. Similarly name of newcomer birds were crow, white-headed bird, Luiche, black long tailed bird, Kalij and koili. Name of extinct animals were jackal, tiger, bear, Nigale and Chituwa. Similarly, name of extinct birds were eagle, Chibe, Thaula, Bhyakur, Hutityau, Maina, Long tailed bird, Koili, Gauthali, sparrow, Rupi, Kukku, Queen bird Karangkurung, Bakula, dove, peacock, Chil, Biuchara, Kekastochha, Kaphalpako and Jhiljhile. These evidences have proved that there has been increasing the green coverage in the territory.

### **Declining Water Sources**

The sources of water were found decreasing in condition in the study area. It was reported that the source was decreasing continuously from last thirty years. The quantity of snow in mountain and snow line was sharply decreasing every year and snow & frost falling rate and snow falling area was declining. The quantity of

monsoon fall in summer was sharply decreased before ten years. Respondents said that monsoon was for seven days to fifteen days continuously in past but now a day that became history.

More than 60 percent respondents said that there was less depth of lake and pond than past due to the less rainfall and deposition of sand and clay. More than 49 percent participants said that there was less quantity of water in streams and rivers than past due to the less rainfall and decreasing sources of water. Some drinking water sources were dry and decrease long time in winter season than in past. Some participants were surprising because of decreasing the water level in Arun River. People were able to cross Arun river in winter of this year which the participants had not seen the incidents before in their life.

### **Changing Pattern of Insect Adaptation**

The respondents reported that different insects and pests were found more in study area. The number of mosquitoes was continuously increasing from last ten years and also found in high altitude. The quantity of pest is highly increasing from last ten years. The majority number of respondents said that there was continuously increasing diseases in plants, livestock and human before twenty years. The chemical fertilizer and pesticides were highly used from twenty years before. At present, nearly 80% households were using the chemical fertilizer and pesticides. The new danger diseases like Bird flu and Swine flu was repeating every year that was not known in the past years. It has indicated that the habitats of the animals and insects have been changed rapidly and similar effect can be seen in livelihood of human beings.

### **Changing Pattern of Flowering and Ripening Fruits**

The respondents reported evidences about the fast flowering and ripening the flowers and fruits respectively. More than 72 percent respondents were unknown of fast and late flowering and fruiting time but 17 percent respondents said that there was faster flowering and fruiting than past due to quick starting of summer. Similarly, few respondents said that there was later than past about flowering due to the late pattern of rainfall at present. More than 68 percent respondents were unknown of ripening time of the fruits. Similarly, more than 26 percent respondents said that there was faster ripening than past due to start of summer soon. Fewer respondents said that there was later than past due to the late pattern of rainfall at present.

The evidences have proved that though people from the area were little aware in the changing pattern of flowering and ripening of fruits, the field observation indicated the rapid change in season. The crop varieties felt needed to be changed based on the climatic variations.

### **Declining Crops Production**

The quantity of crop production was continuously decreasing before thirty years to present. The quantity of livestock farming trend was sharply decreasing from thirty years now and production of crops was interrelated with farming of the cattle.

Similarly, majority respondents said that there was less production of crops due to the irregular rainfall pattern, lack of fertilizer, quality seeds, and irrigation. Few respondents said that there was increased production of crops due to use of high quality of seeds, facilities of good irrigation and use of chemical & organic fertilizers, and pesticides. There were not any one participant on the favor of climate change for

good production. More than 36 percent respondents said that there was alternative income by working as a labor to recover the decreased production and 35.32 percent said there was alternative income from overseas employment. Similarly, other participants said that there was alternative income by keeping the cattle and small business.

The migration from study area was higher than migration to that area. There were reasons for migrating due to the facilities of education, service, health, transportation, and drinking water. There was other reason for migrating pattern from Arun valley to other places especially to Terai reason because of poverty. The decline in the crop production was found severe and mitigation of the problem was extremely felt.

### **Over Rainfall and Drought**

The flood and landslide was higher before twenty years but the flood and landslide is sharply decreased after twenty years because of fewer monsoons. Based on the participants experiences, there is flexible in over rainfall and draught that frequently happen in different year. They said that there were consistent monsoon in past years. They reacted that the draught appeared and reduced the crop production. Similarly, over rainfall also damaged crops, life, and property of people through landslide, flood and untimely rainfall.

### **People's Feeling of Climate Change**

The experiences of respondents about the climate change were change in rainfall pattern. It indicated that there was not regular rainfall as in the past years. Monsoon

was being late, the some sources of water were totally dried and the quantity of water of some sources was decreasing. There was no more snow in Mt. Makalu as in past years and also snow line was diminishing, large black spots were seen on Mt. Makalu, flood of snow in Arun river increasing from few years ago, fog covered long time which had been seen since five years from the past. Fruits and crops were highly affected by insects.

People realized the severe symptoms of climate change in their areas. The effects were found not only in their livelihood but also in natural conditions and geographical inhabitation.

### **Including Excluded Groups in Cooperative**

Only few numbers of Dalit, marginal, and excluded poor people were found participated in cooperative movement. Fewer numbers of these people were actively working. More than 47% participants' views were that there was little advantages Dalit, marginal, excluded and poor people receiving from the participation in cooperative organizations. More than 69 percent participants were agreed to increase the value of co-operative by uniting the poor and excluded people as a small group with principle, value, and norms of cooperative to involve in cooperative movement. They suggested that small groups should be converted into primary cooperatives. The participants who were not agreed to name as a primary cooperative of these groups, their suggestion was to develop the co-operative education platform for these groups.

The government or non-government organizations felt needed to provide the co-operative education to the targeted people like Dalits, marginal, excluded and poor people to involve in cooperative movement. Participants expressed that they needed to

provide the awareness programs through the workshop, training etc. and the subsidies, aids to the co-operatives of the Dalits, marginal, excluded, and poor people. They also demanded the compulsory literacy classes for illiterate members of co-operatives.

Based on the participants' view, it was realized that the co-operative movement should be in favor of poor and excluded people and it should be based on agriculture, and local level resources. Public land should use in contact for poor and excluded people through the co-operative base. Forest should use as a co-operative model like community forest and government should receive the cost of carbon from the rich and industrial countries to develop the green revolution. The sustainable livelihood of poor and excluded family should make easy through the new model of micro co-operative and concept of small groups of cooperative. Respondents also referred the other alternative models for poverty alleviation like poverty alleviation fund, NGOs, INGOs' model, especially the poverty alleviation models of government.

### **Poverty Alleviation versus Cooperatives**

The views more than 72 percent participants were the effective action and plans in order to alleviate the poverty of Dalit, Marginal, excluded and poor people through co-operative movement by forming the small groups with based on value and norms of co-operative to provide the co-operative education. The views of few participants were the need of effective action and plan to alleviate the poverty by increasing the speed of present co-operative movement for involving in Co-operative and remaining other programs like poverty alleviation fund and models of NGOs/INGOs.

Cooperative and poverty alleviation ministry of government could provide the educational support for children of poor co-operative members and the identity card

for purchasing daily-required materials with cheapest price through the co-operative shop to poverty alleviation. It was also felt that there was extreme need to provide the support for family health insurance, livestock insurance and crops insurance. The government could also provide the facility of registration of co-operative in local level with small number of single digit.

It needed to focus on agricultural based suitable co-operative model for alleviating the poverty and to provide the modern agricultural equipment with technical supports for poor farmers. Government would focus on employment generated co-operatives with the base of local resources and would provide the staff of co-operative in local level for registration, supervision, monitoring and to provide the essential suggestion, training of management, accounting system, marketing etc. It needed to provide the soft loan to the members of co-operative through the government, micro finances, co-operative banks, other commercial banks etc. Poverty Alleviation Fund (PAF) would be one option to focus the co-operative members to alleviate the poverty.

The views of most of the participants were to enhance the activities of co-operatives to extend the co-operative activities, to enhance the co-operation between private & government sectors, to activate the concern groups and to activate the non-governmental sectors for poverty alleviation.

### **Without, With and Beyond the Cooperatives**

The private, public, and cooperative partnership programs were found effective. There were many groups of people who by tradition had the custom of money lending and making credit for their household purposes. Still people shared work for work and in



turn used human resources for the purpose of economic promotion. Without the existence of cooperatives, people also practiced the financial managerial activities. However, cooperative intervention played a pivotal role for the proper financial management of the economic activities. The small groups and the cooperatives have improved the livelihood of people and initiated the entrepreneurial activities in the village. The saving culture of people was increasing and loan scheme was found easier to be managed. The study demanded that cooperatives should go beyond its practice and move in the direction of micro cooperatives or primary cooperatives. Because of the limited people in marginal communities, small number of members would also facilitate the small groups to be involved in cooperatives. It would be better if micro cooperative exists in future.

### **Micro-Cooperatives: An Alternative Platform of Being Together**

Among the participants who were agreed to name the primary cooperative for small groups, more than 44 percent participants were agreed to register the primary cooperative with the minimum seven members and 27.01 percent participants agreed to register the cooperative with eleven members. Similarly, more than 48 percent participants agreed to establish the registration office of primary co-operative in local level like Village Development Committee and Municipality. More than 64 percent participants agreed to convert the primary co-operatives into co-operative network or secondary cooperative. Nearly, 63 percent participants agreed for converting the primary cooperative to secondary cooperative having at least 25 members of individual or group (micro cooperative). They felt the needs of counting of each members of the group to 25 members. Fewer participants agreed at least 25 members

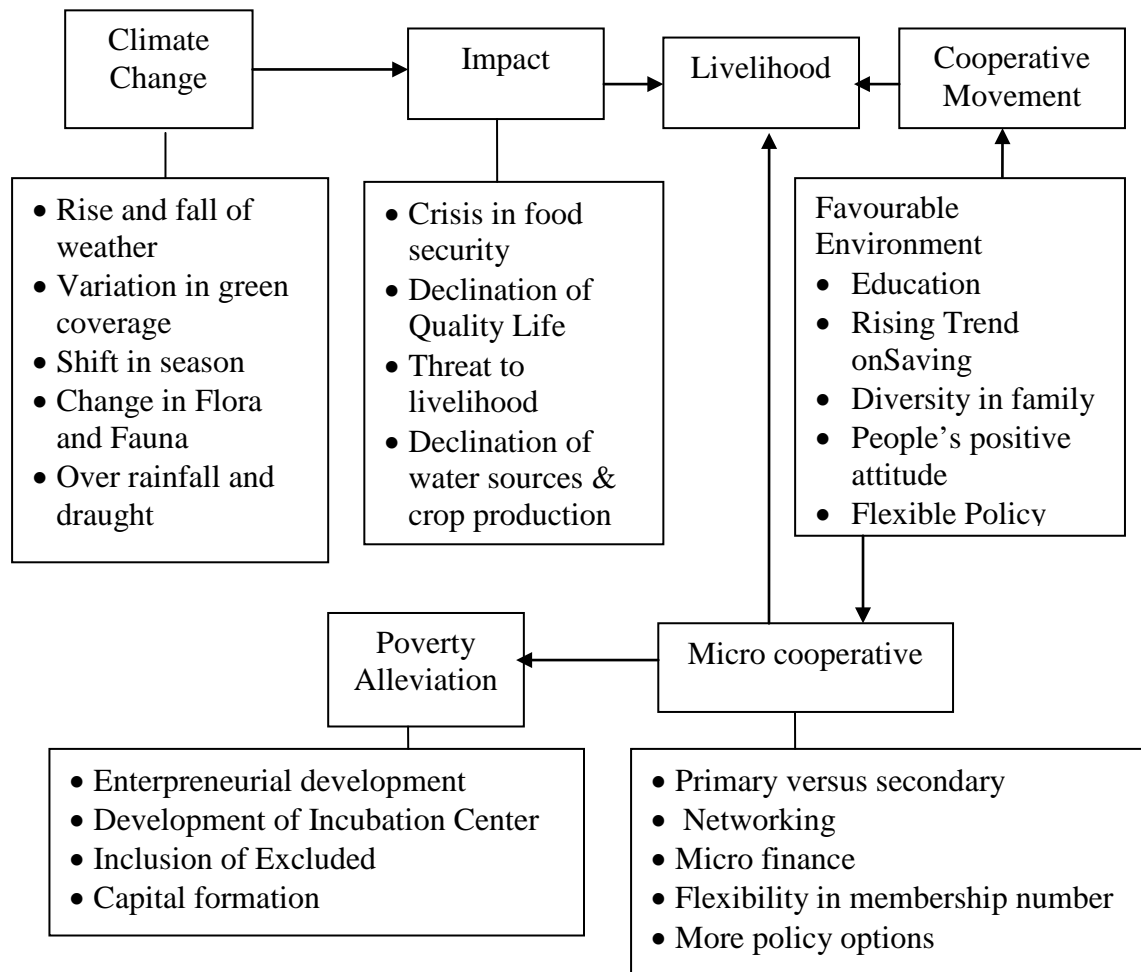
of three and five united primary cooperatives for secondary cooperative. More than 58 percent participants agreed to provide the options for fractional right for primary cooperatives from secondary cooperative. The rest of the participants did not agree for fractional right because there may be development of the conflict among them. The secondary cooperative may not work smoothly. Nearly 63 percent participants were agreed the name of primary co-operative as a name of micro- cooperative network.

From this study, it can be concluded that micro cooperative or primary cooperative may be the alternative platform for being together and the new approach for reaching the unreached. It may increase collaboration and cooperation among the people.

### **New Grounded Settings: The Knowledge Claim**

The grounded setting of poverty alleviation through micro-cooperatives model dealt with the micro-cooperative works as a tool of poverty alleviation for the improvement of livelihood. The climate change affected the rise and fall of weather, variation in green coverage, shift in season, and change in flora and fauna and over rainfall.

It also increased the frequency of draught, and the impacts of climate change on livelihood resulted crisis in food security, declination of quality life, thereat to livelihood, and declination of water sources and crop production. For the sustainable livelihood, cooperative movement played the vital role. The favorable environment of education, rising trend on saving, diversity in family, people's positive attitude and flexible policy pushed up the cooperative movement.

**Figure 7.1 The Ways to Extend the Co-operative Activities for Poverty****Alleviation**

The favorable environment also encouraged the micro-cooperatives. The micro-cooperative may cover the primary versus secondary cooperatives, networking, flexibility in membership number, options of policies and interrelated with micro finance, micro credit, poverty alleviation funds, NGOs and INGOs for jointly working to alleviate the poverty. Due to the micro cooperative movement, there may be development of the entrepreneurial development, development of incubation center, and inclusion of excluded and capital formation like physical, financial, natural, social, and human capitals. The micro cooperative may be the pivot to improve livelihood and to alleviate poverty.

### **Chapter Summary**

This chapter described emerging themes including the diversity in family composition, education as a lever for promoting employment, raising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement. It also illustrated declination of quality life and climate change, shift in season, weather change, variation in green coverage, declination of water sources, changing pattern of insect adaption, changing time of flowering and ripening fruits, declining crops production, over rainfall, drought, and people's feeling of climate change. The issues of cooperatives covered the inclusion of the excluded groups in cooperatives, poverty alleviation versus cooperative movement, with, without and beyond cooperatives, micro-cooperatives. The next chapter describes detail of the summary, conclusion, and implications of the study.

## CHAPTER VIII

### SUMMARY, CONCLUSION AND IMPLICATIONS

The previous chapter has described the discussion and new-grounded setting including the diversity in family composition, education as a lever for promoting employment, raising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement. Similarly, the previous chapter also illustrated the emerging themes like declination of quality life, climate change, and shift in season, weather change, variation in green coverage, and declination of water sources. The chapter also described about the changing pattern of insect adaption, changing time of flowering and ripping fruits, declining crops production, over rainfall and drought, people's feeling of climate change, the inclusion of the excluded groups in cooperatives, poverty alleviation, and micro-cooperatives.

This chapter deals about the summary, conclusion, and recommendation of whole study describing the process of research in brief in summary, making conclusion of the research work and finally pointing out the implications of the research outputs.

#### **Summary**

Climate change is hitting hard the countries with poor and weak economies. Most developing countries and the poor have been most vulnerable as they depend on climate sensitive sectors like agriculture. The process of adaptation is always constrained by the institutional, social, economic, and political environment in which

people must operate. The climate change has become complexities and more challenges in the developing world. Nepal is the vulnerable country due to the impacts of climate change. The overall effect of climate change on agriculture and livelihood depend on the balance of the effects. The farmers have to adjust to the changes in climate by adapting their usual crop cycle and production systems to an unpredictable situation due to the climate change. These issues made careful engagement of multiple decision makers in the development and implementation of adaptation strategies even more important. The proposed research study identified the problem statement as the impacts of climate change in sustainable livelihood and response through cooperative movement of vulnerable groups like poor, marginalized, Dalit and excluded people. The purpose of the study is to trace out the current trend of climate change, resulting impact on livelihood and required type of co-operative movements for their sustainable life. The research questions for guiding the research were devised as,

- a) What are the measurements of adaptation and mitigation for secure livelihood of people?
- b) How does climate change affect in livelihood of the Nepalese people? and
- c) How does co-operative movement promote sustainable livelihood of vulnerable and marginalized people to cope with climate change?

The thesis was organized in eight chapters. The first chapter contained introduction, second the literature review, third the research methodology, four five and six about the findings, seven the discussion and finally the summary and conclusion were present in the chapter eight along with the implications of the result.

The literature review was carried out making the thematic review, theoretical review, and contemporary research studies. The review was concluded by making a model of conceptual framework for the purpose of the study.

This study was an exploratory and descriptive research based on qualitative and quantitative research approaches. Components like justification for the selection of field survey method as the main research method, use of study tools, data collection and analysis procedures and validity and reliability of the study tools were sketched in details under the research methodology approach. In light of this, the researcher positioned himself within the positivistic discourse, for assessing livelihood and climate change impacts. The purpose of this method was to explore the epistemological and ontological knowledge with the process of transforming things believed into things known.

This study applied explorative and analytical research methods. The research included the gathering of information and data, quantitative and primary sources. This study was mostly focused on primary data, which was collected from field study. Interview bases on schedule, case study, focus group discussion, and observation. The sources of secondary data were various published and unpublished books, journals, project reports, articles, feature writing, newspapers, official letters and statements, formal and informal speeches, governmental and non- governmental documents & reports, reports of different research centers and institutions, related conference papers and declarations and other many related materials. The study area of this survey research was focused in the Arun Valley, which lies in the eastern part of Nepal. Data were collected from the study area with the help of questionnaires, interviews and other relevant tools. The collected data was analyzed both descriptive and inferential

statistical tools. The validity of this research was enhanced by the extensive and participatory nature of the investigations.

To further guarantee validity, the same instruments, persons, and procedure were used for data collection in all sectors of livelihood, climate change, and cooperative. This measure was taken to ensure that the model produces the effect for which it was designed. The pre-test and piloting of the instrument provided the opportunity to check and revise of the instruments. The reliability of the study was ensured with multiple source of evidence, which leads to triangulation of data, the detailed, rich and thick descriptions of the researcher's own assumptions and position in the study, data collection, category derivation, decision making procedures and ultimate conclusions. These may lead the accuracy and credibility of the data. For the reliability and validity, designed instruments were tested and feed- backs were collected from experts providing proposal of research. The researcher reworked to modify the tools for further modification of research design.

The findings were illustrated in chapter four, five and six including livelihood, climate change and cooperative findings respectively. The chapter four presented the existing status of the livelihood in detail and covered family background, education, land status, economic status and profession, and the entrepreneurial activities of the people with detail of all family members. Chapter five presented the climate change and its thereat to everywhere including impact of climate change in natural resources, bio-diversity, agriculture, social and economic sectors. The study was focused in the deepest valley of the world named as Arun Valley. Similarly, the sixth chapter presented access of excluded communities in cooperatives, moving ahead: from group to primary cooperative versus micro-cooperative, primary cooperative (Micro-



cooperative) management, future cooperative model: alternative platform for primary poverty alleviation and beyond the existing cooperative for poverty alleviation.

Chapter seven dealt about the discussion of the findings from the chapters four, five and six and illustrated the new emerging themes from the grounded settings.

Finally, the conclusion was drawn based on the discussion of the findings and interpretation from the grounded settings. The themes emerged indicated the new knowledge claim and thus implications were made to concerned areas of further intervention.

### **Conclusion**

The present study has devised a model for policy option in the field of mitigating climate change, and improvement of livelihood through micro cooperative movement. The study reflected about different emerging themes from the grounded settings.

The livelihood setting demonstrated diversity in family composition, education as a lever for promoting employment, rising trends of saving, crisis of food security and agro production, cooperative movement for livelihood improvement, declination of quality life and climate change. The households were found economically rich, middle, and poor class family; landless family and socially woman headed family. That represents the socio-economic status of Nepalese people in general. The size of the family determined the source of income, expenditure and saving in a family. The size of the family in marginalized group was bigger than in the other groups. The educated families of the study area were getting good opportunity for jobs either domestic or overseas and their economic status was seen well than the illiterate families. The illiterate families were found below the absolute

poverty line. Still there was the problem of awareness of families for education. The people were mainly dependant on agriculture as their primary or secondary sources of income. They demanded to improve the agriculture and there is rising trend of saving in general. Farmers were also in problem of availability of quality seed, chemical fertilizers, and pesticides in time. There is in fact crisis in agro production and food security. The people involved in the group, cooperatives were found more active, and livelihood had been improved. Farmers were found interested to develop the agriculture and animal keeping sectors for their secure life. Their expectation was towards the support to modern agriculture system and soft loan for agriculture sector. Farmers were not successful to improve their life due to the problems of agricultural sector. Small farmers were working for just to live and they were being poor and poor. Due to the impacts of climate change, water sources were decreasing and that directly affected to livelihood. The rainfall pattern was found sharply changing and that affected in agro-production. The poor people were being vulnerable and they had to face to shocks of natural events like floods, droughts, and health of the family members, health of livestock, economic uncertainty, conflict, violence, deaths and so on. It means the impacts of climate change directly and indirectly threatened to livelihood.

The assessment of climate change impacts illustrated about shift in season, weather change, variation in green coverage, declination in water sources, changing pattern of insect adaption, changing time of flowering and ripping fruits, declining crops production, over rainfall, drought, and people's feeling about climate change. The pattern of warm in summer was found consistent before twenty years but it was found raised after ten years. The time of dryness in winter was being long every year

from thirty years then. At the time of data collection, the fog and precipitation was high. The dewdrops and cold waves in winter were constant before twenty years ago and the rate of dewdrops and cold waves were decreasing after twenty years. The monsoon was also being late in the year of the data collection. The quantity of heat haze before ten years and this year is similar and before twenty to ten years, it was found higher.. The global impact of climate change could be also seen as over rainfall in some years and draught in some years. The rise and fall of temperature and weather change had correlation with the global warming. The pattern of firing in the forest was decreasing before ten years due to the community forest. Also, there were few new coming of wild animals & birds around the fields and forests due to protection of green coverage than in past years. The sources of water were found decreasing in condition in the study area. Some drinking water sources were dry and decrease long time in winter season than in past. People were able to cross Arun river in winter of this year which the participants had not seen the incidents before in their life. The new danger diseases like Bird flu and Swine flu was repeating every year that was not known in the past years. It has indicated that the habitats of the animals and insects have been changed rapidly and similar effect can be seen in livelihood of human beings. The crop varieties felt needed to be changed based on the climatic variations. The quantity of crop production was continuously decreasing before thirty years to present. The migration from study area was higher than migration to that area. There were reasons for migrating due to the facilities of education, service, health, transportation, and drinking water. There was other reason for migrating pattern from Arun valley to other places especially to Terai region because of poverty. The decline in the crop production was found severe and mitigation of the problem was extremely

felt. The flood and landslide was higher before twenty years but the flood and landslide has been sharply decreased after twenty years because of fewer monsoons. Over rainfall damaged crops and life and property of people through landslide, flood and untimely rainfall. People realized the severe symptoms of climate change in their areas. The effects were found not only in their livelihood but also in natural conditions and geographical inhabitation.

In case of the cooperative movement has also raised issues regarding the inclusion of the excluded groups in cooperatives, poverty alleviation versus cooperative movement, with, without and beyond cooperatives, and micro-cooperatives as an alternative platform of being together. Only few numbers of Dalit, marginal, and excluded poor people were found participated in cooperative movement. Fewer numbers of these people were actively working. The government or non-government organizations felt needed to provide the co-operative education to the targeted people like Dalits, marginal, excluded and poor people to involve in cooperative movement. The sustainable livelihood of poor and excluded family should make easy through the new model of micro co-operative and concept of small groups of cooperative. Respondents also referred the other alternative models for poverty alleviation like poverty alleviation fund, NGOs, INGOs' model, especially the poverty alleviation models of government. Cooperative and poverty alleviation ministry of government could provide the educational support for children of poor co-operative members and the identity card for purchasing daily required materials with cheapest price through the co-operative shop to poverty alleviation. It was also felt that there was extreme need to provide the support for family health insurance, livestock insurance and crops insurance. The government could also provide the

facility of registration of co-operative in local level with small number of single digit. It needed to focus on agricultural based suitable co-operative model for alleviating the poverty. Poverty Alleviation Fund (PAF) would be one option to focus the co-operative members to alleviate the poverty. The views of most of the participants were to enhance the activities of co-operatives to extend the co-operative activities, to increase the co-operation between private & government sectors, to activate the concern groups and to activate the non-governmental sectors for poverty alleviation. The study demanded that cooperatives should go beyond its practice and move in the direction of micro cooperatives or primary cooperatives. Because of the limited people in marginal communities, small number of members would also facilitate the small groups to be involved in cooperatives. It would be better if micro cooperative exists in future.

From this study, it is concluded that micro cooperative or primary cooperative may be the alternative platform for being together and the new approach for reaching the unreached. It may increase collaboration and cooperation among the people.

### **Implications**

In fact, the study has made a contribution to the field of climate change, sustainable livelihood and cooperative movement. The study confirmed pointing out the impacts of climate change on livelihood and ways of mitigation through the micro cooperative model. At present, overseas employment has been one of the major sources of national income. Agriculture is one of the vital income sources for sustainable livelihood in rural communities. The deviation and shift in the sector of overseas employee, at that time the economic crisis, may be burden for nation. The best

solution of sustainable livelihood is the well management of the agriculture system in nationwide. The agriculture sector would be an option to address the crisis of overseas employment. The climate change has produced thereat to livelihood. At this situation, micro-cooperative movement may work as a best tool to withstand the impacts of climate change and poverty alleviation.

The agricultural sector felt needed to be established in priority list of government. The governmental and non-governmental sectors can focus in creation of available opportunity for youth through the modernization of agriculture. The implications of the present study can be illustrated in the following sectors:

### **Philosophical Implications**

A key philosophical approach from sustainable livelihood analysis is the holistic approach and does not imply that multi sector and multilevel interventions are necessarily appropriate. There is no specific right way of applying the sustainable livelihood approach. The seven theories of climate change can be an option for the mitigation of climate change with respect to livelihood sustaining.

The seven principles of cooperatives can be the alternatives for membership practice in democratic way. Education, training and information, cooperation among the members and responsibility to the community would be the philosophical basis of cooperative principles for democratic member control.

### **Implication to the Policy Makers**

Policy makers should realize the impact of policy decisions on successful implementation of development programs for sustainable livelihood. The climate change has been found directly and indirectly affecting on livelihood. In this condition, policy makers can focus on rules and regulations for good governance. It

may be the best key for poverty alleviation. The network of Poverty Alleviation Fund working nationwide can bring changes in local level like VDCs/ municipalities especially in income generation sectors either in agriculture or non agriculture base in order to alleviate poverty.

Governmental policies should address education rights of all people, vocational training, and technical education. Public land use policy would be an option to provide in contract base/ lease for poor and excluded people through the co-operative base policies. Model irrigation system policies should be developed in farming area such that the right should be established as 'irrigation is the right of farming land' and also there is need to provide the support for family health, livestock and crops insurance.

Government should focus on agriculture based co-operative and to provide the modern agricultural equipment and economic supports for them. It should provide the services of co-operative in local level as registration, supervision, monitoring and to provide the essential suggestion, training of management, accounting system, marketing and other relevant services. Flexibility in membership taking even single digit group felt need of accepting the formation of groups (micro cooperative or primary cooperative) and the co-operative education should be provided to the targeted people like Dalits, marginal groups, excluded and poor people. The compulsory literacy classes for illiterate members of co-operative should be run so that it may help to improve the awareness and sustainability of the co-operative. Rural agriculture and farming is dependent upon climate and season. Since farmers are dependent upon monsoon, productive and fertile lands are also unable to increase the production. Farmers were found unable to receive manure and seeds in time. If

farmers are provided with manure, seeds, pesticides, agricultural tools at cheap price in time, then agriculture production would be more efficient and effective.

### **Implication to Development Partners**

International donor agencies, NGOs and INGOs should work for special poverty alleviation programs focusing on sustainable model. Private, public and cooperative partnership programs should be in priority and coordination for economic growth and creation of job opportunity for solving the problem of unemployment should be development goals. Development partners should focus on awareness of farmers and should focus for the development of training centers, quality seed production centers, cold storage centers, organic production markets, agricultural equipment production centers. In addition, their support is needed for the modernization system in agriculture by management of water for irrigation, by using the maximum utility of machinery equipments. The agriculture based industries should be developed and needed to encourage the people for production of require raw materials.

### **Implication to Community Workers**

This study has emphasized that community people should involve for alternative additional occupation like farming, trade, handicrafts, animal keeping, bee keeping, silk farming and so on. They should apply modern farming system, collection of rain water in ponds for irrigation. They have to prioritize for evergreen farming and herbal production. Farmers should use organic fertilizer and the plastic tunnel for off seasonal vegetables, and quality seeds. People should be careful for cooperating works for mass production and distribution of agro products.



### **Implication to Environment Managers**

Hydropower energy is the best energy for sustainable development. Forest is being highly destroyed for firewood and conservation of them is necessary the use of alternative resources of cooking like electricity, bio gas, solar energy and others. Modern technology would be added advantage if used properly on agriculture sectors according to changing climate. The 'cost of carbon' should be used for poverty alleviation program of green coverage of farming or plantation, which comes from rich and industrial countries. Environment scientists should focus on fruit farming, evergreen farming, and biannual plants like cardamom, tea, Kiwi, herbs and other Non-timber plants. The environment managers provide the awareness programs about the climate change and possible sustainable programs to withstand the climate change.

### **Implication to Cooperative Management**

Co-operatives can work as effective tools for poverty alleviation. Thus different programs should be applied from governmental and non-governmental sectors for encouraging the people to involve in the cooperative movement. Co-operatives should focus on agriculture and base of local natural resources. The life of poor and excluded family could be improved along with their economic status through the new model of micro co-operative and small groups. It is needed to provide the soft loan to the members of cooperatives through the government, micro finances, co-operative banks, and other commercial banks. Poverty Alleviation Fund (PAF) should help the co-operative members to alleviate the poverty and needs to develop the network in local level to support the agricultural based, employment generating and income generating professional co-operatives.

### **Implication to Agriculture Scientist**

The agriculture scientists should refer alternative crops to farmers according to changing climate. The impacts of climate change have directly affected the farming systems and production is decreasing every year. It is needed to research the adaptive vegetables, fruits, crops, medicinal herbs and other useful plants according to altitudinal range and changing pattern of climate.

### **Recommendation for Further Research**

The study has contributed to the field of environment science, farming sectors, sustainable livelihood and cooperative movement. The study confirmed pointing out that the micro-cooperative model as a tool for the poverty alleviation in developing countries. It is needed to test the micro-cooperative model to alleviate the poverty.

The theory and practices are in line with the design of cooperative models. A set of micro cooperative principles was derived in the course of the research, which may be used as a framework for the design of primary cooperatives in similar Nepalese contexts. The design framework was generated by the mixed method research methodology. The second contribution of the study is in the field of sustainable livelihood.

Further research is needed to determine if these findings are transferable to a larger audience, or if they are unique to them. It is possible that other variables might be equally influential in helping the people understand climate change and mitigating through cooperative movements. Further research should involve a large number of areas and people, additional levels of cooperatives, additional categories, and additional environments. This additional research might further help to answer the question, “how can a concise framework of micro cooperative be designed and

developed that accommodates cooperative principles, livelihood theories, and principles of climate change in different contexts.

Further research might also explore the people's perspective of coping with climate change through cooperative movement from different sectors who have endorsements in both macro and micro levels in cooperatives and in other socioeconomic situations. That might lead to new discoveries explaining how the marginalized groups understand micro cooperatives. This additional research may increase our understandings of the significant relationships between economic growth, development interventions, climate change consequences and improvement of livelihood in sustainable manner.

In addition, further research is needed to more deeply understand the gender perspective on the relationship between male and female people's involvement in terms of participation. This research may help explain why the males outperformed the females based on professions but not based on the cooperatives. In a time of increased accountability and testing, we need to be sure about our testing strategies as free of bias in ethnicity and culture.

Future research might explore which strategies of cooperative intervention micro or macro cooperative are most appropriate for culturally and ethnically diverse people in different geographical areas with different professions.

## REFERENCES

- Abate, F.S. (2009). *Climate Change Impact on Livelihood, Vulnerability and Coping Mechanisms: A Case Study of West-Arsi Zone, Ethiopia*. M.Sc. Thesis Lund university, US. Retrieved from [www.documbase.com/Abate-Local-6.pdf](http://www.documbase.com/Abate-Local-6.pdf) , at 11th Feb. 2012.
- Acharya, B.M. (2009). *Rural Agricultural Cooperative Societies in Nepal: Performance and Member participation*. Ph.D. Thesis
- Action Aid (2006). *Climate change and smallholder farmers in Malawi Understanding poor people's experiences in climate change adaptation*. [www.actionaid.org](http://www.actionaid.org) Accessed on 2<sup>nd</sup> October, 2012.
- ADB (2011). *Country's Environment Analysis for Nepal*. Asian Development Bank, 2011.
- Agrawal, G.R. (2005). *Entrepreneurship and small business management in Nepal*. Kathmandu: M.K Publishers and Distributors.
- Agrawal, S., Vivian R., Maarten A., Peter L., Joel S. and John R. (2003). *Development and Climate Change in Nepal*. Retrieved from [www.env/epoc/dcd/dac](http://www.env/epoc/dcd/dac). at 12<sup>th</sup> September, 2012.
- Aikenhead, G. (1997). *A Framework For Reflecting On Assessment And Evaluation. Headliner, Symposium 4: Assessment Strategies*. Online Accessed On 16 September 2011. Available From <http://www.usask.ca/>
- Alexander (2006). *Global warming has a distinct greenhouse signature*. Retrieved from [www.skepticalscience.com](http://www.skepticalscience.com), on 1<sup>st</sup> November, 2011.
- Alexander, L.(2011). *Uncertainty & Learning in Global Climate Analysis*. Ph.D Thesis. Planen Bauen Umwelt der Technischen Universität Berlin. From [www.pik-potsdam.de/.../20111021DissertationAlexanderLorenz.pdf](http://www.pik-potsdam.de/.../20111021DissertationAlexanderLorenz.pdf)
- Anwar, A. (1999). *Climate change impacts and adaptation assessment in Bangladesh*. Space Research and Remote Sensing Organization (SPARRSO), Bangladesh.
- Arrhenius, S., (1908). *Words in the making: The Evolution of Universe*. New York: Harper and Brothers, USA.

- Ashley, Carney, D. (1999). *Sustainable Rural Livelihoods in Mali*. Research Report 35. Brighton, UK: Institute of Development Studies.
- Aspers, P. (2004). *Empirical Phenomenology. An Approach for Qualitative Research*. Online. Accessed On 15 July 2008. Retrieved from [www.lse.ac.uk/collections/methodologyinstitute/pdf](http://www.lse.ac.uk/collections/methodologyinstitute/pdf).
- Bahar, M. & Hansell, M. (1999). *The Relationship between Some Psychological Factors And Their Effect On The Performance Of Grid Questions And Word Association Tests*. Retrieved from <http://www.itea.org/patt11/atkinsondef.p>
- Ball,T.(2010). *Significant Reductions in Energy Use, Greenhouse Gas Emissions Highlight Ball's Second Sustainability Report*. Sustainability, Research, Reports & Publications Ball Corporation, 2010.
- Bangladesh Cooperative Act (2003). *Registration of cooperatives*. Bangladesh cooperative Department, Dhaka, Bangladesh .
- Bashyal, R. (2008). *Micro-finance: Access to finance for Nepal's Rural Poor*. Kathmandu: Institute for integrated Development Studies.
- Behr, A. (1983): *Empirical Research Methods For The Human Sciences*. An Introductory Text For Students Of Education, Psychology And Social Sciences, Pretoria: Butterworth.
- Braganza (2004). Global warming has a distinct greenhouse signature. Retrieved from [www.skepticalscience.com](http://www.skepticalscience.com). at 5th April, 2012.
- Cahn, M.(2006). *Sustainable Livelihoods, Micro-Enterprise and Culture in the Pacific Islands: Case studies from Samoa*. Ph. D Thesis. Massey University, Palmerston North, New Zealand. Available from [mro.massey.ac.nz](http://mro.massey.ac.nz) Cambridge UK, 20<sup>th</sup> January 2007.
- Cardwell, M., Clark, L. and Meldrum, C. (2004). *"Psychology"*. 3rd Edition, Harper Collins.133-134.
- Carney, D. (1998). *Sustainable Rural Livelihoods: What contribution can we make?* London Department for International Development (DFID), UK.

- CBS (2001). *Statistical Year Book of Nepal*. Publication: Department of Central Bureau of Statistics. Kathmandu, Nepal.
- CBS (2007). *Statistical Year Book of Nepal*. Publication: Department of Central Bureau of Statistics. Kathmandu, Nepal.
- Central Bureau of Statistics, (2005). *Summary Results on Poverty Analysis from Nepal living standards Survey 2003/04*. Publication: Nepal Government, Kathmandu, Nepal.
- Chambers, C. (1992). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*, Discussion Paper 296. Brighton, UK: Institute of Development Studies.
- Chambers, R. (1995). *'Poverty and Livelihoods: Whose Reality Counts?'* Discussion Paper 347. Brighton, UK: Institute of Development Studies.
- Collins, A., Joesph, D. & Bielaczyc, K. (2003). *Design Research: Theoretical And Methodological Issues*. Retrieved from <http://www.extension.harvard.edu/>
- Cooperative Laws in Afganstan (1997). *Trends of Institutionalization of cooperatives*. Afgastan cooperative Department. Retrieved from [www.uwcc.wisc.edu/.../Afghanistan1/Review-of-Co-op-Laws-in-Afg...](http://www.uwcc.wisc.edu/.../Afghanistan1/Review-of-Co-op-Laws-in-Afg...), at 14<sup>th</sup> March, 2012.
- Creswell, J. (1994). *Research Design: Qualitative and Quantitative Approaches*. London: Sage Publication, 1994.
- Creswell, J. (1998). *Qualitative Inquiry and Research Design. Choosing Among Five Traditions*. Thousand Oaks, California: Sage Publications, 1998.
- Creswell, J. (2003). *Research Design: Qualitative, Quantitative and Mixed Approaches*. Thousand Oaks, CA: Sage Publication, 2003.
- Cumhur, A., Malcolm, S. C. (2008). *The Effects of Global Climate Change on Agriculture*. American - Eurasian. *Journal of Agricultural and Environmental Science*, 3(5): 672-276.
- Denzin, N. (1978). *The Search Act: A Theoretical Introduction to Sociological Methods* (2nd Ed.). New York: Mcgraw Hill.

- Derar, R.. (2007). *Socio-Economic Impacts of Climate Change in Afghanistan*. A Report to the Department of International Development, London.
- DFID (2000). *Sustainable Livelihoods-Current thinking and practice*. London: Department for International Development. . London, UK.
- DFID (2000c). *Achieving Sustainability: Poverty Elimination and the Environment, strategies for Achieving the International Targets*. London: Department for International Development. London, UK.
- DFID (2000e). *Eliminating World Poverty: Making Globalization Work for the Poor, White Paper on International Development*. London: Department for International Development. London, UK.
- DFID (2001). *Sustainable Livelihoods Guidelines Sheets*. Numbers 1-8. London: Department for International Development. . London, UK.
- DFID (2003). *Policy, Overseas Development Institute*, Discussion Paper 217 London: Department for International Development. London, UK.
- Diamantopoulos, k. (2011). *Globalization, Social Innovation, and Co-Operative Development: A Comparative Analysis of Québec and Saskatchewan from 1980 to 2010*. University of Saskatchewan, Saskatoon, Ph. D Thesis.
- Dixit, A., (2011). *Climate change in Nepal: Impacts and adaptive strategies*, World Resources Report. Institution for Social and Environmental Transition-Nepal, 2011. Retrieved from [www.scoop.international.org/.../climate-change-nepal/.../climate-change-in-nepal-im](http://www.scoop.international.org/.../climate-change-nepal/.../climate-change-in-nepal-im). On 11<sup>th</sup> March,2012.
- Economic Survey F.Y, (2010/ 2011). *Government of Nepal, Ministry of Finance*. Kathmandu: Nepal Government.
- Elis, F., (1998). *Livelihood Diversification and Sustainable Rural Livelihoods' in Carney, D.(ed.) Sustainable Rural Livelihoods: What Contribution can We Make?* London: Department for International Development (DFID). Englewood Cliffs, NJ: Educational Technology Publications.

- Eriksson M., Jianchu Xu, Shrestha A. B., Vaidya, R. A., Nepal S. & Sandstrom (2009). *The Changing Himalayas' Impact of Climate Change on water resources and Livelihoods in the greater Himalayas*. ICMOD, Kathmandu, Nepal.
- Evans, D. (2006). *Empirical evidence that humans are causing global warming*. Retrieved from [www.skepticalscience.com](http://www.skepticalscience.com), on 14<sup>th</sup> May, 2012.
- FAO (2012). *Socio-economic Survey EADD-MICCA Pilot Project in Kenya*, Final Report, FAO.
- FAO (1997). *Development, the proceeding of World Forestry*, Congress, Italy, FAO.
- Fiji Cooperative Law (2004). *Registration process of cooperatives in Fiji*. Retrieved in [www.uwcc.wisc.edu/.../Co-operative.../Part-II---Review-of-Co-op-La...](http://www.uwcc.wisc.edu/.../Co-operative.../Part-II---Review-of-Co-op-La...) , on 5<sup>th</sup> March, 2011.
- Gagne, R. & Glaser, R. (1987). *Foundations in Learning Research*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Gephart, R. (1999). *Paradigms And Research Methods*. Online. Accessed on 16 March 2011. Retrieved from <http://www.aom.pace.edu/rmd/>
- Gerard, J.(1995). *Agriculture and Environment in the Midhills of Nepal: A Core of Mistake Identity Winrock International*. Winrock International Institute for Agricultural Development. Kathmandu, Nepal :
- Gurung, S. B.(1988). *Rural Development Approaches in Nepal*. Bidharthi Publication, Kathmandu, Nepal.
- Gyamtsho P., Rimal L. (2006). *Securing Sustainable Livelihoods in the Hindu Kush – Himalayas*. Directions for future Research, Development and Cooperation, ICIMOD 21<sup>st</sup> Anniversary Symposium, ICMOD, Kathmandu, Nepal.
- Henning, E., Rensburg, W. & Smit, B. (2004). *Finding Your Way In Qualitative Research*. Pretoria: Van Schaik.
- HMG (1992). *Report of Natural Resources of Nepal*. HMG, Kathmandu, Nepal.



- Hoermann B., Choudhary D., Choudhury D. & Kollmair M. (2010). *Integrated value Chain Development as a Tool for Poverty Alleviation in Rural Mountain Area.* An analytical and strategic framework, ICMOD, Kathmandu, Nepal.
- HRD (2001). *Human Resource Development in Nepal.* UNDP, Kathmandu, Nepal.
- HRD (2007). *Human Resource Development in Nepal.* UNDP, Kathmandu, Nepal
- ICA (1995). *Statement on Co-operative Identity Background Paper.* ICA. Available in [www.icacommission.org](http://www.icacommission.org), on 15<sup>th</sup> January, 2011.
- ICIMOD, (2010). *Mountain Initiative Status Paper.* Prepared for the United Nations Framework Convention on climate Change. (UNFCCC) and Rio+20 processes, ICMOD, Kathmandu, Nepal.
- ICMOD (2010). *International Expert Consultation Meeting: Mountain Initiative on Climate Change.* Convened by the Government of Nepal and ICIMOD 23 – 24 September 2010, Kathmandu, Nepal
- IFPRI (2009). *Climate change: Impact on agriculture and costs of adaptation.* IFPRI Policy seminar, 2009. Kathmandu, Nepal.
- India Cooperative Society Act (1995). *Trends of Institutionalization of cooperatives.* India Cooperative Society Act 1995, India.
- Indonesia Cooperative Act (1997). *Membership of cooperatives.* Indonesia Cooperative Act 1997. Indonesia.
- IPCC (2001). *Climate Change 2001 (TAR). Working Group II: Impacts, Adaptation and Vulnerability IPCC.* Third Assessment Report 2001, IPCC. Retrieved in [www.ipcc.ch/publications\\_and\\_data/publications\\_and\\_data\\_reports.shtml](http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml), on 22<sup>nd</sup> February, 2011.
- IPCC (2007). *Summary for Policy makers. In: Climate Change 2007 (AR4): Impacts, Adaptation and Vulnerability.* IPCC Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Jack, D. I. , Shrestha R. B. & Mool p. K (2010). *Formation of Glacial Lakes in the Hindu Kush- Himalayas and GLOF Risk assessment.* ICMOD, Kathmandu, Nepal.

- James (2003). *Global warming has a distinct greenhouse signature*. Skeptical Science. Available in [www.skepticalscience.com](http://www.skepticalscience.com), on 7<sup>th</sup> December 210.
- Japan Cooperative Society Act (1993). *Membership of cooperatives*. Japan Cooperative Society Act 1993, Japan.
- Jha, P. K. , Baral, S. P. , Karmacharya, S. B., Kekhak, P. , Baniya, C. B., (1998). *Bio-diversity, Agriculture and Pollution in South Asia*. Ecological Society (ECOS) Nepal.
- Jones & Mann, (2004). '*Climate over past millennia*.' Department of Environmental Sciences, University of Virginia, Charlottesville VA, USA.
- Joseph, L. (2010). *Seven Theories of Climate Change*. Heartland Institute 19 South LaSalle Street Chicago, Illinois 2010. Available in [heartland.org/policy-documents/7-theories-climate-change](http://heartland.org/policy-documents/7-theories-climate-change) on 28<sup>th</sup> November, 2011.
- Kanel, K., Kandel, B. (2004). *Revising Community Forestry in Nepal: Achievements. Challenges.* " Forest and Livelihood" 4(4): 55-63. On 19th December, 2011.
- Karianne, D. B. (2011). *Economic Analysis of Adaptation to Climate change under Uncertainty*. Wageningen University, the Netherlands, Ph. D Thesis.
- Khadka (2011). Impacts of climate change in Nepal. Presentation note on Regional conference of South Asian Alliance for Poverty Eradication. Kathmandu, Nepal.
- Khanka, s. (2009). *Human Resource Management*. New Delhi: S. Chand & Company.
- Kothari, C.R. , (2004). *Research Methodology methods and Techniques (Second Revised Edition)*. New Age International Publishers, India.
- Krefting, L. (1991). *Rigor In Qualitative Research*. The Assessment of Trustworthiness. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
- Kuhn, E. & Martorama, S. (1982). *Qualitative Methods For Institutional Research*. London: Jossey Bass.

- Kunzing, R., Broecker, W.(2009). *Fixing climate: The story of climate science and how to stop global warming*. Publication, green profile in association with sort of book, London.
- Lal, M. , Cubasch, U. ,Voss, R. , Waszkewitz, J. , (1995). *Effect of transient increase in greenhouse gases and sulfate aerosols on monsoon climate* . Curr. Sci., 69(9), 752– 763.
- Lal, M. Cubasch, U. Santer, B.D. (1994). ‘*Effect of global warming on Indian monsoon simulated with a coupled ocean-atmosphere general circulation model.*’ Retrieved from [tao.cgu.org.tw/pdf/v94p673.pdf](http://tao.cgu.org.tw/pdf/v94p673.pdf).,on 11th September, 2011.
- Latovika (2006). *Atmosphere and Greenhouse Warming*. Retrieved from [www.skepticalscience.com](http://www.skepticalscience.com). on 24th November, 2011.
- Leedy, P. (1997). *Practical Research: Planning And Design*. New York: Prentice Hall.
- Leeuwis, C. (2000). *Reconceptualizing Participation for Sustainable Rural Development: towards Negation Approach*. Development and Change 31, pp. 1-16.
- Macchi M. & ICIMOD team (2010). *Mountains of the World – Ecosystem services in a Time of Global and Climate change*. Seizing Opportunities – Meeting Challenges,
- Mandke, P. (2007). *Understanding the Linkages between Tourism and Urban Poverty Reduction Using Sustainable Livelihoods. Framework*. Ph. D Thesis.
- Manning, M.R. (2006). *Advances in Climate Change Research*. The treatment of uncertainties in the fourth IPCC assessment report, 2006.
- Maxwell, J. (1998). *Designing A Qualitative Study*. Handbook Of Applied Social Research Methods, (p. 66-100). Thousand Oaks: Sage publication.
- MDG (2009). *The Millennium Development Goals report 2009*. United Nation, America, New York.
- MHAHE (2000). *Degrees of Coastal Erosion*. Ministry of Home Affairs Housing and Environment, Maldives, Male.

- MHAHE (2001). *Climate Change and Sea level Rise*. Maldives, Male.
- Miles, M. & Huberman, A. (1994). *Qualitative Data Analysis* (2nd Ed.). Sage Publication.
- Ministry of Environment (2010). *National Adaption Programme of Action to climate change*. Kathmandu, Nepal.
- Ministry of Environment (2011). *Status of Climate change in Nepal*. Kathmandu, Nepal.
- MoF (2002). *Economic Survey of Nepal*. Ministry of Finance, Kathmandu, Nepal.
- MoPE (2000). *Environment Issue of Nepal*. HMG Nepal and MoPE, Kathmandu, Nepal.
- MoPE (2001). *Bio diversity of Nepal*. HMG Nepal and MoPE, Kathmandu, Nepal.
- Morse, J. (2005). *Approaches to Qualitative and Quantitative Methodological Triangulation*. Nursing Research, p120-123.
- Murphy, P. (2010). *Design, Implementation and Characterization of a Cooperative Communications System*. Rice University, Ph.D Thesis.
- NAPA (2003). *A Case Study: Economic Status of Nepal*. 9-11 September, 2003. Thimpu, Bhutan.
- Nepal Gov.(2000). *Loosing Traditional Seed Management Systems: A Threat to Small Farmers' Food Security in Nepal*. Kathmandu, Nepal.
- Nepal Gov.(2007). *Contribution of cooperative sectors*. Nepal government, Kathmandu, Nepal.
- Nepal Gov.(2012). *The Statistic Information of Cooperative in Nepal*. Department of Cooperative, Kathmandu, Nepal.
- Nepal Government (2009). *Statistical information of Nepalese Co-operatives Institution Agriculture and Co-operative Ministry, Department of Co-operative*. Kathmandu, Nepal.

- Nepal Government (2010). *Statistical information of Nepalese Co-operatives Institution (part-1)*, Agriculture and Co-operative Ministry, Department of Co-operative, Kathmandu, Nepal.
- Nepal, R.(2009). *Climatic Condition of Nepal*. Presentation note on Regional Conference of South Asian Alliance for Poverty Eradication. Kathmandu, Nepal.
- NPC (2007). *Three Year Interim Plan, Co-operative Sector*. National Planning Commission, 2007. Publication: Department of Co-operatives, Kathmandu, Nepal.
- NPC (2001). *Population Policy and Reproductive Health*. National Planning Commission, 2001. Kathmandu, Nepal.
- Pakistan cooperative Act (1999). *Trends of Institutionalization of cooperatives*. Pakistan cooperative Act 1999, Pakistan.
- Paudel D. (2011). *Impact of Climate change on rural Nepal*. University of Louisiana/LCC CRSP SLPS Project & Sarah Lupis, LCC CRSP.
- Paudel, R. (2008). *The end of Poverty*. Kathmandu: Oxford International Publication.
- Pelejero (2005). *Fossil Fuel Carbon*. Retrieved from [www.viewpointonline.net/global-warming-in-a-single-graphic-john-c](http://www.viewpointonline.net/global-warming-in-a-single-graphic-john-c), on 28Th December, 2011.
- Philippines cooperative Act (1999). *Trends of Institutionalization of cooperatives*. Philippines cooperative Act 1999, Philippines.
- Plass, G.N.(1965). *Carbon Dioxide and Climate* . Amer. Science. 44, 302 (1965).
- Pokharel, B. & Nurse, M.(2004). *Forests and People's livelihood: Benefiting the poor from Community Forest*. Journal of Forestry and Livelihood, vol. 4 (1): 19-29.
- Population Census (2001). *Tables of Eastern Development Region, June 2002*. Central Bureau of Statistic Department, Kathmandu, Nepal.
- Poudel,H.(2009). *Natural resources of Nepal*. Kathmandu, Nepal.

- Reeves, T. & Hedberg, J. (2003). *Interactive Learning Systems Evaluation*. Englewood Cliffs, NJ: Educational Technology Publications.
- Regmi, B. & Adhikari A. (2007). *Human Development Report 2007 Climate change and human development - risk and vulnerability in a warming world: Country Case Study-Nepal*. Kathmandu, Nepal.
- Reigeluth, C. M. & Frick, T. W. (1999). *Formative research: a methodology for improving design theories*. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: a new paradigm of instructional theory* (pp. 633–651). Mahwah, NJ: Lawrence Erlbaum Associates.
- Roe, E. (1998). *Policy Analysis and Formulation for Sustainable Livelihoods*. New York: United Nations Development Programme.
- Rupa K. K. , Ashrit, R. G. , (2001). *Regional aspects of global climate change simulations: Validation and assessment of climate response over Indian monsoon region to transient increase of greenhouse gasses and sulfate aerosols.* Mousam, 52, 229-244.
- SAAPE (2010). *Impacts of Climate Change on Food security under Market Mechanism: Focusing Dalit and Fisher Folks of Nepal*. Publication: All Nepal Peasants' Federation, Kathmandu, Nepal.
- Santer (2003). *Atmosphere and Greenhouse Warming*. Retrieved from [www.skepticalscience.com](http://www.skepticalscience.com), on 26th March, 2011.
- Schmidt, G. (2004). *Methane*. A Scientific Journey from Obscurity to Climate Super-Stardom, National Aeronautics Space and Administration (NASA).
- Schoones, I. (1998). *Sustainable Rural Livelihoods: a framework for Analysis*. Institute of Development Studies, University of Sussex Brighton.
- Shah, A. (2011). *Climate Change and Global Warming*. Retrieved from [www.Globalissues.org](http://www.globalissues.org) climate-change-and-global-warming-introduction, on April 14, 2011.
- Sharma K. P. (2009). *Climate Change Trends and Impacts on Livelihood of People*. Jalsrot Vikas Sanstha/Nepal Water Partnership, Kathmandu, Nepal.

- Sharma, K.P (2010). *Climate Change Trends and Instances of Socio-economic Effects in Nepal*. Jalsrot Bikash Sashta, Nepal/Nepal Water partnership, Kathmandu, Nepal.
- Sharma, M. ,Adhikari,S.N.(1990). *Capacity of Hydro in Nepal*. Kathmandu, Nepal.
- Sharma, p. (2003). *A Hand book of Social Science Research Methodology*. Kshitiz Publication, Kathmandu, Nepal.
- Sharma, P., Thapa, K.(2000). *Situation of Natural Resources*. Kathmandu, Nepal.
- Sharma, R. (1998). *Conflict in Community Forestry in Nepal: a review*. Banko Jankari. Forestry Information for Nepal.Vol 8 (2).
- Shephrd, G.& Gill, G. (1999). *Community Forestry and Rural Livelihoods in Nepal*. Nepal UK Community Forest project. Kathmandu, Nepal.
- Shrestha A. B. & Devkota, L. (2010). *Climate change in the Eastern Himalayans: Observed Trends and Model Projections, Climate change Impact and Vulnerability in the Eastern Himalayas – Synthesis Report'* ICIMOD, Kathmandu, Nepal.
- Shrestha, A. B. , Wake, C. P, Mayewski, P. A. , Dibb, J.E. (1999). '*Maximum temperature trends in the Himalaya and its vicinity: An analysis based on temperature records from Nepal for the period 1971-94.*' Journal of Climate.
- Shrestha, H.M (1968). *Water and Power Potential of Nepal*. Ph. D. Thesis (1966) from Moscow Power Institute, USSR.
- Shrestha, K. (1995). *Community Forestry in Nepal and an Overview of Conflicts*. Banko Jankari. A journal of forestry information for Nepal, vol.5 (3).
- Shrestha, T. (1999). *The Implementation of Decentralisation Scheme in Nepal*. Kathmandu, Nepal.
- Shrestha,T.B(1989). *Development Ecology of the Arun River Basin in Nepal*. ICIMID, Kathmandu, Nepal.

- Singh, Gilman, j.(2000). Employment and Natural Resources Management. A Livelihoods Approach to Poverty Reduction, SEPED Conference Paper Series 5, 2000.
- South African Cooperative Act (2003). *Registration of cooperatives*. South African cooperative sector, 2003.
- Springate, Sussan, J. (2003). *Community Forest Management in the Middle Hills of Nepal: The changing Context*. A journal of Forest and Livelihood Vol (3).
- Sri Lanka cooperative Act (1999). *Trends of Institutionalization of cooperatives*. Sri Lanka.
- Stainton, J. (1972). *Forestry of Nepal*. Murray, London.
- Stevenson et al.(2006). *Preindustrial to present day changes in troposphere hydroxyl radical and methane lifetime from the Atmospheric Chemistry and Climate Model Inter comparison Project (ACCMIP)*. Retrieved from [www.atmos-chem-phys-discuss.net](http://www.atmos-chem-phys-discuss.net)
- Strauss, C. (1990). *Basics of Qualitative Research: Grounded Theory*. SAGE Publications, Inc; 2nd edition (September 1, 1990).
- Subel, B. (2009). *Applications of Mass Spectrometry to Poly and Kinetics*. Ph. D Thesis, University of Akron.
- Thakuri, C.B. (2010). *An Anatomy of Cooperative Movement in Nepal*. Upakar Prakashan: Kathmandu, Nepal.
- Thompson, D, (1994). *Co-operative Principles Then and Now*. Cooperative Grocer (national Cooperative Grocers Association, Minneapolis). Thousand Oaks: Sage Publication.
- Titus, P. (1991). *Greenhouse Effect and Sea level Rise: The Cost of Holding Back the Sea*. Office of Policy Analysis U.S, Environmental Protection Agency, Washington DC, USA.
- Tiwari,P. ,Fahad S.M,(2000). *Microfinance Institutions in India: Concept paper*, Mumbai, India.



- Trochim, W. (2002). *Ethics In Research*. Online. Accessed On 2 April 2008.  
Available from <http://www.socialresearchmethods.net/kb/ethics.htm>
- Tse-ring K., Sharma E., Chhetri N. & Shrestha A.(2010). *Climate Change Vulnerability of Mountain Ecosystems in the Eastern Himalayas, Climate change Impact and Vulnerability in the Eastern Himalayas – Synthesis Report*' ICIMOD, Kathmandu, Nepal.
- UNDP/SEPED (2001). *Livelihood policy relationship in South Asia Working paper 1*, University of Leeds, UK.
- UNDP/SEPED (2001). *Livelihoods Approach to Poverty Reduction*. UNDP/SEPED Conference Paper Series 5, 2000.
- UNEP (2001). *State of the Environment of Nepal*. UNEP, NORAD, MoPE/HMG, Kathmandu, Nepal.
- UNEP (2008). *UNEP 2008 Annual Report*. UNEP Division of Communications and Public Information.
- Warner, C. (1997). *The Vision and Role of Community Forestry in Sustainable Development, the proceeding of World Forestry Congress 1997*. FAO, Italy.
- Weart, S. (2007): *The Discovery of Global Warming*. Retrieved from LiveScience.com. Wikipedia website, 'Atmosphere of Earth' Wikipedia.org/wiki/File, on 9th December, 2010.
- WECS (1988). *Water Resources Strategy Nepal*. HMG, Water and Energy Commission Nepal.
- WECS (1997). *Water Resources Strategy Nepal*. HMG, Water and Energy Commission Nepal.
- WECS (2002). *Water Resources Strategy Nepal*. HMG, Water and Energy Commission Nepal.
- World Bank (2002). *World Resources: 2000-2001*. World Resources Institute, Washington, DC, USA.

World Bank (2003). *World Resources: 2001-2002*. World Resources Institute, Washington, DC, USA.

World Bank (2008). *Global Monitoring Report 2008*. Retrieved from [www.worldbank.org](http://www.worldbank.org), on 27th January, 2012.

WRI (2003). *WRI Annual Report 2003*. World Resources Institute, 2003. Publications: Climate, Energy & Transport. Retrieved from [www.wri.org](http://www.wri.org), on 14<sup>th</sup> March 2011.

Xu, J. , Shrestha, A.B. , Vaidya R. , Eriksson, M. , Nepal, S. Sandstrom, K. (2008). *The changing Himalayas. Impact of climate change on water resources and livelihoods in the greater Himalayas*. Kathmandu: International Centre for Integrated Mountain Development.

## ANNEXES

**Some Visuals from the Study Field****Group discussion with participants****Researcher with respondents at Kharang, Sankhuwa Sabha**



**Group discussion with participants**



**Discussion with old aged people of Manakamana Ashram**





**Researcher with respondents of Kaurenipani, Bhojpur**



**Researcher with respondents of Chanuwa, Dhankuta**



**Researcher with respondents of Chanuwa, Dhankuta**



**Bhojpur and Dhankuta districts beside the Arun River**





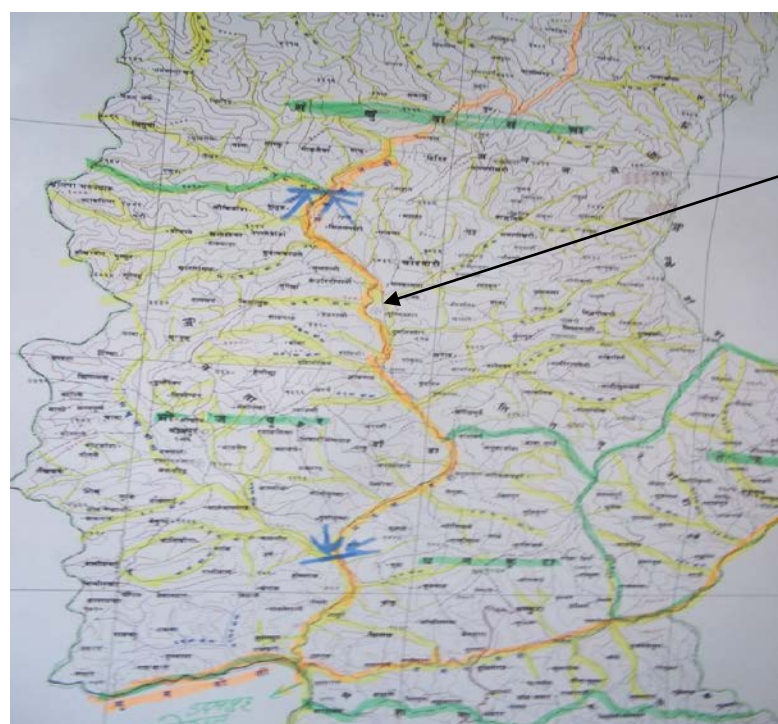
**Sankhuwa sabha and Bhojpur districts beside the Arun River**



**Combustion the forest of Akhibhui, Sankhuwa Sabha**



**Respodent of Sankhuwa Sabha**



**Arun River**

**Map of Study Area**





**The Maldivian Cabinet Underwater Meeting to Highlight on Climate Change**



**Nepalese Cabinet meeting at Kalapathar of Everest Base Camp**

**Tables**  
**Number of Primary Co-operative in Sankhuwa-Sabha District of Nepal**

| S.N. | Types of Cooperatives           | Number | Male Members | Female Members | Total Members |
|------|---------------------------------|--------|--------------|----------------|---------------|
| 1    | Savings and Credit Cooperatives | 29     | 439          | 305            | 744           |
| 2    | Multipurpose Cooperatives       | 40     | 1933         | 628            | 2561          |
| 3    | Dairy Cooperatives              | 2      | 148          | 95             | 243           |
| 4    | Electricity Cooperatives        | 1      | 18           | 7              | 25            |
| 5    | Tea producers cooperatives      | 1      | 25           | 1              | 26            |
| 6    | Others                          | 1      | 14           | 13             | 27            |
|      | Total                           | 83     | 2622         | 1056           | 3678          |

**Number of Primary Co-operative in Bhojpur District of Nepal**

| S.N. | Types of Cooperatives           | Number | Male Members | Female Members | Total Members |
|------|---------------------------------|--------|--------------|----------------|---------------|
| 1    | Savings and Credit Cooperatives | 71     | 1207         | 2575           | 3782          |
| 2    | Multipurpose Cooperatives       | 34     | 4394         | 1141           | 5535          |
| 3    | Agriculture Cooperatives        | 4      | 93           | 21             | 114           |
| 4    | Electricity Cooperatives        | 3      | 68           | 13             | 81            |
| 5    | Tea producers Cooperatives      | 1      | 7            | 19             | 26            |
| 6    | Communication Cooperatives      | 1      | 22           | 5              | 27            |
|      | Total                           | 114    | 5791         | 3774           | 9565          |

**Number of Primary Co-operative in Dhankuta District of Nepal**

| S.N. | Types of Cooperatives           | Number | Male Members | Female Members | Total Members |
|------|---------------------------------|--------|--------------|----------------|---------------|
| 1    | Savings and Credit Cooperatives | 42     | 412          | 1562           | 1974          |
| 2    | Multipurpose Cooperatives       | 43     | 4375         | 8609           | 12984         |
| 3    | Dairy Cooperatives              | 29     | 846          | 122            | 858           |
| 4    | Electricity Cooperatives        | 3      | 71           | 20             | 91            |
| 5    | Tea producers cooperatives      | 7      | 213          | 44             | 257           |
| 6    | Agriculture Cooperatives        | 19     | 368          | 149            | 517           |
| 7    | Herbal Cooperatives             | 1      | 22           | 7              | 29            |
| 8    | Consumer cooperatives           | 40     | 871          | 369            | 1240          |
| 9    | Others                          | 1      | 22           | 5              | 27            |
|      | Total                           | 185    | 7218         | 10887          | 18105         |

## QUESTIONNAIRES

### प्रश्नावली नं. १ (जलवायु परिवर्तनसंग सम्बन्धित)

नाम : उमेर : लिङ्ग :  
जिल्ला : गा.वि.स : वा.नं :  
शैक्षिक योग्यता : मुख्य पेशा : परिवार संख्या :

आफूलाई सही लागेको उत्तरमा ठीक चिन्ह (✓) लगाउनु होस् ।

१. तपाईंको घरमा खाना पकाउने इन्धन के प्रयोग गर्नु भएको छ ?

(क) दाउरा (ख) मट्टितेल (ग) ग्यास (घ)कोइला / गुइठा (ङ) अन्य

२. तपाईंलाई पहिले भन्दा वन जंगल वढेको जस्तो लाग्छ कि घटेको जस्तो लाग्छ ?

(क) वढेको छ (ख) घटेको छ (ग) खासै फरक छैन

३. तपाईंको आसपासमा पहिले भन्दा वन जंगल अर्थात् हरियाली वढेको जस्तो लाग्छ भने के कारणले वढेको होला ?

(क) खेती कम गर्ने भएर (ख) जंगल फडानी कम भएर (ग) सामुदायिक वनको विकास भएकोले (घ) सदावाहर खेतीमा वृद्धि भएर (घ) अन्य

४. तपाईंको आसपासमा पहिले भन्दा वन जंगल अर्थात् हरियाली घटेको छ भने किन घटेको होला जस्तो लाग्छ ?

(क) जंगल फडानी भएर (ख) आगो लागि भएर (ग) वस्ती विस्तार भएर (घ) चरिचरन वढेर (ङ) अन्य

५. तपाईंले पानीका स्रोतहरु (धारा, कुवा, इनार, खोलाखाल्सी, नदी)मा पानीको मात्राको अवस्था कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले   | २० वर्ष पहिले   | १० वर्ष पहिले   | ५ वर्ष पहिले    | यो वर्ष        |
|-----------------|-----------------|-----------------|-----------------|----------------|
| क. वढी थियो     | क. वढी थियो     | क. वढी थियो     | क. वढी थियो     | क. वढी छ       |
| ख. कम थियो      | ख. कम थियो      | ख. कम थियो      | ख. कम थियो      | ख. कम छ        |
| ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक छैन |

६. यहाँबाट देखिने हिमालमा हिउँको मात्रा कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले   | २० वर्ष पहिले   | १० वर्ष पहिले   | ५ वर्ष पहिले    | यो वर्ष        |
|-----------------|-----------------|-----------------|-----------------|----------------|
| क. वढी थियो     | क. वढी थियो     | क. वढी थियो     | क. वढी थियो     | क. वढी छ       |
| ख. कम थियो      | ख. कम थियो      | ख. कम थियो      | ख. कम थियो      | ख. कम छ        |
| ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक थिएन | ग.खासै फरक छैन |





१७. गर्मि समयमा लामखुट्टेको मात्रा कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

१८. तपाईंले मनसुनी वर्षाको मात्रा कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

१९. तपाईंले खेतीपाती गरिरहनु भएको वालीनालीमा लाग्ने कीराको मात्रा कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२०. जनवार तथा मानिसमा नयाँ रोगहरु देखा पर्ने क्रम कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२१. तपाईंले थाहा पाए अनुसार खडेरी पर्ने क्रम कुन कुन समयमा कस्तो कस्तो देख्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२२. बाढी, पोहिरोको प्रकोप कून कून समयमा कस्तो कस्तो देखै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२३. तपाईंले गरिरहनु खेतीपातीमा रसायनिक मल, कीटनाशक औषधी प्रयोग कुन कुन समयमा कस्तो कस्तो गर्दै आउनु भएको छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२४. तपाईंको गाउँघरमा अन्नवालीको उत्पादनको मात्रा कस्तो छ जस्तो लाग्छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२५. तपाईंको गाउँघरमा पशुपालनको अवस्था कस्तो छ जस्तो लाग्छ ?

| ३० वर्ष पहिले    | २० वर्ष पहिले    | १० वर्ष पहिले    | ५ वर्ष पहिले     | यो वर्ष         |
|------------------|------------------|------------------|------------------|-----------------|
| क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी थियो      | क. बढी छ        |
| ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम थियो       | ख. कम छ         |
| ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक थिएन | ग. खासै फरक छैन |

२६. तपाईंको गाउँघरमा बसाई सरेर आउने र तपाईंको गाउँघरबाट बसाई सरेर जाने मध्ये कुनको संख्या बढी छ जस्तो लाग्छ ?

(क) बसाई सरेर आउने (ख) बसाई सरेर जाने (ग) बसाई सरेर आउने र जाने बराबर जस्तै छ

२७. तपाईंको गाउँघरमा बसाई सरेर आउनेको संख्या बढी हुनुका कारणहरु के के होलान् ?

(क) शहरीकरण भएर (ख) खेती योग्य जमिन भएर (ग) शिक्षा, स्वस्थ, खानेपानी, यातायता आदिको सुविधा भएर

२८. तपाईंको गाउँघरबाट बसाई सरेर जानेको संख्या बढी हुनुका कारणहरु के के होलान् ?

(क) खाना लाउन नपुगी गरिवी भएर (ख) खेती योग्य जमिनको अभाव भएर (ग) शिक्षा, स्वस्थ, खानेपानी, यातायता आदिको सुविधा नभएर (घ) धनी भएर

२९. तपाईंको खेतवारी तथा वनका बोटविरुवाहरु फुल्ने तथा फल लाग्ने समयमा परिवर्तन त पाउनु भएको छैन ?

(क) पहिले भन्दा चाडै फुल्छ (ख) पहिले भन्दा ढिलो फुल्छ (ग) खासै फरक परेको छैन

३०. तपाईंको आसपासमा भएका पोखरी तथा तालमा पानीको गहिराईमा के फरक पाउनु भएको छ ?  
(क) पहिले पानीको सतह बढी थियो (ख) अहिले पानीको सतह बढी छ (ग) खासै फरक परेको छैन
३१. तपाईंको आसपासमा भएका खोला तथा नदीमा पानीको सतहमा केही फरक पाउनु भएको छ ?  
(क) पहिले पानी बढी थियो (ख) अहिले पानी बढी छ (ग) खासै फरक परेको छैन
३२. तपाईंले लगाउनु भएको फलफूल अगाडि वा पछाडि पाक्ने त गरेको छैन ?  
(क) अगाडि पाक्ने गरेको छ (ख) पछाडि पाक्ने गरेको छ (ग) खासै फरक परेको छैन
३३. तपाईं वसोवास गरेको क्षेत्रमा वन्य जन्तु तथा चराचुरुङ्गीहरू संख्या कस्तो छ ?  
(क) बढेको छ (ख) घटेको छ (ग) खासै फरक परेको छैन
३४. तपाईं वसोवास गरेको क्षेत्रमा पहिले नभएका जनवार, चराचुरुङ्गीहरू त पाइने गरेका छैनन् ?  
(क) छैनन् (ख) छन् – जनवार:  
– चराचुरुङ्गी:
३५. तपाईं वसोवास गरेको क्षेत्रमा पहिले भएका जनवार, चराचुरुङ्गीहरू लोप हुँदै गएका त छैनन् ?  
(क) छैनन् (ख) छन् – जनवार:  
– चराचुरुङ्गी
३६. मौसम, वर्षा तथा तापक्रममा परिवर्तन आई तपाईंको उत्पादनमा के फरक भएको छ ?  
(क) बढेको छ (ख) घटेको छ (ग) खासै फरक छैन
३७. उत्पादन बढेको भए के कारणले बढेको होला ?  
(क) मल, औषधीको प्रयोग गरेर (ख) उन्नत जातको बीउ विजन प्रयोग गरेर (ग) सिचाईको व्यवस्था राम्रो भएर (घ) मौसम परिवर्तन अनुकूल भएर (ङ) माथिका सबै
३८. उत्पादन घटेको भए वैकल्पिक खाद्य तथा आय स्रोतको व्यवस्था कसरी गर्नु भएको छ ?  
(क) मजदुरी गरेर (ख) जागिर खाएर (ग) वैदेशिक रोजगारी गरेर (घ) पशुपालन गरेर (ङ) अन्य
३९. जलवायु परिवर्तनका असर बारे अन्य केही कुराहरू देख्दै भोग्दै आउनु भएको छ की ?



## पारिवारिक जीवन निर्वाहसंग सम्बन्धित (प्रश्नावली नं.२)

घरमूलीको नाम:

परिवार संख्या:

## १. पारिवारिक विवरण तालिका

| महिलाको उमेर | महिलाको संख्या | कमाई गर्ने महिला | शैक्षिक योग्यता | पुरुषको उमेर | पुरुषको संख्या | कमाई गर्ने पुरुष | शैक्षिक योग्यता | कैफियत |
|--------------|----------------|------------------|-----------------|--------------|----------------|------------------|-----------------|--------|
| ० - १०       |                |                  |                 | ० - १०       |                |                  |                 |        |
| १० - २०      |                |                  |                 | १० - २०      |                |                  |                 |        |
| २० - ३०      |                |                  |                 | २० - ३०      |                |                  |                 |        |
| ३० - ४०      |                |                  |                 | ३० - ४०      |                |                  |                 |        |
| ४० - ५०      |                |                  |                 | ४० - ५०      |                |                  |                 |        |
| ५० - ६०      |                |                  |                 | ५० - ६०      |                |                  |                 |        |
| ६० - ७०      |                |                  |                 | ६० - ७०      |                |                  |                 |        |
| ७० - ८०      |                |                  |                 | ७० - ८०      |                |                  |                 |        |
| ८० - ९०      |                |                  |                 | ८० - ९०      |                |                  |                 |        |
| ९० - १००     |                |                  |                 | ९० - १००     |                |                  |                 |        |

२. तपाईंको परिवारले गरेको आम्दानीले तपाईंको घर परिवार चलाउन खर्च पुग्छ कि पुग्दैन ?

(क) दुःखसुख पुगेकोछ (ख) ऋण नगरे खर्च पुग्दैन (ग) खर्च गरेर केही वचत हुन्छ

३. यदि तपाईंलाई घर परिवार चलाउन खर्च पुग्दैन भने नपुग खर्चको लागि वार्षिक कति ऋण गर्दै आउनु भएकोछ ?

(क) २० हजार भन्दा कम (ख) ४० हजार भन्दा कम (ग) ६० हजार भन्दा कम (घ) ८० हजार भन्दा कम (ङ).....

४. यदि वार्षिक आम्दानीले तपाईंको घर परिवार चलाउन खर्च पुगेर वचत हुन्छ भने वार्षिक कति वचत गर्नु हुन्छ ?

(क) २० हजार भन्दा कम (ख) ४० हजार भन्दा कम (ग) ६० हजार भन्दा कम (घ) ८० हजार भन्दा कम (ङ).....

५. तपाईंको परिवारको नाममा खेत, वारी, पाखोवारी कति छ ?

(क) खेत रोपनी/कट्ठा (ख) वारी रोपनी/कट्ठा (ग) जग्गा विहिन

६. तपाईंले उत्पादन गरेको अन्नले तपाईंको परिवारलाई कति महिनाको लागि खान पुग्छ ?

(क) १-३ (ख) ३-६ (ग) ६-९ (घ) ९-१२ (ङ) १२ महिना भन्दा बढी

७. पहिलेको र अहिलेको तपाईंको आर्थिक अवस्थामा के कस्तो फरक पाउनु भएकोछ ?

(क) पहिले भन्दा राम्रो (ख) पहिले भन्दा खराब (ग) पहिले र अहिलेमा केही फरक छैन

८. अहिलेको आर्थिक अवस्था राम्रो हुनका कारणहरु के होलान् ?

(क) स्वादेशी रोजगारीको संख्या बढेर (ख) वैदेशिक रोजगारीको संख्या बढेर (ग) उत्पादनमा वृद्धि भएर (घ) व्यावसायमा वित्तिय लगानी बढाएर (ङ) अन्य.....

९. अहिलेको आर्थिक अवस्था खराब हुनका कारणहरु के होलान् ?

(क) स्वादेशी रोजगारीको संख्या घटेर (ख) वैदेशिक रोजगारीको संख्या घटेर (ग) उत्पादनमा ह्रास आएर (घ) व्यावसायमा वित्तिय लगानी बढाउन नसकेर (ङ) अन्य.....

१०. अहिलेको आर्थिक अवस्था सुधार गर्न के को अपेक्षा गर्नु भएकोछ ?

(क) स्वादेशी रोजगारको व्यावस्था गरेर (ख) वैदेशिक रोजगारमा जान ऋणको व्यावस्था गरेर (ग) व्यावसायमा वित्तिय ऋण लगानी बढाएर (घ) कृषि आधुनिकिकरणमा सहयोग जुटाएर (ङ) अन्य.....

११. विद्यालय जाने उमेर समूहका तपाईंका बालबच्चाहरु पढिरहेका छन् कि छैनन् ?

(क) सबै छोरा छोरी पढिरहेका छन् (ख) छोरा/छोरी मात्र पढिरहेका छन् (ग)..... जना छोरोमा..... छोरा मात्र पढ्छन् (घ)..... जना छोरीमा..... छोरी मात्र पढ्छन् (ङ) कोही पनि पढ्दैनन्

१२. तपाईंको परिवारको मुख्य पेशा के हो ?

(क) कृषि तथा पशुपालन (ख) जागिर (ग) व्यापार (घ) वैदेशिक रोजगार (ङ) मजदुरी (च) अन्य

१३. तपाईंको परिवारको सहायक पेशा के हो ?

(क) कृषि तथा पशुपालन (ख) जागिर (ग) व्यापार (घ) वैदेशिक रोजगार (ङ) मजदुरी (च) अन्य

१४. तपाईंले उत्पादन गर्नु भएको वस्तु तथा सामग्रीको विक्री गर्ने बजार पुग्न कति समय लाग्छ ?

(क) १५ मिनेट (ख) ३० मिनेट (ग) १ घण्टा (घ) २ घण्टा (ङ) ३ घण्टा (च) ३ घण्टा भन्दा बढी

१५. बजारको नजिकै व्यावस्था भए तपाईं थप उत्पादन गर्न सक्नु हुन्छ ?

(क) सक्छु (ख) सकिदैन (ग) भन्न सकिन्न

१६. बर्षे खेतीको लागि सिचाईको व्यावस्था कस्तो छ ?

(क) राम्रो (ख) सामान्य (ग) छैन

१७. हिउदे खेतीको लागि सिचाईको व्यावस्था कस्तो छ ?

(क) राम्रो (ख) सामान्य (ग) छैन

१८. तपाईंको नजिकको बजारमा मल, बीउ तथा बिषाधीको व्यावस्था कस्तो छ ?

(क) राम्रो (ख) सामान्य (ग) छैन

१९. तपाईं आफ्नो जीविकोपार्जनको लागि कुनै सहकारी संस्था वा समूहमा रहेर काम गरिरहनु भएकोछ ?

(क) छ (ख) छैन

२०. यदि काम गरिरहनु भएको छ भने कस्तो सहकारी वा समूहमा आवद्ध हुनुहुन्छ ?

(क) कृषिमा आधारित समूह वा सहकारी (ख) कृषि बजारमा आधारित समूह वा सहकारी (ग) वचत तथा ऋण समूह वा सहकारी (घ) अन्य.....

२१. सहकारी वा समूहमा आवद्ध भएर काम गर्दा कस्ता कस्ता फाइदाहरु पाउनु भएकोछ ?

(क) आम्दानी वृद्धि भएको छ (ख) रोजगारी थपिएको छ (ग) सामुहिक भावानाले आत्मा बल बढेको छ (घ) माथिका सबै  
(ङ) खासै फाइदा लिन सकेको छैन

२२. आर्थिक उपार्जनको लागि कुनै संघ संस्थाले तपाईंको टोल छिमेकमा काम गरिरहेको छ ?

(क) छ (ख) छैन

२३. छ भने त्यो संस्था तपाईंको घरबाट कति टाढा पर्छ ?

(क) १५ मिनेट (ख) ३० मिनेट (ग) १ घण्टा (घ) २ घण्टा (ङ) ३ घण्टा (च) ३ घण्टा भन्दा बढी

२४. तपाईं वा तपाईंको समूहलाई कुन संस्थाले सहयोग गरिरहेको छ ?

(क) सहकारी संस्था (ख) लघु वित्तिय संस्था (ग) गरिवी निवारण कोष (घ) गैर सरकारी संस्था (ङ) सरकारी निकाय

२५. तपाईं कुन व्यावसाय वा रोजगारीको काम गर्न चाहानु हुन्छ ?

(क) कृषि तथा पशुपालन (ख) व्यापार (ग) नोकरी (घ) वैदेशिक रोजगार (ङ) अन्य.....

२६. तपाईंले गर्न चाहानु भएको व्यावसाय वा रोजगारीका पूर्वाधारहरु के छन् ?

(क) कृषि जनशक्ति र जमिन प्रयाप्त भएको (ख) व्यापार गर्ने क्षमता भएको (ग) नोकरीको लागि शैक्षिक योग्यता र क्षमता भएको (घ) वैदेशिक रोजगारको लागि व्यावसायिक शिप भएको (ङ) अन्य.....

२७. त्यस्तो व्यावसायमा तपाईंले आशा गरेका सहयोगहरु के के छन् ?

(क) आर्थिक तथा भौतिक सहयोग (ख) प्राविधिक शिप तथा तालिमको सहयोग (ग) बजार व्यवस्थापनको सहयोग (घ) यतायातको सहयोग (ङ) कृषि तथा पशुपालनमा सहयोग (च) माथिका सबै

२८. त्यस्तो व्यावसाय वा रोजगारीमा जलवायु परिवर्तनले पार्ने प्रभाव बारे ध्यान दिनु भएको छ ?

(क) छ (ख) छैन

२९. सम्भाव्य जलवायु परिवर्तनबाट वाच्च सावधानीका उपयाहरु के के हुन सक्छन् ?

(क) सहकारी वा समूहमा संलग्न भएर काम गर्नु (ख) थप नयाँ व्यावसाय तिर लाग्नु (ग) सुरक्षित स्थानमा बसाई सर्ने (घ) वैदेशिक रोजगारमा जोड दिने (ङ) मौसम अनुकूलको कृषि प्रणालीमा जोड दिने (च) अन्य.....

३०. सावधानीका प्रयासमा सहकारी वा समूहमा संलग्न हुनाले पाउने फाईदा के के छन् ?

(क) सामुहिक प्रयास हुने (ख) व्यावसाय गर्न ऋण सजिलै प्राप्त हुने (ग) रोजगारीको अवसर प्राप्त हुने (घ) सरकारी तथा गैर सरकारी सहयोग प्राप्त हुने (ङ) माथिका सबै

### सहकारीसंग सम्बन्धित प्रश्नावली नं. ३

(सहकारी संस्थामा आवद्ध भएका सहकारीका सदस्यहरु, उपभोक्ताहरु तथा सहकारीसंग सम्बन्धित विभिन्न सरकारी तथा गैर सरकारी निकायका व्यक्तिहरु, सहकारीको बारे जानकारी भएका व्यक्तिहरूसंग मात्र सिमित गर्ने)

सहभागीको नाम :

संलग्न संस्था वा कार्यलयको नाम :

संलग्न संस्था वा कार्यलयमा आवद्ध भएको समय :

१. सहकारीमा दलित, जनजाती, अल्प संख्याक, सिमान्तकृत जाती तथा गरिव वर्गको सहभागिता कस्तो छ जस्तो लाग्छ ?  
(क) राम्रो (५० प्रतिशत भन्दा बढी सहभागी) (ख) सामान्य (२० प्रतिशत देखि माथि ५० प्रतिशत भन्दा कम सहभागी)  
(ग) न्युन (१० - २० प्रतिशतसम्म सहभागी) (घ) अति न्युन (५ - १० प्रतिशतसम्म सहभागी) (ङ) सून्य
२. सहकारीबाट पिछ्छडिएका तथा गरिव वर्गले कति फाइदा लिइरहेका छन् जस्तो लाग्छ ?  
(क) राम्रो फाइदा लिएका छन् (ख) सामान्य फाइदा लिएका छन् (ग) न्युन फाइदा लिएका छन् (घ) अति न्युन (ङ) सून्य
३. गरिवी निवारणमा सहकारी आन्दोलनलाई प्रभावकारी बनाई पिछ्छडिएका तथा गरिव वर्गलाई माथि उठाउन के गर्नु पर्ला ?  
(क) सहकारीको मूल्य र मान्यतामा आधारित साना साना समूह गठन गरी सहकारी शिक्षा दिई सहकारी तर्फ आकर्षण गर्ने  
(ख) हालको सहकारी आन्दोलनको गति बढाई सहकारी तर्फ आकर्षण गर्ने (ग) अन्य
४. यदि सहकारीको मूल्य र मान्यतामा आधारित साना समूह गठन गरी पिछ्छडिएका तथा गरिव वर्गलाई सहकारी आन्दोलनमा सरिक गर्दा के होला ?  
(क) सहकारीको महत्व बढ्छ (ख) सहकारीको महत्व घट्छ (ग) खासै फरक पर्दैन
५. यदि सहकारीको मूल्य र मान्यतामा आधारित साना समूह गठन गर्नु ठीक हो भने त्यस्ता गठित समूहलाई प्रारम्भिक सहकारीको मान्यता दिँदा के हुन्छ होला ?  
(क) प्रारम्भिक सहकारीको मान्यता दिनु राम्रो हुन्छ (ख) प्रारम्भिक सहकारीको मान्यता दिनु राम्रो हुँदैन  
(ग) खासै फरक पर्दैन
६. यदि त्यस्ता साना समूहलाई प्रारम्भिक सहकारीको मान्यता दिनु राम्रो हुँदैन भने के गर्नु पर्ला ?  
(क) सदस्यहरु बीच आपसी समझदारीमा सहकारीको मूल्य र मान्यताको आधारमा काम गर्न दिने  
(ख) त्यस्ता समूहलाई सहकारी संस्था भन्दा छुट्टै संस्थाको रुपमा विकास गर्ने  
(ग) सहकारी शिक्षा दिने थलो मात्र बनाई सहकारीमा सहभागी गराउने प्रयास गर्ने
७. यदि त्यस्ता साना समूहलाई प्रारम्भिक सहकारीको मान्यता दिनु राम्रो हुन्छ भने न्युनतम कति सदस्यहरुले प्रारम्भिक सहकारी गठन गर्दा ठीक होला जस्तो लाग्छ ?  
(क) ३ जना (ख) ५ जना (ग) ७ जना (घ) ९ (ङ) ११
८. यस्तो प्रारम्भिक सहकारी संस्थालाई कहाँ दर्ता गर्ने व्यावस्था गर्नु राम्रो होला जस्तो लाग्छ ?  
(क) स्थानीय निकाय - गा.वि.स./न.पा (ख) निर्वाचन क्षेत्र स्तरीय निकाय (ग) जिल्ला स्तरीय निकाय (घ) हाल सहकारी संस्था दर्ता भएकै निकाय
९. एकै प्रकृतिका प्रारम्भिक सहकारी संस्थाहरु सहकारीमा परिणत गर्नु ठीक हुन्छ कि हुँदैन ?  
(क) सहकारीमा परिणत गर्नु ठीक हुन्छ (ख) सहकारीमा परिणत गर्नु ठीक हुँदैन (ग) खासै फरक पर्दैन
१०. यदि प्रारम्भिक सहकारी संस्थाहरु सहकारी संस्थामा परिणत गर्नु पछि भने कसरी गर्नु ठीक होला ?  
(क) एउटै प्रारम्भिक सहकारी संस्थाका कम्तिमा २५ सदस्य बनाएर

(ख) २ प्रारम्भिक सहकारी संस्थाहरूका कम्तिमा २५ सदस्य बनाएर (ग) ३ प्रारम्भिक सहकारी संस्थाहरूका कम्तिमा २५ सदस्य बनाएर (घ) ४ प्रारम्भिक सहकारी संस्थाहरूका कम्तिमा २५ सदस्य बनाएर (ङ) ५ प्रारम्भिक सहकारी संस्थाहरूका कम्तिमा २५ सदस्य बनाएर (च) माथिका सबै विकल्प खुल्ला गर्ने

११. एकै प्रकृतिका प्रारम्भिक सहकारी संस्थाहरू मिली बनेको सहकारी संस्थाबाट प्रारम्भिक सहकारी संस्थाहरू अलग हुन चाहेमा स्वातन्त्रता दिने कि नदिने ?

(क) स्वातन्त्रता हुन दिने (ख) स्वातन्त्रता हुन नदिने (ग) खासै फरक पर्दैन

१२. प्रारम्भिक सहकारी संस्थालाई लघु सहकारी संस्था नामाकरण गर्दा के होला ?

(क) प्रारम्भिक सहकारी संस्था नै ठीक छ (ख) लघु सहकारी संस्था ठीक छ (ग) खासै फरक पर्दैन

१३. सहकारीमा दलित, जनजाती, अल्प संख्याक जाती, सिमान्तकृत जाती तथा गरिव वर्गको सहभागिता बढाउन तपाईंका केही सुझावहरू छन् कि ?

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१४. सहकारीलाई गरिवी निवारणको आधार बनाउन हालको सहकारी व्यवस्थामा के कस्तो सुधार गर्नु पर्ला ?

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१५. गरिवी निवारणमा सहयोग पुर्याउन उपयुक्त सहकारीको मोडल कस्तो हुनु पर्ला ?

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१६. जलवायु परिवर्तनबाट बचाउन गरिव तथा पिछडाडिका वर्गलाई दिगो जिविकोपार्जन प्रणालीमा लैजान के गर्नु पर्ला ?

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१७. के सहकारी जलवायु परिवर्तनबाट बचाउन उपयोगी हुन सक्छ ? सक्छ भने यसका आधार के के हुन सक्छ ?

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१८. गरिवी निवारणमा सहकारी बाहेक अन्य कुनै संस्थागत ढाँचा सोच्नु भएको छ ?

(क) छ (ख) छैन

१९. छ भने कस्तो संस्थागत ढाँचा सोच्नु भएको छ ?

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२०. छैन भने यस प्रयासको लागि सहकारीको स्वरूप कसरी व्यापक गर्नु पर्ला ?

(क) सहकारी क्षेत्रबाट अभियान चलाएर (ख) नीजि तथा सरकारी साभदारीमा (ग) नीजि क्षेत्रलाई सक्रिय बनाएर (घ) सरोकारवाला समूहलाई अगाडि बढाएर (ङ) गैर सरकारी संस्थाहरूलाई परिचालन गराएर

२१. थप अन्य सुझावहरू केही छन् की ?