STUDY ON HUMAN DEVELOPMENT FOR INCLUSIVE AND SUSTAINABLE GREEN GROWTH IN HIMACHAL PRADESH

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CONTENTS

PREFACE

The growing need for environment-friendly sustainable economic growth is owing to the deepening global environmental crisis and depletion of natural resources. The IPCC (Inter Governmental Panel on Climate Change) reports that the global average temperature has increased by 0.6℃ over the last century, thereby emerging as the biggest environmental problem that human beings have encountered. Climate change triggers a variety of meteorological disasters and results in ecosystem disturbance, which threaten the survival of life on earth. As a result, sustainable green growth as an alternative has become an emerging solution to help curb greenhouse gases and environmental pollution across countries, while ensuring sustainable economic growth.

During the past few decades, Himachal Pradesh has earned the distinction of being one of the most progressive hills State of the country and its efforts have been acknowledged globally. The progress made by the State in terms of availability of health and education facilities has been commendable. Despite the geo-climatic fragility, the State has remarkably improved in the availability of physical infrastructure. It however, continues to face the vagaries of nature in the form of floods, earthquakes and landslides.

It is in this background that this study has been undertaken by Himachal Pradesh Human Development Research and Coordination Society Regd. (HPHDRCS) through R G Foundation to assess the overall level of Human Development and green growth achieved in the State over the last decade, and to suggest ways to achieve environmentally sustainable and inclusive green growth.

The team of Himachal Pradesh Human Development Research and Coordination Society (Regd.) is also instrumental in coordinating various aspects of the study and providing relevant information and data to the R.G. Foundation, New Delhi which did field survey, collected data, data analysis and report writing. The valuable comments and suggestions provided by the Dr. Suryanarayan M.H., Professor, Indira Gandhi Institute of Development Research, Mumbai who reviewed the draft report have contributed in improving the quality of the report.

This research study has been a matter of pride for us and the report presented herein is the result of dedicated efforts. The recommendations made in this study are based on the detailed interactions with a number of experts/advisors. We hope this study would help the policy-makers, academicians, Government functionaries, NGOs, international agencies and all those engaged in developing the State of Himachal Pradesh.

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ABBREVIATIONS

AIDS	Acquired Immuno Deficiency Syndrome
ANMS	Auxiliary Nurse Midwife
BCG	Bacillus Calmetta Guerin
BOD	Bichemical Oxygen Demand
CBR	Crude Birth Rate
CDR	Crude Death Rate
CFC	Chloro-Floro-Carbons
CL	Chlorine
CO	Carbon Monoxide
CPR	Couple Protection Rate
CSSM	Child, Survival Safe Motherhood Programme
CSW	Commercial Sex Worker
Cu.m	Cubic Metre
DIET	District Institute of Education and Training
DO	Dissolved Oxygen
DPT	Diphtheria Pertussis Tetanus
EDII	Equally Distributed Income -Index
FSI	Forest Survey of India
GAD	Government Ayurvedic Dispensary
GDI	Gender Related Development Index
GDP	Gross Domestic Product
GEM	Gender Empowered Measure
GER	Gross Enrolment Ratio
GHI	Gender related Health Index
GoHP	Government of Himachal Pradesh
H_2S	Hydrogen Sulphide
Ha	Hectares
Hc	Hydro Crabon
HDI	Human Development Index
HDR	Human Development Report
Hect.	Hectare
HIV	Human Immunodeficiency Virus
HMHS	High Mountain Horse Shoe
ICDS	Integrated Child Development Services
IFA	Iron and Folic Acid
IMR	Infant Mortality Rate
IRDP	Integrated Rural Devlopment Programme
ISM&H	Indian System of Medicine and Homeopathy
Kg.	Kilogram
Km.	Kilometre

Kms	Kilometers
KWh.	Kilowatt hour
LAR	Largi
LEB	Life Expectancy at Birth
LEPR	Labour Force Participation Rate
LHP	Low Hills and Plains
L & S	Lahaul & Spiti
M.C.M	Million Cubic Metre
m.s.i	Mean Sea Level
M.T.	Metric Ton
MAT	Mother Teacher Association
Mg	Magnesium
Mg	Microgram
mg	Miligram
MMR	Maternal Mortality Rate
MPCC	Monthly Per Capita Consumption
MW	Megawatts
NA	Not Available
NABARD	National Bank for Agriculture and Rural Development
NACO	National AIDS Control Organization
NCERT	National Council of Education Research and Training
NDP	Net Domestic Product
NER	Net Enrolment Ratio
NFHS	National Family Health Survey
NH_3	Ammonia
NIEPA	National Institute of Education, Planning and Administration
NLM	National Literacy mission
NO_2	Nitrogen Dioxide
NO_3	Nitrate
Nox	Oxides of Nitrogen
NSSO	National Sample Survey Organization
ODP	Ozone Depletion
ORS	Oral Re-hydration Solution
ORT	Oral Re-hydration Therapy
P	Provisional
PAT	Parents Teacher Association
Pb	Lead
PDGoHP	Planning Department Government of Himachal Pradesh
PLP	Post Literacy Programme
PPP$	Purchasing Power Parity in dollars
PROBE	Public Report on Basic Education
Q	Quick Estimates
R	Revised

RAV	Ravi
RCH	Reproductive and Child Health Programme
REDP	Rural Entrepreneurship Development Programme
RIDF	Rural Infrastructure Development Fund
RPM	Respirable Particulate Matter
Rs.	Rupees
RSPM	Residual Suspended Particulate Matter
SGSY	Swaranjayanti Gram Swarozgar Yojana
SO_2	Sulphur dioxide
SO_4	Sulphate
SPM	Suspended Particulate Matter
Sq.Kms	Square Kilometers
SRS	Sample Registration System
STD	Sexually Transmitted Disease
TC	Total Coliform Organism
TFR	Total Fertility Rate
TLC	Total Literacy Campaign
TSP	Total Suspended Particulate
TT	Tetanus Toxoid
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund

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R G Foundation

EXECUTIVE SUMMARY

INTRODUCTION

Environmental damage has not only created obstacles to sustainable economic development but is also posing great threats to human health, ecological systems and to the socio-cultural environment in which human beings lead their daily lives. As a result, sustainable green growth has become an emerging solution to help restrict greenhouse gases emission and environmental pollution in the world and to ensure sustainable economic growth.

It is believed that though, Himachal Pradesh has achieved rapid economic growth; it needs to improve its effectiveness on management in environmental resources, protect the vulnerable ecosystem and work towards sustainable development. The focus should be to maintain the pristine Himalayan environment while ensuring Human Development. There is also need to combine efforts towards increasing the per capita income and facilitate sustainable use of natural resources. In this context, Himachal Pradesh Human Development Research and Coordination Society (HPHDRCS), Planning Department, Himachal Pradesh carried out the present study.

OBJECTIVE OF THE STUDY

The focus of the study is to assess the level of Human Development achieved in the State of Himachal Pradesh in the last decade following a life cycle approach, and to institutionalize the integration of Human Development into the planning process in Himachal Pradesh to achieve environmentally sustainable and inclusive green growth.

The specific objectives of the study are to:

1. Assess overall level of Human Development achieved in the State of Himachal Pradesh over the last decade.
2. Assess the green growth and development that has been achieved through productive consumption and use of natural resource in Himachal Pradesh.
3. Analyze how environmental challenges are affecting Human Development and to document linkages between Human Development and environmental sustainability.
4. Analyze the detrimental effects of climate change and environmental degradation on the poor and vulnerable population.
5. Examine the extent to which the environmental concerns are integrated into planning process in Himachal Pradesh.
6. Develop a strategy and to give recommendations for inclusive and sustainable green growth for the people of Himachal Pradesh.

METHODOLOGY

Methodology for conducting the study is confined to secondary data/ information collected from various sources comprising of Government publications, reports and desk research through internet browsing.

The study used secondary data to assess Human Development and to identify green growth opportunities in the State of Himachal Pradesh. The analytical insights produced are validated against case studies from field visits, extensive Government-stakeholder consultations and a comprehensive policy landscape analysis of sector-wise interventions in Himachal Pradesh.

However, the study has some limitations. Finding relevant, reliable and updated data on socio-economic, developmental and environmental indicators of Himachal Pradesh was a major challenge. Though data was collected from various reliable sources, due to discrepancy in the data, it was difficult to construct appropriate models by using required data. It was also intended to carry out modelling on environmental sustainability; but, due to data constraints it could not be undertaken. Nevertheless, all efforts have been made to maintain consistency and make the study useful and relevant.

SUMMARY OF THE FINDINGS

DEMOGRAPHIC PROFILE OF THE STATE

- Himachal Pradesh's geographical area is 55673 Km^2. The total population of the State (Census 2011) is 68,64,602, of which 34,81,873 are males (51 percent) and 33,82,729 (49 percent) are females. The sex ratio is 972.
- The urban population forms about 10.03 percent of the total population.
- The State has a population density of 123 persons per sq. km., lower than the national average of 382 persons per sq. km (Census 2011).
- The Life Expectancy at birth is 702.15 years (higher than the National average of 68.45 years) for 2011-2015.
- The literacy rate has increased from 76.48 percent in 2001 to 82.80 percent in 2011, while the male and female literacy increased to 89.53 percent and 73.51 percent respectively. There has been a marked increase in female literacy rate, which was 65.61 in 2001.

ECONOMIC PROFILE OF THE STATE:

- The economy of Himachal Pradesh has transformed rapidly over the last two decades.
- The Gross State Domestic Product (GSDP) at factor cost at constant (2011-12) prices in 2017-18 was estimated at Rs. 1,09,747 crore as against Rs. 1,03,038 crore in 2016-17 registering a -growth of 9.1 percent during the year as against the growth rate of 8.1 percent during the previous year.
- The Per Capita Income at current prices increased from Rs. 85,792 in 2012-13 to Rs. 95,582 in 2013-14 registering a growth of 11.38 percent.
- The Per Capita Income at current prices for the year 2017-18 was at Rs. 1,60,711 as against Rs. 1,49,028 in 2016-17.

- There has been a rise in the number of schools and colleges. Total number of Government Primary Schools in 2017-18 was 10,657 and number of Middle Schools was 1996 in 2017-18.
- During the year 2017-18, the total number of Primary School teachers was 23909, Middle School teachers were 6614 and High School teachers were 36288. The total number of teachers in Himachal Pradesh was 66811.
- In 2017-18, the Student-Teacher ratio in the Primary, Middle, High School and College level was 1:11, 1:32, 1:05 and 1:59 respectively

HEALTH AND NUTRITION STATUS

- The State of Himachal Pradesh has better public health care infrastructure and better health status than many other Indian States.
- The proportion of births attended by skilled health personnel has increased and the Maternal Mortality Rate (MMR) is 54, which is below the National Average of 130 in 2010-12 (SRS 2010-12).
- The Infant Mortality Rate (IMR) in the State declined from 38 in 2011 to 25 in 2016 and further to 22 in 2017.
- The proportion of underweight children under the age of three has declined to 21.2 percent in 2015-16 from 36.5 in 2005-06
- For Himachal Pradesh, the Life Expectancy for males was 66.4 and for females it was 75.5 in 2012-16.
- The Crude Death Rate was 6.8 in 2016.

INFRASTRUCTURE: HOUSING

- As per the State Statistical Abstract of Himachal Pradesh, in 2013-14, fifty-three percent of the households (47 percent in rural and 89 percent in urban HHs) live in *pucca* houses. Electricity is available in 99.85 percent of the households. A total of 97 percent of the urban households and 87 percent rural households use improved source of drinking water. About 84 percent of the urban households and 47 percent rural households have access to piped water in their dwelling units.
- In 2012, 73.7 percent of rural households and 95.7 percent of urban households had access to improved sanitation. Himachal Pradesh has recently achieved cent percent sanitation facilities for all the households and has been declared, 'Open Defecation Free'.

INFRASTRUCTURE: ELECTRICITY AND WATER

- The total electricity generation has increased from 1332.4MU in 2005-06 to 2096.82 MU in 2014-2015 and further declined to 15.73.10 MU in 2015-16 and again slightly increased during 2017-18 to 1941.32 MU.
- Maximum consumption of electricity is by the industrial sector (4815.70 MU), followed by domestic consumption (2008.8 MU), while the least is by streetlights (11.3 MU). The total consumption of electricity in the State has steadily increased from 3568.7MU in 2005-06 to 8404.6 MU in 2017-18.
- Per Capita Energy Consumption (PEC) in Himachal Pradesh has steadily increased from 872 kwh in 2006-07 to 1289 kwh in 2011-12.

- Except Lahaul and Spiti, the villages of all other districts of Himachal Pradesh are fully electrified. The percentage of electrification of villages has seen a rise from 99.92 percent in 2011-12 to 100 percent in 2017-18.
- In all districts, most of the villages have drinking water facilities. Mandi records 100 percent availability of drinking water, while Kinnaur records the least at 52.56 percent.

INFRASTRUCTURE: ROAD TRANSPORT, BANKS AND TELE-DENSITY

- The total road length in Himachal Pradesh has increased from 34,169 Kms. in 2011-12 to 37,586 kms. in 2017-18.
- The total number of vehicles in Himachal Pradesh has increased from 78,985 in 2010 to 1,29,666 in 2017.
- The total number of bank branches in Himachal Pradesh is 1,532 with the maximum in Kangra district (290). The total amount deposited in all the bank branches of Himachal Pradesh is Rs. 85,753 crores, with the maximum amount deposited in Shimla (Rs. 18,453 crores).
- The tele-density in Himachal Pradesh has seen a steep rise from 10.14 (per 100 persons) in 2004 to 150.44 in 2017. In the rural sector, the tele-density increased from 5.51 to 115.22, whereas in the case of the urban sector, it was 51.15 in 2004 and 411.17 in 2017.

Assessment of Human Development in Districts of Himachal Pradesh through Human Development Index (HDI)

- The composite Human Development Index (HDI) which is an average of scores affecting Human Development viz. income index, social index, education index, and health and environment sustainability index shows that district Lahaul and Spiti is the best performer with respect to the HDI followed by Chamba, Kinnaur and Shimla. The lowest HDI is reported in Kangra district.

CARBON EMISSIONS IN HIMACHAL PRADESH:

Sector-wise Green House Gas Emissions (GHG) in Himachal Pradesh

- The net Green House Gas (GHG) emissions in Himachal Pradesh, i.e, emissions with LULUCF, for activity database for year 2012-13 were 9.197 million tons of CO_2 equivalents (eq) in comparison to 10.083 million tons in 2008-09. During the year 2012:
    - ✓ CO_2 emissions were 8.73 million tons
    - ✓ CH_4 emissions were 0.134 million tons
    - ✓ N_2O emissions were 0.0070 million tons

- GHG emissions from Energy, Industry, and Agriculture sectors constituted 47.29 percent (5146.9196 Gg), 51.19 percent (5570.8844 Gg), 1.50 percent (163.9438 Gg) of the net CO_2 eq emissions respectively.
- Energy sector emitted 5.15 million tons of CO_2 eq, of which 2.756 million tons of CO_2 eq were emitted from electricity consumption in Industrial, Commercial and Institutional sectors and 1.405 million tons of CO_2 eq were emitted from energy consumption in the Residential sector.
- Industry sector emitted 5.57 million tons of CO_2 eq.
- LULUCF sector was a net sink, with 1.68 million tons of CO_2 eq.

- Himachal Pradesh's per capita CO_2 eq emissions including LULUCF showed a decreasing trend and were 1.341 tons/capita in 2012 against 1.47 tons/capita levels in 2008-09

Assessment of Green Growth Intensity in the districts of Himachal Pradesh

- Himachal Pradesh consists of 12 districts and they reflect wide variations in terms of Human Development indicators as well as perceptible environmental coverage.
- Data clearly shows that, Himachal Pradesh is a sensitive State in terms of green growth intensity. However, the endowment and approaches of districts differ in terms of initiation and pursuance of policies to take on the challenges of GGI, which is a combination of factors linked to Human Development and environmental conjectures.
- Among the 12 districts, Lahaul & Spiti, Kinnaur, Shimla and Kullu are in a better position, while districts like Una, Sirmaur, Hamirpur and Kangra require special efforts to improve their position.

GREEN GROWTH: ISSUES AND CHALLENGES IN HIMACHAL PRADESH

Agriculture:

- The ratio of net cultivated area in the State to the total geographical area has decresed from 19.07 percent in 1972-73 to 11.81 percent in 2009-10. This could be owing to the inconsistent climatic conditions because of which a large number of farmers have taken up non-agricultural work, leaving their lands uncultivated, which subsequently results in degradation of land over a period of time.
- While the contribution of the primary sector to the GSDP declined, more than 55 percent of the working population is still dependent on this sector for livelihood. Ensuring the viability of agriculture as a feasible livelihood option is a challenge faced by policy makers in the State.

Industry

- The industrial sector is one of the major consumers of energy. Within energy sector, cement sector is a significant energy consumer.
- The major challenge the industrial sector is facing is the lack of awareness of Energy Efficient (EE) technologies/available good practices.

Building

- Himachal Pradesh lags behind in the concept of 'green building'. Energy consumption in building accounts for over 30 percent of electrical energy, and is rising annually at 8 percent.
- Despite appropriate legal framework, the sector faces several barriers in greening the building sector.
- The existing capacity of the local authorities to monitor the implementation of the State Energy Conservation Building Code (ECBC) is limited.

Transport

- Lack of adequate road connectivity and physical accessibility particularly to far flung areas in higher reaches of Kinnaur, Lahaul, and Spiti valley is a major challenge in the State.
- Majority of roads in the State of Himachal Pradesh are single laned and with increasing vehicle density, the existing road network in the State faces capacity issues causing traffic congestion.
- Lack of adequate transport facilities adversely affects mobility of people, agricultural and horticultural products and thereby affects the overall economic growth.

- Heavy inflow of tourists and tourist vehicles in the State further puts pressure on the road network. Nearly 0.2 million vehicles enter the State during the tourist season for about nine months in a year.

Energy

- In Himachal Pradesh, GHG emissions from the energy sector is around 5.15 million tons, which is about 47.29 percent of the total GHG emissions of the State.
- Out of total energy consumption in the State, industrial consumption accounts for around 60 percent, domestic around 22 percent while the agricultural sector accounts for only 7 percent.
- It has been envisaged that the demand and energy requirements are expected to increase in the State by two and a half times in the coming 15 years, giving rise to GHG emissions further.

Renewable Energy

- Though renewable energy sources can produce electricity below the cost of fossil-fuel based power stations, this sector has not been exploited fully.
- The banks and financial institutions are cautious while lending for renewable energy (RE) projects, given the poor State of the evacuation measures.
- Himachal Pradesh has adopted a single window project approval and clearance system for renewable energy. However, that is not effective.

Air Pollution

- Particulate matter (PM10) is above the annual average standard of 60 μg/m3 in all the cities of Himachal Pradesh where monitoring stations have been set up.
- Most of the households in the rural areas of the State depend on traditional sources of energy like fuel wood, dung and crop residue for cooking and heating, thereby producing large amounts of CO_2.
- Industrial emissions are a major concern for the State. These emissions can either be solid particles or gaseous emissions, containing toxic pollutants. The high concentration of atmospheric particles over widespread urban and industrial areas can have dangerous effects on the biosphere in immediate surroundings.
- Vehicles are another major source of air pollution in the State. They emit harmful pollutants such as Carbon Monoxide, Hydrocarbons, Nitrogen Oxides, Sulphur dioxide and toxic substances like Total Suspended Particulate (TSP) and lead.
- Construction activities related to roads, bridges, buildings etc. largely contribute to air pollution, since they are in many cases carried out in an unplanned manner with mismanaged debris.

Water Scarcity and Pollution

- The availability of water is highly uneven in Himachal Pradesh, with some parts becoming water stressed.
- This phenomenon may rise considerably due to the combination of factors such as; climate change causing escalation of water crisis and occurrences of water related disasters, like; floods, erosion and increased droughts etc.
- Growing pollution of water sources, especially through industrial effluents, is affecting the availability of safe water besides causing environmental and health hazards.
- Service delivery of water supply and sanitation schemes in both rural and urban areas is low and cost recovery is negligible.

Forests:

- Himachal Pradesh's forests are under great stress due to the combined impact of globalisation, economic development and growth in human and cattle population. The open forests which constitute 35 percent of Himachal Pradesh's forest cover have undergone large scale degradation as a result of the over-exploitation for wood, fodder, timber and non-timber forest products (NTFPs). This disturbance in the natural habitat is reflected in the fall in the forest area by 26 sq. kms.

Environmental Distress and Climate Change

- With high dependence of the economy and livelihood on natural resources and ecologically fragile ecosystems, Himachal Pradesh is highly vulnerable to climate change. The State has been facing environmental problems, such as, deforestation, landslides, land degradation and desertification, further adding to the vulnerability of the State towards climate change

Waste Management

- Managing waste is a great challenge for the State. The lack of segregation of waste at source is also a hurdle. Towns are small and remotely located. Establishing waste-to-energy facilities for each town individually would require huge investment and is financially unviable.
- Getting the most credible waste inventory data is a problem. In absence of dynamic waste inventory, long-term planning for waste management becomes difficult.

INTERVENTIONS FOR SUSTAINABLE GREEN GROWTH

Policy level Interventions in Himachal Pradesh

The Government of Himachal Pradesh is implementing policies to counter climate change and to facilitate and monitor green growth in the State. Major policy level interventions by the Government of Himachal Pradesh are as follows;

- **State Strategy and Action Plan on Climate Change** –The Himachal Pradesh's **Action Plan on Climate Change** provides a framework for sector-wise actions and recommendations on adaptation as well as mitigation through recognised implementing institutions with time-frame and an estimated budget for each of the sectors.
  Some key sectors identified under adaptation include tourism and eco-tourism, health, biodiversity and ecosystem, water resources, forest, agriculture and horticulture.
- **State Centre on Climate Change** – The State Centre on Climate Change was established to synergize Himachal Pradesh Government's initiatives with the centre's initiatives
- **Organic Farming policy** – Since organic farming relies mainly on the use of renewable resources, it would significantly help cut down the use of non-renewable energy sources, which would in turn help reduce the carbon footprints.
- **Ecosystem Services Policy-** To improve the ecosystem services such as availability of clean water, soil formation and conservation, bio-diversity conservation, recreation and aesthetics etc. the State is exploring incentive-based mechanisms to promote plantation of trees, watershed management, weed control etc.
- **Solar Power Policy** –The State Govt. formulated its Solar Power Policy, which was notified on March 4, 2014. The main objective of the policy is to promote generation of electricity from solar energy to promote energy security and sustainable development, which is the core Development Policy of the State.

- **Eco-Tourism Policy** – The revised Eco-Tourism Policy of 2016 aims at bringing the rich biodiversity and ecosystems of the State of Himachal Pradesh closer to visitors while safeguarding and conserving these natural resources. The policy aims at involving the community, thereby generating more livelihood opportunities along with their engagement in building awareness, protection of the State's resources as well as appreciation of their natural and cultural heritage.
- **State Tourism Policy** – "Himachal Pradesh Home Stay Scheme-2008", was aimed at promoting comfortable home stay accommodation to tourists in the rural areas, by providing basic infrastructure and services. The scheme is being implemented successfully in the State.
- **Environment Master Plans** – In an effort to ensure environmental sustainability and conservation of natural resources, the Himachal Pradesh Government has initiated formulation of Environment Master Plan (EMP), which would serve as a strategic guide while dealing with environmental issues concerning the State.

Practical Interventions: Major Drivers of Sustainable Green Growth :

a) **Enactment of a Blanket ban on Plastic Bags** – Himachal Pradesh is the first Indian State to completely ban the production, storage, sale, use and distribution of small polythene bags, in 2004.

b) **Garbage Collection in Urban Areas** – The State has adopted the latest technology for waste collection and underground waste bins have been placed in such a manner that no person in the town has to walk for more than 100 metre to find a waste bin. It is ensured through effective community mobilisation that people dispose of segregated bio-degradable waste in waste bin meant for it.

Bio-degradable waste has the potential of generating income through composting, biogas or any other product such as electricity through incineration. So, Government is taking initiative in this regard.

c) **Rural Tourism & Tourist Home Stays** –In order to attract visitors, the State has introduced "Himachal Pradesh Home Stay Scheme 2008". As per the scheme, in 2012, at Kullu, 15 home stay units accommodated 21,012 tourists. At Shimla, in 2012 they accommodated 10,800 tourists. It is clear that home stay units in Kullu and Shimla are getting adequate number of tourists and locals are getting good opportunities for earning.

d) **Cold Desert Sustainability** – Himachal Pradesh has initiated an exercise to conserve the rare biodiversity spread over an area of 7000 sq. kms. in the cold desert of the Spiti Valley with Central Assistance. Sanction to the tune of Rs.5.12 crore ($838,000) has been received in this regard.

e) **Use of Plastic Waste for Road Construction** – The Himachal Pradesh Government has come up with a novel way of paving roads using plastic waste. As of now, all the divisions of the Public Works Department (PWD) are using plastic for roads.

f) **CFL as Protector of Energy Usage** – The Himachal Pradesh Government has launched a scheme, 'Atal Bijli Bachat Yojna' under which free eco-friendly Compact Fluorescent Lamps (CFLs) have been distributed to domestic consumers.

g) **Promotion of Wind Energy as a renewable source of energy** –Twelve sites have been identified in the past three years for setting up of wind energy plants in Kullu, Chamba, Kinnaur,

Lahaul-Spiti and Shimla. The Himachal Pradesh State Electricity Board Ltd. has proposed to install a hybrid power plant of 2.5 MW or megawatt peak at Rangrik in Kaza in the Spiti Valley.

h) **Promotion of E-vehicles** – The Himachal Pradesh Government, in order to provide a sustainable and environment-friendly public transport system and to encourage the use of Electric Vehicles, and has exempted electric vehicles from payment of token tax and registration fee. The State is also introducing lithium ion-powered buses and set to become the first State to introduce zero-emission electric buses in the country.

i) **Promotion of Micro-Irrigation for efficient use of water** – Under "Dr. YS Parmar Kisan Swarozgar Yojna", the Himachal Pradesh Government has decided to set up 4,700 poly houses and 2150 drip irrigation or sprinkler units in the next four years for which Rs. 111.19 crore has already been allocated. Under the scheme, 85 percent subsidy is being provided to the farmers to set up poly houses and drip or sprinkler irrigation units.

j) **Open Defecation Free (ODF) State**–Himachal Pradesh has recently been declared, "Open Defecation Free (ODF)", the second State after Sikkim.

k) **Promotion of Solar Lights** –In its effort to boost the use of solar power, the State Government has installed 27,574 solar street lights in different panchayats of the State. Approximately 4337 solar lanterns have been distributed to shepherds in the State and 10,000 solar lanterns have been provided to the flood-affected areas in Kinnaur district free of cost.

l) **Policy on Afforestation:** As per the afforestation policy by Himachal Pradesh Government, area under forest and tree cover is being expanded through implementation of afforestation and rehabilitation programmes in degraded and open forests and available non-forest lands.

Suggestions and Recommendations for Sustainable Green Growth :

Agriculture

- Emphasis should be laid on raising agricultural productivity and adding value to agricultural produce through necessary processing.
- Steps should be taken to prevent the incidence of degradation of agricultural land and the using of agricultural land for non-agricultural purposes.
- Cultivation of crops in line with soil fertility status in different agro-climatic zones as per their suitability must be adopted.
- Identification of crops which can adapt to climate change
- Awareness campaigns to educate farmers on promotion of bio-pesticides, organic farming, integrated pest management technology, and soil conservation measures.

Forests

- Restoring degraded forests, through natural regeneration where possible and mixed plantation of local species/varieties such as; Oak, Deodar, Kharsu, Kail, and Walnut can be undertaken.
- Use of superior planting stock to be raised through tree breeding programmes, as well as through clonal technology and tissue culture.
- Himachal Pradesh forestry sector has enormous scope for establishing and promoting forestry enterprises. Medicinal plant-based enterprises have huge untapped potential in the State.
- 'Sanjhi Van Yojna' has to be made more effective. This will help in protecting the saplings and checking of forest fires, which are a frequent menace.
- It is desirable to construct roads passing through the protected forest under the supervision of the Forest Department to avoid damage to forests.

- Efforts need to be made to prevent individual encroachments on forest land and to inform the administration when detected.
- Seventy one percent of the forest land in the State has not been surveyed and entered into the forest book. It must be surveyed through Forest Settlement processes.
- Developing efficient fire detection and management system is another very important measure.
- Mitigation and adaptation measures towards Climate change need to be built into the working plan prescriptions of the State Forest Department. There could be three major areas where the States can immediately develop a collaborative research programme with national and international agencies and valuation of ecosystem services, identification of threatened flora and fauna, and promotive sustainable and equitable utilization of biodiversity.

Industry

- The State Government should promote energy audits in the industries (including Medium and Small Micro enterprises (MSMEs) to identify the energy saving areas.
- Promotion of energy efficient (EE) technologies in the industrial sector.
- The Government needs to set up 'incubation centres' and incentivize cluster level fabricators to develop local low cost technological solutions.
- Public-private participation is required for Research, Development, Demonstration, and Deployment of clean technologies in the MSME sector to invest in cost-effective technological solutions customized to local conditions. Blended cement can be manufactured from industrial wastes. Biomass can also be utilized beneficially during clinker burning process. Various substitute fuels need to be explored, depending on their availability locally in the State.

Building

- Energy efficient green buildings must be built, keeping in mind the environmental benefits of these designs. The green buildings should consume less water, make efficient use of energy, conserve natural resources, generate less waste and provide healthier spaces, compared to conventional buildings.
- Waste water management, sewage treatment, slope protection, solid waste management and passive solar building designs are important measures to ensure the greening process.

Transport

- Apart from construction of new roads, straightening the curves of the existing ones is also necessary. This is with special reference to the busy corridors such as, Shimla-Dharmshala, Bilaspur-Kullu, and Kalka-Shimla. This will reduce transport cost incurring time and fuel savings.
- Though the railways play a small role in the State, yet the existing rail-routes of Kalka-Shimla (96 kms.), Pathankot-Jogindernagar (113 kms) and Nangal Dam-Una (16 kms) rail route can be developed innovatively for heritage tourism in collaboration with the Central Government. .
- Ropeways can be laid over more for carriage of goods than passengers.
- Use of electric vehicles can be explored for local urban transportation where the terrain permits.

Energy

- Despite the low cost of power generation, the actual cost of electricity per unit is high primarily due to excessive distribution cost. This is attributed to overstaffing of the Himachal Pradesh State Electricity Board Ltd. A desired way out is to raise manpower efficiency through additional power generation with the same number of employees and rationalization of the distribution system.

- The State has a vast hydropower potential of 27,436 MW, out of which a potential of about 24,000 MW is harnessable in its five river basins namely Satluj, Beas, Ravi, Chenab and Yamuna. So, the State should leave no stone unturned to achieve this potential.

Renewable Energy

- The renewable energy sources can produce electricity at a lower cost than the fossil-fuel based power stations and moderate global warming affordably. The cost of producing electricity from renewable sources such as wind and solar photovoltaic (PV) has been declining in the past. The Government must work on expanding these technologies. The State should promote solar cookers, solar-based room heating technologies, solar water heaters, solar dryers, and photovoltaic for residential as well as hospitality, commercial, industrial, and agricultural sectors.
- "Spiti" has abundant sunshine and wind to generate energy. The vast Spiti cold desert can be developed into a renewable energy hub by setting up renewable energy facility.

Air pollution

- The State needs to identify heavily polluting industries and put them under the heavy polluter category and monitor and regulate the smoke emitted by them.
- More industrial activities should not be encouraged in already developed and saturated industrial areas.
- New areas can be identified for developing industrial sites with proper planning and regulations. Moreover, non-polluting labour intensive light industries can be encouraged. These industries will generate more income earning and employment opportunities for the local population especially women.
- Air Pollution Control Equipment (APEC) must be installed in all industrial units with regular checks and monitoring.

Improved access to clean water

- Water needs to be managed as a common community resource under the State's control in order to achieve water security, food security, support livelihood and ensure equitable and sustainable development for all.
- The predicted increase in variability of the available water owing to climate change should be dealt with by augmenting the storage of water in its various forms, including soil moisture, ponds, ground water, small and large reservoirs and their combination.
- Direct use of rainfall, de-salination and avoidance of unintended evapo-transpiration are the new additional strategies for ensuring increase in utilisable water resources.

Waste Management

- Information and technologies are very much crucial for better management of wastes. The Government must promote policies and effective, eco friendly, and sustainable technologies in such a way that private sector is encouraged to invest, establish, and operate facilities in the waste management sector.
- Technologies, such as enhanced acidification and methanation, can be used for utilizing waste. Sectors that generate organic waste in large amounts, such as food and fruit processing industries, hotels, community kitchens, and vegetable markets, can make the best use of such technologies.

Steps to Counter Climate Change and Its Impact

- In order to counter extreme climate events and impacts of climate change, the State should explore and initiate interventions relating to disaster risk reduction and management. As a part of

the NAPCC plan, the Himachal Pradesh Government prepared the, 'State Strategy and State Action Plan on Climate Change' in 2012. The State Action Plan of Himachal Pradesh has been endorsed and approved by the National Steering Committee of the Ministry of Environment, Forests and Climate Change (MoEFCC). As per the action plan, two fundamental response strategies can address climate change.

  - Adaptation
  - Mitigation

- While adaptation aims to lessen the adverse impacts of climate change through a wide-range of system-specific actions (Fussel and Klein, 2002), mitigation looks at limiting climate change by reducing the emissions of GHGs (greenhouse gases) and by enhancing opportunities.
- The short term adaptation strategies include comprehensive State level adaptation planning ; integration of land use planning and climate adaptation planning; improved emergency preparedness, improved response capacity for climate change impacts, strengthening of the climate change research and science programs.
- Mitigation refers to measures that are taken to reduce the causes of climate change with an aim to promote sustainable development and contribute to the national goal of reducing Greenhouse Gas emissions.

Himachal Pradesh has a framework for reducing the effects of climate change. By aligning the developmental activities of the State towards climate change, it can effectively utilize the benefits of sustainable development.

CHAPTER I
THE CONTEXT OF THE STUDY

1.1 INTRODUCTION

Himachal Pradesh is situated in the North Western part of the Himalayas, covering an area of 55,673 Sq. Kms. and has a population of 6.86 million, as per Census 2011. It is mostly a mountainous state bordering Tibet and China in the East, the State of Jammu and Kashmir in the North and Uttarakhand, Uttar Pradesh, Punjab and Haryana to the South. Administratively, the State has been divided into 12 districts, located at altitudes ranging from 350 to 7,000 meters (1,050 to 21,000 feet) in the Western Himalayas. Important mountain ranges in the State include the Shivaliks, Dhauladhar, Pir Panjal, Great Himalayas and Zanskar. With 1.7 percent share in the country's total geographical area, Himachal Pradesh harbours approximately 7.32 percent of flora and 7.4 percent of fauna in India, reflecting the State's rich biodiversity.

It is primarily an agrarian State where agriculture and horticulture are the major economic activities. It has physio-climatic conditions suited to almost all types of crops and fruits. The State is called 'the apple bowl of India. Its notable accomplishments have been in literacy, agriculture, horticulture, roads, forests, hydel power generation and tourism. The progress made by the State in terms of availability of health and education facilities has been impressive during the last forty five years. Despite belligerent geo-climatic conditions, the availability of physical infrastructure in the State has improved remarkably.

Although, Himachal Pradesh has achieved rapid economic growth it needs to improve its effectiveness in environment management, protect the vulnerable ecosystem and work towards sustainable development. The objective should be to preserve the pristine Himalayan environment while ensuring Human Development.

During the recent years, the State Government's efforts towards conservation of environment have been globally acknowledged. Taking a lead in reducing carbon emissions and earning carbon credits, Himachal Pradesh has emerged as the first State in the country to march towards achieving carbon neutrality. The State has taken various steps to protect the environment and achieve carbon neutrality, thus earning the distinction of being a trendsetter in development issues.

For a progressive State like Himachal Pradesh, economic growth will remain a priority but the need of the hour is to combine efforts towards increasing the average income with the sustainable use of natural resources. With poverty and inequality set to intensify further with environmental degradation and climate change, it appears necessary to understand Human Development from the perspective of environmental sustainability and the potential impact that climate change and environmental degradation may have on Human Development.
In this backdrop, Himachal Pradesh Human Development Research and Coordination Society (HPHDRCS), Planning Department, Himachal Pradesh has undertaken the present study.

1.2 OBJECTIVES OF THE STUDY

The main purpose of the study is to assess the overall level of Human Development achieved in the State over the last decade following a life cycle approach to Human Development and to institutionalize the integration of Human Development in the planning process to achieve faster, environmentally sustainable and inclusive green growth.

The specific objectives of the study were:

- Assess overall level of Human Development achieved in the State of Himachal Pradesh over the last decade.
- Assess the green growth and development that have been achieved through productive consumption and use of natural resource in Himachal Pradesh.
- Analyze how environmental challenges are affecting Human Development and to document linkages between Human Development and environmental sustainability.
- Analyze the detrimental effects of climate change and environmental degradation on the poor and vulnerable population.
- Examine the extent to which the environmental concerns are integrated into planning process in Himachal Pradesh.
- Develop a strategy and to give recommendations for inclusive and sustainable green growth for the people of Himachal Pradesh.

1.3 SCOPE OF THE STUDY

As per the terms of reference (TOR) of the study, the proposed study was undertaken for Himachal Pradesh to:

1. Make an assessment of the overall level of Human Development achieved in the State of Himachal Pradesh over the last decade following a life cycle approach.
2. Analyze and document linkages between Human Development and environmental sustainability by examining dominant environmental concerns in the State's context and the manner and extent to which they impact Human Development indicators and exacerbate inequalities.
3. Analyze the detrimental effects of environmental degradation on the poorer and vulnerable sections taking into account the extreme weather patterns, climate change and environmental changes.
4. Examine the extent to which the environmental concerns are integrated into Planning for Human Development at the National (in recent five year plan) & State level (Himachal Pradesh).
5. To record people's perception about Human Development and its linkages with the environmental policy and climate change.
6. Analyze the existing policy framework on the process of Human Development and the environmental concerns and to make recommendations based on the findings of the study.

1.4 RATIONALE OF THE STUDY

Data collection and compilation is crucial for any planning and programme, and is an important tool for all local and international players/agencies involved in improving the quality of life of the people.

It is hoped that this study will go a long way in providing valuable inputs to policy makers, Government functionaries, international agencies and other stakeholders engaged in the welfare of the people of Himachal Pradesh.

1.5 THE METHODOLOGY

The methodology of the study is descriptive as it predominantly engages and discusses varied environmental issues and suggests ways to overcome them. However, different statistical techniques such as trend and content analysis have been used to measure the impact of environmental pollution.

The study is based on secondary data collected from various sources. Data on Net State Domestic Product (NSDP), Per Capita Net State Domestic Product (PCNSDP), poverty, literacy rate, gross enrolment ratios, health indicators like Life Expectancy, Infant Mortality, Maternal Mortality, access to safe drinking water have been collected from Census of India, Registrar General of India, CSO (Central Statistical Organization), National Account Statistics, Planning Commission, Reserve Bank of India publications - RBI Bulletin, Directorate of Economics and Statistics, various publications of India Development Reports, National Human Development Reports, Annual Reports, Economic Surveys, Retrospective MMR Surveys, SRS Prospective Household Reports, Statistical Reports and Registrar General of India Sample Registration System Bulletins. The study helps to examine the economic development and green growth in HP.

Natural resource endowment data have been collected from the reports published by the Ministry of Environment and Forests, India. The literature and data sources available within the Environment Information System (ENVIS), Himachal Pradesh, were also consulted for the study. Additionally, the Parliamentary Session data books were used, as they provide testimony to the concerns of policy makers regarding the environment, as well as steps taken to mitigate environmental degradation. Other reports like: Annual Forest Reports, State Action Plan on Climate Change, Annual Plans, National Human Development Reports, National Population Census, Agricultural Census, National Family and Health Survey Reports, National Sample Survey Reports, Statistical Compendium of Environmental Indicators, other Central Statistical Organization (CSO) Reports, State Budgets, and other Government Reports were also consulted. Two OECD publications-the Report of the Working Group on Environmental Information and Outlook on "Aggregated Environmental Indices -Review of Aggregation Methodologies in Use" and the OECD Statistics Working Paper, "Handbook on Constructing Composite Indicators: Methodology and User Guide"-have been used, as they provide frameworks with which statistical methodologies could be compared.

The study also used evidence - based analytical methods for developing policy choices and green growth opportunities. The analytical insights produced are validated against case studies from field visits, extensive Government-Stakeholder consultation and a comprehensive policy landscape analysis of sector-wise interventions in Himachal Pradesh.

1.7 LITERATURE REVIEW

The goal of this section is to review the existing literature related to this study i.e. on Human Development; Sustainable Development, Green Growth etc. Various resources have been accessed for the literature review. These include traditional sources such as text books as well as published and printed journals and a variety of electronic materials, articles from on-line refereed journals.

Existing Literature on Economic Development, Human Development & Sustainable Development

Economic Development is a process whereby the real per capita income of a country increases over a long period of time. The increase in the quality of life of the people through education, health, nutrition, etc., help to increase the physical output (Schultz, 1978)[1]. Therefore, human resource development along with physical capital formation plays a useful role in economic development. In fact, effective use of physical capital itself is dependent upon human resources.

When the United Nations Development Programme (UNDP) constructed the Human Development Index (HDI) for the first time in 1990, its major goal was to shift attention away from income, towards a more comprehensive measure of Human Development. UNDP did not deny, of course, that per capita income is one of the main determinants of a country's level of Human Development. But it proposed to treat income as only one out of three factors - the others being life expectancy at birth as a proxy for health achievement and adult literacy together with educational enrolment as proxies for educational attainment. What is more, income is not privileged as primus inter pares, i.e. it is not given a higher weight than the two other factors. Rather, all three variables are aggregated via a simple arithmetic average into the HDI and are thus treated equally.

Catherine Benoît and Gina Vickery-Niederman (2010) described different methodologies available to assess social impacts and how they relate to one another, as well as different initiatives that are shaping the social responsibility field and hence affecting business practices.

Nkechinyere V. Attah (2010) discussed the concept of environmental sustainability and tried to assess efforts made to curb the impact of environmental degradation on the society by some developed and developing countries such as Switzerland, United States of America and China. Excessive emphasis on environmental sustainability using some policies could hurt the economic activities of a country through loss of jobs and societal mishaps while on the other hand too much emphasis on economic growth could result into health risks, global warming and environmental degradation within the society. He further discussed the need to strive towards a balance between environmental sustainability and economic growth. Sustainable environment and growth can only be achieved through the integration of policies that connect the environment, the economy and the society. He also analyzed a number of strategic initiatives adopted by some developed countries that other countries can adopt to achieve the balance between environmental sustainability and growth through the integration of policies that connect the environment, society and economy.

The G20 Summit report (2012) contended that the global economy is facing complex challenges towards achieving a sustainable and balanced growth. In order for growth to be sustainable over the long-term, countries must confront and implement solutions to rising environmental challenges. Unless countries move to greener growth paths, characterised by economic growth and Human Development that better conserves natural resources, continuing environmental degradation will lead to significant negative impacts on human well-being. 174 countries signed 'Paris Agreement' on the reduction of climate change in April, 2016 in New York and began the implementation within their own legal framework. The agreement calls for zero net anthropogenic greenhouse gas emissions to be reached during second half of the 21st Century.

[1] *Schultz.T.W*, "**Nutrition and Human Development Formation**", Human Resource Development (ed) Madhan Mohan Varma, (New Delhi: Geetanjali Publishing House, 1978), p.150.

The UNDP Asia Pacific Regional Human Development Report (2012) on '*Sustaining Human Progress in a Changing Climate'* demonstrated with the help of evidence that climate change threatens progress in poverty reduction and is capable of rendering the past Human Development gains unsustainable. According to OECD report (2012) on 'Green Growth and Developing Countries', in the face of increasing economic and environmental crisis, efforts at the national and international levels have deepened to promote green growth as a new source of growth.
The report pointed out that the developing countries are the most vulnerable to climate change and tend to depend more on the exploitation of natural resources for economic growth, than the developed economies. Although these developing countries contribute only a small share to global greenhouse gas emissions as against the more developed economies, their share would only see an increase if they continue following conventional development patterns.

The global community must work towards creating an enabling environment which would facilitate a momentum for green growth. A few steps that the countries could together take are:

- Enhancing capacities to adopt and deploy green technologies
- Strengthening development assistance by leveraging private investment
- Promoting innovation and disseminating the existing green technologies
- Developing effective policies

Literature on Green Growth:

In the face of the global financial crisis and pressing environmental and climatic threats, green growth has emerged as a new development paradigm capable of achieving economic and environmental objectives simultaneously.

The World Bank (2012) released a report titled "*Inclusive Green Growth – The Pathway to Sustainable Development*," which challenged Governments to change their approach to growth policies, measuring not only what is being produced, but what is being used up and polluted in the process. It argues that sustained growth is necessary to achieve the urgent development needs of the world's poor and that there is substantial scope for growing cleaner without growing slower. It also noted that green growth requires improved indicators to monitor economic performance.

The report focused on 5 main points:

- Greening growth– it is suggested that this is necessary, efficient, and affordable, and critical to achieving sustainable development;
- Chief obstacles to greening growth-such as political barriers, entrenched behaviours and norms, and a lack of financing instruments;
- Multi-disciplinary solutions to overcome constraints and ensure progress;
- Green growth 'variability' - it is pointed out that strategies will vary across countries; and
- Green growth not being inherently inclusive - it is highlighted that green growth policies must be carefully designed to be inclusive, by maximizing benefits for, and minimizing costs to, the poor and most vulnerable to avoid irreversible negative impacts.

The Global Green Economy Index (GGEI) (2014) provided a ranking of how 60 countries and 70 cities performed in the global green economy and how expert practitioners perceive this performance. The GGEI performance index used quantitative and qualitative indicators to measure how well each country performed on four key dimensions: leadership & climate change, efficiency sectors, markets &

investment and environment & natural capital. Then, the GGEI perception survey collected assessments from expert practitioners on these same four dimensions.

Hammer, S. et al. (2011) addressed the policies and tools that can enable the transition to green growth in cities and examine the role that multi-level governance, effective measurement tools and finance must play in delivering green growth in cities.

Literature on Sustainable Human Development and Green Growth in India

According to The Energy and Resource Institute (TERI) in its report(2015) on 'Green Growth and Sustainable Development in India', for a fast growing country like India, where development is indispensable, environmental consequences can be significant as it would place grave limitations on natural resources such as fuel, land, water and minerals, hiking up their prices. Achieving a 'green economy' would depend largely on the country's ability to reduce the quantity of resources required to support economic growth, over a period of time. As India scales up its development agenda, the challenge it faces is to provide improved services and quality of life to the citizens within the ecological capacity and constraints. Intended Nationally Determined Contributions (INDC) has announced to work towards reducing the emissions intensity of its GDP by 33-35 percent by 2030.

According to the UNDP's State Human Development Report, Kerala was ranked first among major Indian States in the Human Development Index in 1981, 1991 and 2001. Literacy and Education have spread across different social groups, even the lower castes being much ahead of their counterparts in other parts of the country.

However, the report pointed out several environmental violations by the State that have put sustainability at stake. A Committee under the Kerala State Coastal Zone Management Authority has detected several tourist resorts and shops to have been constructed in violation of the Coastal Regulation Zone (CRZ) norms. Kerala's unique environment is under threat from climate change, industrialization, urbanization and excessive use of resources by some of the growing sectors of the economy. As a result of the growing urbanization, the State's natural environment, Western Ghats in particular, is facing pressure owing to increased demand for infrastructure and natural resources. The pressure has been relatively high during the last two decades with the emergence of the construction sector as a major driver of the economy.

Punjab had been among one of the fastest growing States, with a steady growth rate in terms of the Net Domestic Product and Per Capita Incomes. According to TERI report (2015) on 'Climate Resilient Green Growth Strategy for Punjab', the State has policy in place for agricultural development with an aim to address the sustainability concerns.

Literature on Status of Human Development in Himachal Pradesh

The World Bank noted in its report (2015) '*Himachal Pradesh: Secrets of Success'* that the State has achieved remarkable economic growth, outperforming other States in the eradication of poverty. The State's Per Capita Income is among the highest in the country, an impressive feat given that more than 90 percent of the population lives in the rural regions. The educational attainment is among the highest in the country, and the share of women in the workforce is larger than many States. The State is the first in the country to have banned the use of plastic bags and the first among the North Indian States to be declared 'Open Defecation Free'.

However, one of the issues of concern for the State Government, as laid out by the World Bank in its report '*Himachal Pradesh : Secrets of Success',* is the dramatic decline in the number of girl children against boys, and the high level of child malnutrition. More than one third of children under five were found to be underweight in 2011, reflecting very little progress over 2005-06 level.

TERI (2015) in its report on Himachal Pradesh suggested climate resilient green growth interventions, which include natural resource management, sustainable energy and inclusive economic development. This report brought together a number of analytical components to inform decision-makers for:

- Climate variability;
- Soil and water conservation;
- Power generation;
- Stakeholder perspectives on natural resource management.

The analytical framework in this report included three models (climate modeling, soil and water assessment tool and energy modeling), case studies from field visits and a comprehensive review of sector wise interventions in Himachal Pradesh.

Literature on Impact of Climate Change on Economic Growth

Many studies have been undertaken/conducted to show effects of temperature change on the economic activities.

First, the damaging impact of climate on ecosystems from erosion, flood and drought, the extinction of endangered species and deaths resulting from extreme weathers cause permanent damages to economic growth. Also, the economic implication of combating the impact of warming would limit the quality and quantity of investment in economic and physical infrastructures, research and development and human capital thereby reducing economic growth (Ali, 2012).

Some of the existing literature showed that climate change affects economic output (GDP). Studies by Deschenes and Greenstone (2007), Barrios, Bertinelli and Strobl (2010) suggested that climate change could impact economic growth. If climate change affected only the level of economic output, for example by reducing agricultural yields when temperature rises (precipitation falls), this would imply that subsequent temperature decreases (precipitation increases) – due to self abatement of emissions – should return the GDP to its previous level. But this is not the case if climate change affects economic growth. Economic growth will be lower even if GDP returns to its previous level because of forgone consumption and investment due to lower income during the period of higher temperature (lower precipitation). In addition, as long as countries spend some resources to adapt to climate change, they incur opportunity costs in terms of not spending these resources on R&D and capital investment. These have negative effects on economic growth.

Dell, Jones, and Olken (2012) provided evidence on the effect of climate change on economic growth from a panel of 136 countries over the period 1950-2003. They discovered three primary results from their study. First, higher temperatures substantially reduced economic growth in poor countries. For instance, a 1^{o} C rise in temperature in a given year reduced economic growth by 1.3 percentage points on average. Second, higher temperatures appeared to reduced growth rates, not just the level of output. Third, higher temperatures had wide ranging effects, reducing agricultural output, industrial output, and political stability. Also Ali (2012), using a Co- integration analysis on Ethiopia found a negative effect on growth.

He specifically observed that change in rainfall magnitude and variability has a long term drag-effect on growth.

Frankhauser and Tol (2005) examined the link between climate change and economic growth using a simple climate-economy simulation model. They argued that the capital accumulation effect is important, especially if technological change is endogenous, and may be larger than the direct impact of climate change. The savings effect is less pronounced. The dynamic effects are more important, relative to the direct effects. They concluded that in the long run, for high direct impacts, climate change may indeed reverse economic growth and per capita income may fall. For global warming of 3^{o} C, the direct damages to the economy are estimated to at least 15 percent of GDP. When the effect of capital accumulation and people's propensity to save are factored into the damages, the impact would be higher.

1.8 CHAPTER SCHEME

The present report incorporates the status and trends of Human Development and Green Growth in Himachal Pradesh. It attempts to identify the environmental challenges affecting Human Development and the poor and vulnerable in Himachal Pradesh. At the end, it gives recommendations for achieving environmentally sustainable and inclusive green growth.

Chapter 1 presents the context of the study and the limitations.

Chapter 2 presents the overview of Human Development in Himachal Pradesh and growth trends over the years on various indicators, such as education, health and nutrition, infrastructure, IT and tourism.

Chapter 3 attempts to assess the green growth and development that has been achieved through productive consumption and use of natural resource in Himachal Pradesh.

Chapter 4 examines the status of climate change in Himachal Pradesh and its impact on Human Development. It tries to understand its impact on the poor and vulnerable.

Chapter 5 outlines policy-related green growth interventions by Himachal Pradesh, covering organic farming policy, ecosystem services policy, solar power policy, and environment master plans, blanket ban on plastic bags, eco-tourism policy and State tourism policy.

Chapter 6 examines the green growth challenges/dominant environmental concerns in the State's context and the manner and extent to which they impact Human Development indicators and exacerbate inequalities.

The concluding remarks and policy recommendations (plan of action for adaptation and mitigation) are presented in Chapter 7.

1.9 LIMITATIONS OF THE STUDY

This study has a number of limitations that must be considered while reading the report.

1) Inconsistent data – The data available from different sources has been found to be inconsistent and insufficient in certain cases. Therefore, the problem of reconciling conflicting data posed a challenge and called for adjustments.
2) Outdated data – Data for recent years were not available for several parameters.
3) Lack of district-wise data – On most of the parameters, district-wise data was not available.

4) Lack of district wise air quality data – The National Ambient Air Quality Monitoring Programme (NAMP) stations are in 10 towns/cities covering 20 locations. However, these stations are not spread across all the districts, thereby making comparison of the air quality data difficult.
5) Lack of data on water quality provided to the households – Data is not available on the quality of water supplied to the households.
6) Lack of data on energy sources – There is a lack of year-wise data on the use of non-renewable sources of energy, e.g. fuel wood, for all the districts. Wood has been and is a major energy source, followed by LPG. It is important to collect and maintain data on non-renewable sources of energy in order to compare and formulate policies to restrict the use of fuel wood and other non-renewable sources, and encourage the consumption of LPG.

CHAPTER II

ASSESSMENT OF HUMAN DEVELOPMENT IN HIMACHAL PRADESH

2.1 INTRODUCTION

Himachal Pradesh scores reasonably high on the Human Development indicators as compared to many developed States of the country. The educational achievements have been impressive, health indicators are generally better than those for the country as a whole and the State has been able to substantially reduce the poverty levels. It has made great strides in the eradication of poverty and has successfully come out as one of the few States with the best Human Development outcomes in recent years (World Bank). It has achieved positive outcomes in the areas of social inclusion, sustainable development, poverty reduction, health, education and gender equality.

In this chapter an attempt has been made to assess and document the status of Human Development in the State of Himachal Pradesh over the decades. Accordingly, the issues related to the basic indicators of Human Development viz. health, education and infrastructure have been addressed in detail.

2.2 DEMOGRAPHIC PROFILE OF THE STATE

The population of Himachal Pradesh (Census 2011) is 68,64,602, of which 34,81,873 are males (51 percent) and 33,82,729 (49 percent) are females. The growth in population in 2011 over Census of 2001 is estimated at 12.94 percent, while in the previous decade the growth was much higher at 17.53 percent.

About 90 percent population of the State (89.97 percent) lives in rural areas. In the total rural population of 61,76,050, 50.36 percent are males and 50.64 percent are females indicating much better gender ratio in rural areas of the State as compared to most of the other States.

The urban population forming about 10.00 percent of the total population has been increasing steadily from 7.61 percent in 1981 to 8.69 percent in 1991, 9.80 percent in 2001 and 10.03 percent in 2011. The urban population is 6,88,552, of which 3,71,528 (53.96 percent) are males and 3,17,024 (46.03 percent) are females indicating considerable gender disparity in urban areas as compared to the rural areas of the State.

The State's geographical area is 55,673 Sq. Kms. which accounts for 1.7 percent of the country's total area. The State's population is about 0.57 percent of Country's total population. It has a density of 123 persons per sq. kms., lower than the national average of 382 persons per sq. kms. (Census 2011). In 2001, the State's population density was 109 per sq. kms., while the national average was 324 per sq. kms.

The life expectancy at birth in Himachal Pradesh is 72.3 years (higher than the national average of 68.7 years) for 2012-2016[2]. The infant mortality rate stood at 25 in 2016. The crude death rate was 6.8 in 2016.

Educational achievement of the State has been much better than many of the Northern States of the country. The literacy rate increased from 76.48 percent in 2001 to 82.80 percent in 2011. The male literacy rate increased from 85.35 percent in 2001 to 89.53 percent in 2011. Similarly, the female

[2] ABRIDGED LIFE TABLES- 2012-16 (India)

literacy rate increased from as low as 65.61 percent to 73.51 percent during the same period indicating a marked increase in female literacy rate.

Table 2.1: Status of Himachal Pradesh on Selected Parameters (2001- 2011)

Description	2011	2001
Population	68,64,602	60,77,900
Male	34,81,873	30,87,940
Female	33,82,729	29,89,960
Population Growth	12.94 percent	17.53 percent
percentage of total Population	0.57 percent	0.59 percent
Sex Ratio	972	968
Child Sex Ratio	909	957
Density/km^2	123	109
Density/mi^2	319	283
Area km^2	55,673	55,673
Total Child Population (0-6 Age)	7,77,898	7,93,137
Male Population (0-6 Age)	4,07,459	4,18,426
Female Population (0-6 Age)	3,70,439	3,74,711
Literacy	82.80 percent	76.48 percent
Male Literacy	89.53 percent	85.35 percent
Female Literacy	75.93 percent	67.42 percent
Total Literate	50,39,736	40,41,621
Male Literate	27,52,590	22,78,386
Female Literate	22,87,146	17,63,235
Rural Literacy	81.90	75.1
Urban Literacy	91.1	88.9

Source: Himachal Pradesh Population Census Data 2011

Average literacy rate in rural Himachal Pradesh is 81.85 percent; and it is 89.05 percent for males, and, 73.42 percent for females. The number of total literates in rural area are 44,71,736. In urban Himachal Pradesh, the literacy rate is 91.10 percent; it is 93.42 percent for males and 88.37 percent for females. Total number of literates in urban region of Himachal Pradesh is 5,68,000.

Almost eight out of every ten persons in the State are literate, and the State ranks 11^{th} in terms of literacy among rest of the States.

District-wise Demographic Profile of Himachal Pradesh

Himachal Pradesh has 12 districts in total, and there has been no change in the number of districts since 1972, even though there have been substantial variations in area and population across the districts. Lahaul &Spiti with an area of 13,841 sq. kms is the largest district occupying 24.86 percent of the State's geographical area followed by Chamba (11.71 percent); whereas, Hamirpur (2.01 percent) having the least area.

However, the rankings keep changing in terms of population. The district Lahaul and Spiti, which ranks at the first place in terms of area, is relegated to the last position in terms of population. Chamba

and the second largest in area, occupies the fifth position in terms of population. Almost half the population lives in three districts - Kangra, Mandi and Shimla and the three districts - Lahaul and Spiti, Kinnaur and Bilaspur, together have 7.24 percent of the State's population.

These variations in the land-man ratio are reflected in the density of population. The low density of population in the larger districts is due to the limited arable land, unfavorable physio-geographical conditions, poor means of transport and communication, hostile climate and low level of economic development.

From the ranking of districts by population it is found that as per Census 2011, Kangra district has the highest population of 15,10,075 (21.99 percent), followed by Mandi district 9,99,777 (14.56 percent), Shimla district 8,14,010 (11.85 percent), Solan district 5,80,320 (8.45 percent), Sirmaur district 5,29,855 (7.72 percent), Una district 5,21,173 (7.59 percent), Chamba district 5,19,080 (7.56 percent), Hamirpur district 4,54,768 (6.62 percent), Kullu district 4,37,903 (6.37 percent), Bilaspur district 3,81,956 (5.56 percent), Kinnaur district 84,121 (1.22 percent) and Lahaul and Spiti district 31,564 (0.45 percent).

The literacy rate in the State is 82.80 percent. Across districts, in 6 out of 12 districts the literacy rate is higher than the State average. The literacy rate in these districts varies between 83.64 – 88.15 percent. These districts are Kangra, Hamirpur, Una, Bilaspur, Solan, and Shimla. In the remaining 6 districts the literacy rates are lower than the State average falling between the lowest at 72.17 percent in Chamba to the highest in 81.53 percent in Mandi.

Table 2.2: Status of Selected Parameters in Himachal Pradesh (2011)

State/ District	Person	Literacy (%)	Sex Ratio	Population-Decadal Growth (percent) 2001-11	Population Density Per Sq. Kms.
Himachal Pradesh	**68,64,602**	**82.8**	**972**	**12.94**	**123**
Chamba	5,19,080	72.80	986	12.63	80
Kangra	15,10,075	85.70	1012	12.77	263
Lahul& Spiti	31,564	76.80	903	-5.0	2
Kullu	4,37,903	79.40	942	14.76	80
Mandi	9,99,777	81.50	1007	10.92	253
Hamirpur	4,54,768	88.20	1095	10.19	407
Una	5,21,173	86.50	976	16.26	338
Bilaspur	3,81,956	84.60	981	12.05	327
Solan	5,80,320	83.70	880	15.93	300
Sirmaur	5,29,855	78.80	918	15.54	188
Shimla	8,14,010	86.60	915	12.67	159
Kinnaur	84,121	80.00	819	7.39	13

Source: Census 2011

The overall sex ratio in the State is 972 females per 1000 males. In nine, out of twelve districts, the female sex ratio was less than 1,000 varying between 819 in Kinnaur to 986 in Chamba. In three districts, the female sex ratio is higher than the male. These three districts are: Hamirpur (1095), Mandi (1007) and Kangra (1012).

The growth in population in the State during the year 2001-2011 was 12.94 percent. In four districts e.g. Kullu, Una, Solan and Sirmour, the growth was much higher than the State average, falling between 14.76-16.26 percent. In the other eight districts, the growth was between 7.39-12.77 percent. In the district of Lahaul & Spiti the growth was negative at (-) 5.0 percent.

The population density in the State is 123 per sq.kms, but varies widely across the districts. In eight districts viz., Kangra, Mandi, Hamirpur, Una, Bilaspur, Solan, Sirmour and Shimla, the density is between 159 per sq.kms. in Shimla to 407 per sq. Kms. in Hamirpur. The districts with low population density are: Lahaul & Spiti (2), Kinnaur (13), Chamba (80) and Kullu (80).

2.3 ECONOMIC PROFILE OF THE STATE:

The economy of Himachal Pradesh has transformed rapidly over the last two decades showing remarkable progress in Industries, Power, Horticulture, Agriculture and Allied Activities. This transformation has placed Himachal Pradesh as a leader in Hilly States.

The Gross State Domestic Product (GSDP) at factor cost at constant (2004-05) prices in 2013-14 was estimated at Rs. 47,376 crores as against Rs. 44,610 crores in 2012-13, registering a growth of 6.2 percent during the year. The State Gross Domestic Product (GSDP) at factor cost at constant (2011-12) prices in 2015-16 was estimated at Rs. 96,289 crore as against Rs. 89,095 crore in 2014-15 registering a growth of 8.1 percent during the year as against the growth rate of 7.5 percent during the previous year. During 2017-18, the GSDP was estimated at Rs.1,03,038 crore registering a growth of 8.1 percent, which has increased to Rs.1,09,711 crore with a growth of 9.1 percent.

The Per Capita Income at current prices increased from Rs. 85,792 in 2012-13 to Rs. 95,582 in 2013-14, registering a growth of 4.74 percent. The Per Capita Income at current prices for the year 2014-15 was Rs.1,24,325 as against Rs.95,582 in 2013-14. The Per Capita Income at current prices increased from Rs.1,35,621 in 2015-16 to Rs.1,49,028 in 2016-17 and Rs. 1,60,711 in 2017-18

Table 2.3: State Domestic Product and Per Capita Income in Himachal Pradesh

Year		Gross State Domestic Product (Rs. in Crore)		Average Annual Growth Rate (H.P.)	Per Capita Income (Rs.)	Average Annual Growth Rate (India)
	Base Year	(At Current Prices)	(At Constant Prices)		(At current prices)	
2005-06	2004-05	27127	26107	8.4	36949	9.48
2006-07	2004-05	30280	28483	9.1	40393	9.57
2007-08	2004-05	33962	30916	8.5	43966	9.32
2008-09	2004-05	41483	33210	7.4	49903	6.72
2009-10	2004-05	48188	35897	8.09	56706	8.59
2010-11	2004-05	56355	39036	8.7	67475	8.91
2011-12	2004-05	63811	41939	7.4	74694	6.69
2012-13	2004-05	76259	44610	6.3	85792	4.47
2013-14	2004-05	85841	47376	6.2	95582	4.74
2014-15	2011-12	104171	89095	6.5	124325	7.18
2015-16	2011-12	113667	96289	7.5	135621	7.93
2016-17	2011-12	125122	103038	8.1	149028	7.11
2017-18	2011-12	138542	109747	9.1	160711	10.0

Source: (i) Economic Survey of Himachal Pradesh 2011-12, 2012-13, 2013-14, 2014-15,2015-16, 2016-17, 2017-18 and 2018-19 Economics & Statistics Department.

Following are the major constituents which attributed to 9.1 percent growth of State Economy during 2017-18.

Table 2.3.A Sectoral Contribution to GSDP in 2017-18

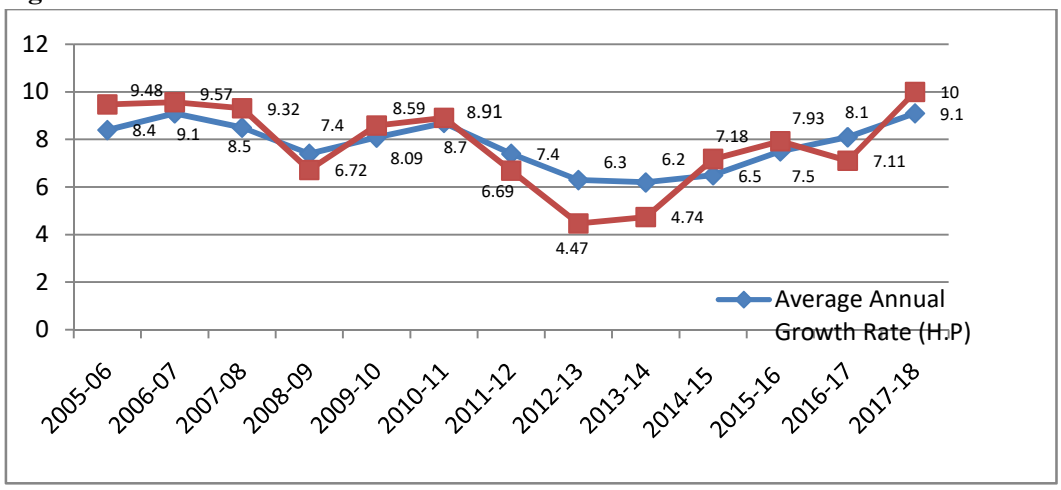
Primary Sector			**Secondary Sector**			**Tertiary sector**		
Primary Sector	**2017-18 (Rs. in Crore**	**% increased /decreased over the previous year**	**Secondary Sector**	**2017-18 (Rs in Crore**	**% increased/decreased**	**Tertiary sector**	**2017-18 (Rs in Crore**	**% increased/decreased**
Agri. and Ani. Husb.	9012	-1.2	Manufacturing	31735	8.5	Transport, Comm. & Trade, Hotel etc.	12800	3.7
Forestry & logging	4321	-1.4	Construction	7937	1.1	Finance & Real Estate	14185	4.5
Fishing	88	2.3	Electricity, Gas, Water Supply	8147	2.8	Community & Personal Services	16235	20.4
Mining & Quarrying	317	9.8						
Total	13738	-1.0		47819	6.2		43220	9.7

Source: Economic Survey of Himachal Pradesh 2016-17

The State had registered a growth of 9.1 percent in 2017-18 over the year 2016-17. From sector-wise breakup it is found that the growth in Primary Sector has no contribution to the overall growth in State's GSDP. Primary Sector, which includes Agriculture, Forestry, Fishing, Mining & Quarrying, during 2017-18, showed a growth rate of (-) 1.0 percent.

The Secondary Sector, which comprises Manufacturing, Construction and Electricity, Gas and Water Supply registered a growth of 6.2 percent during 2017-18. As compared to the last year's performance in manufacturing sector, the growth is 8.5 percent, while it has decreased in construction and electricity, gas & water supply sectors. Transport, Storage, Communications and Trade Sectors show a growth of 9.7 percent during 2017-18. Community & Personal Services Sector had a growth of 20.4 percent in 2017-18.

Figure 2.1: Growth Rates of GDP of Himachal Pradesh and India



Source: *CSO & Economic Survey of Himachal Pradesh 2011-12/ 2012-13/ 2013-14/ 2016-17/2017-18*

The structure of State's economy has shown a shift from Primary Sector to Secondary and Tertiary Sector, as the percentage contribution of Primary Sector in total State Domestic Product has declined from 71.01 percent in 1950-51 to 58.56 percent in 1970-71, 37.82 percent in 1990-91 to 19.72 percent in 2012-13 and this contribution is 13.73 percent in 2017-18.

TABLE 2.4: Sectoral Percentage Contribution of State Domestic Product of HP

Year	**PERCENTAGE CONTRIBUTION OF SECTORAL STATE DOMESTIC PRODUCT AT CURRENT PRICES**		
	Primary Sector	Secondary Sector	Tertiary Sector
1950-51	71.01	9.5	19.49
1960-61	63.14	9.71	27.15
1970-71	58.56	16.73	24.71
1980-81	50.35	18.69	30.96
1990-91	37.82	25.03	37.15
2000-01	27.37	32.5	40.13
2001-02	27.23	32.06	40.71
2006-07	18.00	40.00	42.00
2012-13	19.72	38.35	41.93
2013-14	19.28	37.87	42.85
2014-15	15.91	41.08	43.03
2016-17	16.00	40.00	44.00
2017-18	13.73	43.01	43.26

Source: Deptt. of Economic & Statistics, GoHP (GSDP of HP)

The share of secondary and tertiary sector has increased from 9.5 & 19.49 percent in 1950-51; to 16.73 and 24.71 percent in 1970-71; to 25.03 and 37.15 percent in 1990-91; and to 38.35 and 41.93 percent in 2012-13 respectively. The share of secondary sector has also increased in 2017-18 to 43.01 percent but there is little decrease in tertiary sector, which is 43.26 percent in 2017-18 as compared to 44 percent in 2017-18. The declining share of the agricultural sector does not affect the importance of this sector in the State Economy, as the State's Economic Growth is still being determined by the increasing trend in agriculture and horticulture production. It is an important contributor to the total domestic product and has an overall impact on the other sectors.

The State has made significant progress in the development of Horticulture. The topographical variations and altitudinal differences coupled with fertile, deep and well drained soils favour the cultivation of temperate to sub-tropical fruits. The region is also suitable for cultivation of ancillary horticultural produce like flowers, mushroom, honey and hops.

The fruit production of the State was 9.29 lakh MT in 2015-16, which decreased to 6.12 lakh MT and 5.65 lakh MT, in 2016-17 and 2017-18, respectively. However, annual fluctuations in horticultural produce are attributed to the weather conditions. The State envisages bringing 3,000 hectares of additional area under fruit plants. The State is gradually bringing more area under fruit plantation and is distributing fruit plants of different species to the local people.

During the year 2017-18, 16.91 lakh tonnes of vegetables were produced as against 16.53 lakh tonnes in 2016-17; recording a growth rate of 2.30 percent. The State, through diversification of agriculture into off-season vegetables and other cash crops, has been successful in reducing poverty

and uplifting the minority groups with emphasis on social inclusion regardless of gender, caste or rural and urban divide.

2.4 EDUCATIONAL ATTAINMENT

Education is one of the most important rights of children, who are the future of any society. Himachal Pradesh has been committed to provide free and compulsory education and has made commendable progress in the field of education. The State has brought in place a legislation, which declares free and compulsory education a right of every child between 6 to 14 years of age group. The total number of children who have never attended school have drastically declined in the State, with more and more number of students from the SC and ST category are going to schools for secondary education.

Himachal Pradesh, like other States, also participated in the race to development and growth of the educational system and witnessed a massive quantitative and qualitative improvement towards achieving a distinctive position in the education movement of India. This is now being supplemented with due attention and desired support from the Government of India towards primary and secondary education. The importance of higher education and value of professional courses are being well understood in the present scenario by the students, parents and the society as a whole, which is reflected in their performance.

2.4.1 Number of Schools in Himachal Pradesh

Over the years, Himachal Pradesh has undergone several significant developments in the field of education. The State aspires to become one of the prestigious centers of higher learning in India. In order to improve the academic scenario, the State Government has also started giving special importance to higher education in the State. Year-wise and district-wise number of educational infrastructure of the State is given below:

Table 2.5: Total Number of Schools in Himachal Pradesh (2017-18)

District	Primary Schools	Middle Schools	High/Sr. Secondary Schools	Degree Colleges		Total No. of Degree Colleges
				Govt.	Private	Total
Bilaspur	591	98	160	5	2	7
Chamba	1179	239	235	10	2	12
Hamirpur	478	115	161	6	11	17
Kangra	1681	310	531	28	12	40
Kinnaur	180	34	52	1	0	1
Kullu	760	127	149	7	1	8
L & S	186	32	38	1	0	1
Mandi	1710	324	416	16	5	21
Shimla	1595	308	400	16	7	23
Sirmour	1031	184	238	9	4	13
Solan	767	140	187	10	8	18
Una	499	85	182	9	8	17
HP	**10657**	**1996**	**2749**	**118**	**60**	**178**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

Table 2.6 Year-wise Number of Schools and Colleges in Himachal Pradesh

Year	Primary Schools	Middle Schools	High/Sr. Secondary Schools	Degree Colleges (Govt.)	Degree Colleges (Private)
2001-02	10,508	1,709	1,832	64	.
2011-12	10,771	2,269	2,126	74	23
2012-13	10,739	2,317	2,162	67	65
2013-14	10,650	2,321	2,191	67	66
2014-15	10,712	2,201	2,385	80	68
2015-16	10,710	2,130	2,487	89	67
2016-17	10,724	2,064	2,641	111	62
2017-18	10,657	1,996	2,749	118	60

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

There has been a moderate increase in the number of schools and colleges over the years (Table 2.6). Total number of Government Primary Schools in 2001-02 was 10,508 and by 2017-18 the number increased to 10,657.

However, in 2013-14, there was a steep decline over the previous year i.e., 2012-13 from 10,739 to 10650. This drop could be attributed partially to the increasing number of English medium private schools coming up in the State and mainly to up gradation of primary schools to middle and high schools. On the other hand, the number of middle schools increased from 1709 in 2001-02 to 1996 in 2017-18. Similarly, the number of Higher/Sr. Secondary Schools, increased from 1,832 in 2001-02 to 2749 in 2017-18.

There is a considerable increase in the number of Private Colleges from 23 in 2011-12 to 60 in 2017-18. Similarly, there is steep growth in the number of Government Colleges being 64 in 2001-02 and 118 in 2017-18.

2.4.2 School Enrolment

Enrolment of children in schools is an important indicator which determines the spread of education in an area. The more the enrolment, the higher would be the literacy level.

Table 2.7: Enrolment of Students in Schools and Colleges (2017-18)

District	Primary Schools	Middle Schools (VI-VIII)	High/Sr. Secondary Schools (IX-XII)	Total
Bilaspur	16019	11568	18344	45931
Chamba	37952	26154	32894	97000
Hamirpur	15443	10404	20574	46421
Kangra	41060	31379	68144	140583
Kinnaur	3316	2109	2957	8382
Kullu	23123	16569	22018	61710
Lahaul -Spiti	1275	709	970	2954
Mandi	42143	32987	52389	127519
Shimla	34502	23584	36561	94647
Sirmaur	34335	23790	30090	88215
Solan	30380	19965	26709	77054
Una	23265	15627	25571	64463
HP	**302813**	**214845**	**337221**	**854879**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

Among the districts, the enrolment to primary school is the highest in Mandi (42,143), and the lowest in Lahaul and Spiti (1,275).Wide variation in the total enrolments across districts is owing to the difference in the population among the districts (Table 2.7). The enrolment to middle school is the highest in Mandi (32,987), while it is the lowest in Lahaul and Spiti (709).

The enrolment to high school is the highest in Kangra (68,144), while it is the lowest in Lahaul and Spiti (970). The total enrolment is the highest in Kangra (1,40,583), while it is the lowest in Lahaul and Spiti (2,954). These enrolment figures pertain to government schools only.

The enrolment to Primary Schools has seen a fall from 6,43,167 in 2001-02 to 3,02,813 in 2017-18 (Table 2.8). Similarly, we see a drop in the enrolment to Middle School, from 6,43,167 in 2001-02 to 2,14,845 in 2017-18. The steady decline in the enrolment in government Primary Schools could mainly be due to higher enrolments in English Medium Private Schools.

Table 2.8: Year wise Enrolment of Students in Schools and Colleges

Year	Primary School	Middle School (VI-VIII)	High/Sr. Secondary School (IX-XII)	Total
2001-02	643167	643167	1286334	2572668
2005-06	543805	543805	1087610	2175220
2010-11	422710	422710	845420	1690840
2012-13	380699	262778	406339	1049816
2013-14	361046	253241	392909	1007196
2016-17	311035	232012	347090	890137
2017-18	**302813**	**214845**	**337221**	**854879**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

In the High and Sr. secondary schools enrolment, there has been a drop from 12,86,334 in 2001-02 to 3,37,221 in 2017-18. The total enrolment has seen a decline from 25,72,668 in 2001-02 to 8,54,879 in 2017-18. The decline in the enrolment at the middle and secondary schools could also be due to the dropout rate and some other factors that need to be probed further.

2.4.3 Teachers' Position

In order to impart quality education to the students, adequate number of teaching professionals in schools is most desirable.

The highest number of Primary School teachers is in District Kangra (3855) while the lowest number is in District Lahaul & Spiti (416). In case of Middle Schools, the highest number of teachers is in District Mandi (1155) and lowest in District Lahaul & Spiti (136). District Kangra has highest number of High/Sr. Secondary School teachers (6889) and lowest number has in District Lahaul & Spiti (490).However, these figures are a direct fraction of the number of schools in a district.

Table 2.9.A : Number of Teachers in various Schools in 2017-18

District	Primary Schools	Middle Schools (VI-VIII)	High/Sr. Secondary Schools (IX-XII)	Total
Bilaspur	1228	319	2302	3849
Chamba	2646	835	2656	6137
Hamirpur	1070	396	2495	3961
Kangra	3684	957	7292	11933
Kinnaur	469	148	688	1305
Kullu	1762	404	1803	3969
L & S	395	119	479	993
Mandi	3682	1081	5502	10265
Shimla	3444	1024	5159	9627
Sirmaur	2379	557	2738	5674
Solan	1835	474	2518	4827
Una	1315	300	2656	4271
HP	**23909**	**6614**	**36288**	**66811**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

The number of Primary School teachers has declined from 27,494 in 2000-2001 to 23,909 in 2017-18. Similarly, the number of Middle School teachers has also declined from 7,542 in 2000-2001 to 6,614 in 2017-18. However, the number of High School teachers saw a rise from 22,484 in 2000-01 to 36,288 in 2017-18.This change can probably be attributed to up-gradation of primary and middle schools to higher levels. The total number of teachers in Himachal Pradesh has increased from 57,520 in 2000-01 to 66,811 in 2017-18.

Table 2.9.B: Year-wise Number of Teachers in various Schools

Year	Primary School	Middle School	High/Sr. Sec. School	Total
2000-01	27494*	7542*	22484*	57520
2010-11	26199*	21859*	25375*	73433
2011-12	25817*	21003*	22919*	69739
2012-13	25239	9206*	28641**	63086
2013-14	25234	9009*	29073**	63316
2014-15	25827	8073*	30796**	64696
2015-16	24976	7554*	32727**	64857
2016-17	25087	6870*	34520**	66477
2017-18	**23909**	**6614***	**36288****	**66811**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18
(* Only Government) (** Including Private Sector)

2.4.4 Student-Teacher Ratio

The lesser the number of students per teacher, the more is the amount of individual attention the teacher can offer to the pupils. The teacher-pupil ratio plays a crucial role in the provision of quality education.

Table 2.10: Teacher-Pupil Ratio in Himachal Pradesh

Year	Primary / Junior Basic	Middle /Senior Basic	High/Higher Secondary	Colleges
2000-01	1:23	1:55	1:15	-
2001-02	1:24	1:51	1:14	1:45
2004-05	1:22	1:20	1:13	1:43
2010-11	1:16	1:14	1:16	1:43
2011-12	1:16	1:13	1:19	1:46
2012-13	1:15	1:29	1:14	1:38
2015-16	1:13	1:32	1:11	1:59
2016-17	1:12	1:34	1:10	1:60
2017-18	1:11	1:32	1:05	1:59

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

The Table 2.10 shows that the teacher-pupil ratio in the Primary and middle levels have made has made progress from 1:23 in 2000-01 to 1:11 in 2017-18 and from 1:55 in 2000-01 to 1:32 in 2017-18, respectively. In the High School level, the teacher- pupil ratio is quite good. It was 1:05 in 2017-18. At the College level, there has been progress from 1:45 in 2001-02 to 1:59 in 2017-18.

2.5 HEALTH AND NUTRITION STATUS

The State of Himachal Pradesh has better public health care infrastructure and better health status than many other Indian States. In many indicators it is better than the National Average. The same could be observed from the data given in Table 2.11.

Table 2.11: Health Profile of Himachal Pradesh as compared to All- India

Indicators	Himachal Pradesh	All-India
Total population (In Crore) (Census 2011)	0.68	121.01
Decadal Growth (percent) (Census 2011)	12.95	17.64
Crude Birth Rate (SRS 2016)	16	20.4
Crude Death Rate (SRS 2016)	6.8	6.40
Natural Growth Rate (SRS 2013)	9.2	14.0
Infant Mortality Ratio (2014-16)	25	34
Maternal Mortality Rate (SRS 2010-12)	54	130
Total Fertility Rate (SRS 2012)	1.7	2.3

Source:http://nrhm.gov.in/nrhm-in-State/State-wise information/Himachalpradesh.html#health_profile & HMIS

The State Government in its Millennium Development Goals Report 2014 has indicated steps to be taken for reduction of child mortality, improvement of maternal health and combating HIV/AIDS, Malaria and TB. To this effect, the proportion of births attended by skilled health personnel has increased.

As a result, the Maternal Mortality Ratio in 2014-16 was better than the National Average (54 against 130).The Infant Mortality Rate in the State declined from 35 in 2013 to 25 in 2016 and further to 22 in the year 2017. Thus, owing to the provision of standard medical facilities by the State Government, health of the children has seen an improvement.

2.5.1 Health Services in Himachal Pradesh

Since the First Five Year Plan, the Himachal Pradesh Government has been working towards providing quality health care services to the people of the State. Initially the focus was on the accessibility of health services by way of increasing the number of health care centers and diagnostic facilities.

Although there exists sufficient number of PHC's and Sub centers, there is a shortfall in the required number of medical, paramedical staff and technicians etc. as in the year 2015. The same is presented in the table below:

Table 2.12: Health Infrastructure in Himachal Pradesh (2018)

Particulars	Required	In-Position	Shortfall
Sub- Centers	1285	2084	Nil
Primary Health Centers	212	576	Nil
Community Health Centers	53	91	1
Health Worker (Female)/ANM at Sub Centers & PHCs	2660	1876	814
Health Worker (Male) at Sub Centers	2084	799	1285
Health Assistant (Female)/LHV at PHCs	576	0	576
Health Assistant (Male) at PHCs	576	38	538
Doctor at PHCs	576	622	Nil
Specialists at CHCs (Obstetricians, Gynecologists & Pediatricians)	364	04	360
Radiographers at CHCs	91	24	67
Pharmacist at PHCs & CHCs	667	378	289
Laboratory Technicians at PHCs & CHCs	667	131	526
Nursing Staff at PHCs & CHCs	1213	452	761

Source: RHS Bulletin, March 2018, M/O Health & FW., GOI.

The requirement of health institutions in Himachal Pradesh has been worked out on the basis of the national norms using population figures of the year 2011. However, considering sparsely disbursed population in the State and the population density being as low as 2 persons per square kilometer in Lahaul & Spiti district, the actual requirement of health institutions is much more than the national norms. The issue of providing required number of health professionals in these institutions still remains a challenge

2.5.2 Life Expectancy Rate at Birth

Table 2.13: Life Expectancy from 1976–2016 - Himachal Pradesh and India

Period	All India		Himachal Pradesh	
	Male	Female	Male	Female
1976-80	52.2	52.1	58.1	54.9
1981-85	55.9	55.9	58.5	62.9
1986-90	57.7	58.1	62.4	62.8
1993-97	60.4	61.8	64.6	65.2
1995-99	60.8	62.5	65.1	65.8
1997-01	61.3	63.0	65.5	66.1
1998-02	61.6	63.3	65.7	66.3
1999-03	61.8	63.5	65.8	66.6
2000-04	62.1	63.7	66.1	66.8
2001-05	62.3	63.9	66.3	67.1
2002-06	62.6	64.2	66.5	67.3
2006-10	64.6	67.7	67.7	72.4
2011-15	66.9	70.0	69.1	75.2
2012-16	67.4	70.2	69.4	75.5

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

The life expectancy for both the male and the female population has increased in Himachal Pradesh. Both male and female life expectancy is higher in Himachal Pradesh than the National Average.

During the period 1976-80, the female life expectancy was lower at 54.9 years than males at 58.1 years. As compared to this, during the period 2012-16, female life expectancy has increased to 70.2 years surpassing male life expectancy at 67.4 years. There is an increase of the life expectancy of males and females both in the State of Himachal Pradesh, which are 69.4 years and 75.5 years, respectively, in the same period.

2.5.3 Infant Mortality Rate, Crude Death Rate, Disability

Infant Mortality Rate (IMR) is the death of infants aged less than one year per thousand live births. It is a crucial indicator of the health care available to a mother and a child.

Table 2.14: Infant Mortality Rate (IMR)

Year-Wise IMR in HP	
Year	**IMR**
2000	51
2001	54
2004	51
2005	49
2006	50
2007	47
2008	44
2009	45
2010	40
2011	38
2012	36
2013	35
2014	32
2015	28
2016	25
2017	22

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18 and SRS Bulletin,May,2019

The Infant Mortality Rate has seen a decline from 54 in 2001 to 22 in 2017, suggesting a possible improvement in the health care services (Table 2.14). There is a need for better health care along with more awareness about child and maternal health.

Table 2.15: Comparative Crude Death Rate (CDR)

Year wise CDR in Himachal Pradesh & India			District wise CDR in Himachal Pradesh in 2011	
Year	**Himachal Pradesh**	**India**	**Districts**	**CDR**
1991	8.9	-	Bilaspur	5.8
2001	7.1		Chamba	5.8
2002	7.5	8.1	Hamirpur	7.6
2003	7.1	8.0	Kangra	7.0
2004	6.8	7.5	Kinnaur	5.3
2005	6.9	7.6	Kullu	5.7
2006	6.8	7.5	L&S	5.3
2007	7.1	7.4	Mandi	5.9
2008	7.4	7.4	Shimla	6.4
2009	7.2	-	Sirmaur	5.6
2010	6.9	-	Solan	5.6
2011	6.7	7.1	Una	7.4
2016	6.8	6.4	**HP**	**6.7**

Source: Sample Registration Bulletin, Govt. of India

Note: L&S - Lahaul and Spiti.

The CDR for Himachal Pradesh has declined over the years. From 7.1 in 2001, it has dropped to 6.7 in 2011, but further increased to 6.8 in 2016. The CDR for India has also seen a decline from 8.1 to 6.4 during the same period. (Table 2.15).

The district-wise Crude Death Rate in 2011 reveals low death rate across all districts. The highest CDR is seen at Hamirpur (7.6) while the lowest is in Kinnaur (5.3) and Lahaul &Spiti (5.3).

Table 2.16: Disabled Persons by type of Disability - 2011 Census

Type of Disability	Total	Rural	Urban
Seeing	26076	24140	1936
Speech	8278	7548	730
Hearing	26700	23939	2761
Movement	32550	30427	2123
Mental	14152	12891	1261
Multiple Disability	18536	17468	1068
Any Other	29024	26252	2772
Total	**155316**	**142665**	**12651**

Source: Census of India – 2011, Disability at a Glance, H.P.

Number of differently-abled persons is higher in rural areas than in urban areas of the State (Table 2.16). Out of total 26076 visually impaired persons, 24140 are from rural and 1936 from the urban areas. The total number of differently-able persons in the State is 1,55,316 with 1,42605 in rural and 12,651 in urban areas.

2.5.4 Immunization

The number of children immunized against various infections has declined considerably over the years in the State.(Table 2.17). However, the observed trend needs to be viewed in conjunction with the year wise child population in the State.

Table 2.17: Children Immunization

Year	Number of Children Immunized				
	DPT	DPT (5years)	Polio	BCG	Measles
2000-01	138294	125779	138243	142716	131434
2001-02	135246	124807	135089	140786	133451
2002-03	134296	119556	134397	144019	133908
2003-04	136347	116081	136367	141459	130748
2004-05	133505	121332	133499	136114	131098
2005-06	131548	117587	131288	134050	128306
2006-07	129173	115229	129140	133212	126284
2007-08	127471	112845	127475	129882	125056
2008-09	130842	110470	130839	134334	122206
2009-10	127350	105715	127358	131262	123899
2010-11	121582	101885	121330	128046	116789
2011-12	113040	91364	113559	119455	112573
2012-13	113566	82180	113642	120481	110370
2013-14	112212	87685	112300	115335	108719
2014-15	108419	91014	108515	108406	106932
2015-16	68145	94397	108712	103918	108183
2016-17	100	96610	105895	98124	104574

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

The number of children immunized against DPT declined from 1,38,294 in 2000-01 to 68,145 in 2015-16. Similarly during the same period, immunization for DPT (5 years) declined from 1,25,779 to as low as 84,378; immunization for Polio decreased from 1,38,243 to 1,03,080; BCG from 1,42,716 to 93,294 and Measles from 1,31,434 to 1,04,574.

2.5.5 Nutritional Status of Children

2.5.5. Nutritional Status of Children below 5 years of age (By weight)

Malnutrition is found to be a leading killer throughout the world and is also one of the major indictors to child health. Table 2.18 presents a comparative status of malnourishment in terms of underweight children below the age of 3 years in Himachal Pradesh and India from 1990 to 2005-06. The proportion of underweight children in Himachal Pradesh is found to be less as compared to the all India figures. There has been a decline in the proportion of underweight children during the said period in both Himachal Pradesh and all India. In HP, the proportion of underweight children declined from 40.35 percent in 1990 to 21.2 percent in 2015-16. In case of all-India, the proportion of underweight children has declined from 52.01 percent to 35.5 percent during the same period.

Table 2.18: Proportion of Underweight Children >5 years age in HP

Underweight Children (Below 3 years) in Himachal Pradesh & India (Percent)		
Year	**HP**	**INDIA**
1990	40.35	52.01
1992-93	38.4	51.5
2005-06	36.5	42.8
2015-16	21.2	35.5

Source: National Family Health Survey-4

NFHS-2 used three internationally recognized anthropometric indicators to assess children's nutritional status in terms of weight-for-height, height-for-age, and weight-for-age. Children who are more than two standard deviations below the median of an international reference population are considered underweight (measured in terms of weight-for-age), stunted (height-for-age), or wasted (weight for-height). Stunting is a sign of chronic, long-term under nutrition, wasting is a sign of acute, short-term under nutrition, and underweight is a composite measure that takes into account both chronic and acute under nutrition (Table-2.19).

Table 2.19 Nutritional Status of Children below 5 years (2015-16)

Year	**Total**
Children below 5 years wasted (weight for height-below 2 SD)	13.7
Children below 5 years stunting (height-for-age below 2 SD)	26.3
Children below 5 years underweight (weight-for-age below 2 SD)	21.2

Source: NFHS-4 (2015-16)

Prevalence of underweight children is the percentage of children under 5 years of age whose weight for age is less than minus two deviations from the median for the reference population aged 0-59 months. As per District Level Household Survey (2015-16), overall, 21.2 percent of children below 5 years of age were underweight, 26.3 percent were stunted, and 13.7 percent were wasted.

2.5.6 Prevalence of HIV/AIDS

Table 2.20: Prevalence of HIV among Adult Population

Year	Himachal Pradesh	India
2007	0.14	0.34
2008	0.14	0.32
2009	0.13	0.31
2010	0.13	0.30
2011	0.13	0.29
2012	0.13	0.28
2013	0.12	0.27
2014	0.12	0.27
2015	0.12	0.26
2017	0.05	0.22

Source: India HIV Estimation 2015 & 2017

The National AIDS Control Programme (NACP), 1992, has been implemented in the country as an extensive programme for the prevention and control of HIV/AIDS. The HIV prevalence among adult population was 0.14 in 2007 for Himachal Pradesh against the National level of 0.34 (Table 2.20). There has been a decline in the prevalence from 0.14 in 2007 to 0.05 in 2017 as against the National level from 0.34 to 0.22 in the same period.

Table 2.21: HIV Estimation among Adult Population

Year	Himachal Pradesh	India
2007	5666	2225000
2008	5567	2198000
2009	5485	2174000
2010	5438	2156000
2011	5458	2146000
2012	5541	2143000
2013	5589	2127000
2014	5655	2119000
2015	5723	2116000
2017	3148	2114000

Source: India HIV Estimation 2015 & 2017

The prevalence of HIV estimation for Himachal Pradesh has shown a slight increase from 5655 in 2014 to 5723 in 2015, but there is sharp decline in 2017 to 3148.

2.6 INFRASTRUCTURE

2.6.1 Introduction

Infrastructure comprises of the physical and organizational structures and facilities necessary for the development of a given society. In a hill State like Himachal Pradesh, the key role of infrastructure would be: (i) To improve the accessibility of infrastructure in the State, and (ii) To ensure that the energy and communication demands are met keeping in mind sustained economic development, without causing any environmental damage.

However, infrastructure development in a difficult terrain like Himachal Pradesh is faced with many challenges. To overcome these constraints posed by nature, in a hilly area, infrastructure provision ends up demanding a higher cost. The development of modern transport infrastructure, especially of roads and railways is a costly enterprise in general. Costs in mountains are even higher than in plains, for both construction and maintenance, due to difficult topography, harsh climate, and the need for protection from hazards, such as avalanches, landslides, and rock falls.

2.6.2 Housing

Himachal Pradesh is primarily rural. Only about11 percent households in the State live in urban areas, and the remaining 89 percent are in rural areas.

Table 2.22: Housing Characteristics

Source: State Statistical abstract (2013-14) & Selected Socio Economic Indicators (2010)

Characteristics	Rural (%)	Urban(%)
Pucca houses	47	89
Electricity	98	99
Use improved source of drinking water	87	97
Water pipe in house, yard or plot	47	84

Fifty three percent of the total households of Himachal Pradesh live in pucca houses. In the rural areas, 47 percent of rural households live in pucca houses, whereas in the urban areas 89 percent households live in pucca houses. Electricity is available in 98 percent of the rural and 99 percent of the urban households. Ninety-seven percent of the urban households use improved source of drinking water, while it is 87 percent among the rural households. Eighty-four percent of the urban households have a water pipe in their dwelling, yard or plot, while only 47 percent rural households have it.

The Himachal Pradesh Government also has several schemes in place to provide affordable housing for families belonging to people Below Poverty Line (BPL). In addition to Central Scheme i.e. Pradhan Mantri Awas Yojana, some of these schemes are:

Mukhya Mantri Awas Yojana - The Government announced a new housing scheme named "Mukhya Mantri Awas Yojana" in 2016, aimed at providing housing subsidy of Rs. 1,30,000 to each BPL family belonging to the General Category. Prior to this yojana, there were other housing development

schemes all over the country. However, they all proposed that BPL families belonging to Scheduled Caste or Scheduled Tribe only would get their own house, and there was no mention of BPL families belonging to the general caste. The subsidy has been increased to Rs.1,50,000/- with effect from the financial year 2019-20.

Rajiv Awas Yojana – Rajiv Awas Yojana was a path breaking scheme for the slum dwellers and urban poor people with broad objectives of bringing all the slums into the formal system and also enable access to basic amenities at par with the rest of the Urban Local Bodies.

Integrated Housing and Slum Development Programme – There is need to strengthen the urban planning process by integrating the urban poor in the city planning and development process in a participatory manner and evolve citywide strategies to provide alternatives to slum formation. The basic objective of this scheme is to strive for slum-less cities by adopting a holistic slum development with a healthy and enabling urban environment by providing adequate shelter and basic infrastructure facilities to the slum dwellers of the identified urban areas. Under this programme, the Minimum Floor Area of Dwelling Unit should not less than 25 sq. mts. And preferably two room accommodation plus kitchen and toilet. The main thrust of this programme is integrated development of slums through projects for providing shelter, basic services and other related civic amenities with a view to provide basic amenities to urban poor.

2.6.3 Sanitation

Table 2.23: Percentage of Households with access to Improved Sanitation

Year	Rural	Urban
2008-09	51.9	90.2
2012	73.7	95.7

Source: State Statistical abstract (2013-14) & Selected Socio economic indicators (2010)- NSSO 69th Round(The data on these indicators are not available for next rounds of NSSO)

The sanitation facility available to the households has a huge impact on the living conditions, health and hygiene of the members of the households.

During the year 2008-09, 51.9 percent of rural and 90.2 percent of urban households had access to improved sanitation facilities. In 2012 the same increased to 73.7 percent for rural households and 95.7 percent for urban households. Himachal Pradesh has recently achieved cent percent sanitation facilities for all the households and has been declared, 'Open Defecation Free'.

2.6.4 Electricity

Table 2.24: Generation, Sale and Purchase of Electricity

Year	Installed Capacity in H.P.HPSEB (MW)	Total Generation in the State (MU)	Purchased from Outside (MU)	Sale outside the State (MU)
2005-2006	329.10	1332.4	4919	1722.5
2006-2007	467.10	1432.4	5057	1255.3
2007-2008	467.10	1846.9	5433.4	1198.6
2008-2009	467.10	2075.1	6047.5	1498.2
2009-2010	467.10	1804.1	6616.4	1284
2010-2011	467.10	2045.3	7418.5	1704.6
2011-2012	471.45	2019.95	6822.67	627.28
2012-2013	471.45	1800.19	7957.29	1179.86
2013-2014	477.45	1947.36	8678.666	1999.98
2014-2015	487.45	2096.823	9981.176	2939.506
2015-2016	487.450	1573.103	11168.582	3522.807
2016-2017	487.450	1595.917	11378.988	3578.050
2017-2018	487.450	1941.321	11282.370	3485.430

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

The total electricity generation in the State has increased from 1332.4 MU in 2005-06 to 2096.823 MU in 2014-2015 and decreased during 2015-16 and 2016-17, but increased in 2017-18(Table 2.24). The purchase of electricity from outside the State has also increased from 4919 MU in 2005-06 to 11378.988 MU in 2016-17, but decreased to 11282.370 in 2017-18. On the other hand, the sale of electricity outside the State also had shown an increase from 1722.5 MU in 2005-06 to 3578.050 MU in 2016-17, but decreased to 3485.430 in 2017-18.

Table 2.25: Consumption of Electricity – Various Sectors of Himachal Pradesh

Consumption of Electricity in MU					
Year	**Domestic**	**Non Domestic/ Non Commercial**	**Commercial**	**Industrial**	**Govt. Irrigation and WSS**
1	**2**	**3**	**4**	**5**	**6**
2005-06	866.6	46.9	218.2	1979.1	305.3
2006-07	948.3	63.4	225.8	2553.5	324.9
2007-08	1058.4	77.3	248.2	3100.4	335.0
2008-09	1089.1	80.6	247.7	3385.3	389.3
2009-10	1111.6	89.9	305.6	3596.9	414.9
2010-11	1282.0	89.5	356.6	3993.7	409.9
2011-12	1398.7	95.9	365.0	4288.5	430.7
2012-13	1618.1	106.8	411.0	4511.4	454.0
2013-14	1774.7*	117.6	450.9	4501.2	472.6
2014-15	1893.5*	129.9	473.2	4625.7	502.6
2015-16	1942.2*	129.9	492.6	4603.8	546.3
2016-17	1947.9*	130.4	528.2	4561.5	551.1
2017-18	2008.8*	144.6	567.1	4815.7	605.1

Consumption of Electricity in MU					
7	**8**	**9**	**10**	**11**	**(2 to 11)**
Year	**Street light**	**Agriculture**	**Temporary**	**Bulk and Others**	**Total**
2005-06	11.7	24.7	10.3	105.9	3568.7
2006-07	11.3	26.4	19.4	127.5	4300.4
2007-08	12.6	26.7	23.4	146.5	5028.7
2008-09	13	28.7	22.7	177.1	5460.5
2009-10	12.5	36.6	27.1	218.7	5814.3
2010-11	12.5	35.1	24.7	235.6	6440.2
2011-12	12.7	35.5	28.5	173.2	6828.7
2012-13	13.9	46.6	25.9	169.8	7357.8
2013-14	12.4	41.3	26.8	156.9	7554.4
2014-15	13.3	45.1	25.6	157.3	7866.2
2015-16	13.0	51.7	29.8	141.8	7951.1
2016-17	13.0	57.3	30.0	150.2	7959.7
2017-18	11.3	62.2	36.0	153.8	8404.6

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

*Includes consumption of Antoday

Maximum consumption of electricity is by the industrial sector (4815.7 MU), followed by domestic consumption (2008.8 MU), while the least is by street lights (11.3 MU). The total consumption of electricity in the State has steadily increased from 3,569 MU in 2005-06 to 8,405 MU in 2017-18.

Per Capita Energy Consumption (PEC) during a year is computed as the ratio of the estimate of total energy consumption during the year to the estimated mid-year population of that year.

Table 2.26: Per Capita Consumption of Electricity (KWh)

Year	Himachal Pradesh	India
2006-07	872	672
2007-08	967	717
2008-09	1016	734
2009-10	1145	779
2010-11	1251	819
2011-12	1289	884

Source: Department of Energy, Himachal Pradesh

Owing to rapid urbanization and industrialization in the last decade, the per capita energy consumption in Himachal Pradesh has steadily grown from 872 kwh in 2006-07 to 1289 kwh in 2011-12. The per capita consumption at the national level was just 884 kwh during the year 2011-12 much lower than the State of Himachal Pradesh.

Table 2.27: Number of Villages Electrified

Year/District	Total No. of Inhabited Villages - 2011 Census	No. of Villages Electrified		Percentage of Village Electrified
		During the Year	By the end of Year	
Bilaspur	953	0	953	100
Chamba	1110	0	1102	99.28
Hamirpur	1671	0	1671	100
Kangra	3617	0	3616	99.97
Kinnaur	241	3	238	98.76
Kullu	314	3	314	100
Lahul & Spiti	280	0	277	98.93
Mandi	2850	2	2844	99.79
Shimla	2705	10	2699	99.78
Sirmaur	968	0	968	100
Solan	2383	0	2383	100
Una	790	1	790	100
HP	**17882**	**19**	**17855**	**99.85**
Number of Villages Electrified				
2014-15	17882	0	17827	99.69
2015-16	17882	9	17836	99.74
2016-17	17882	19	17855	99.85
2017-18	17882	0	17855	100.00

Source: H.P. State Electricity Board

Except Lahaul and Spiti, the villages of all other districts of Himachal Pradesh are fully electrified. Electrification of villages has seen a rise from 99.69 percent in 2013-14 to 100.00 percent in 2017-18 (Table 2.27).

2.6.5 Water

It can be seen from the table below that in all the districts, most of the villages have drinking water facilities. Mandi records 100 percent availability of drinking water, while Kinnaur records the least at 52.56 percent.

Table 2.28: Villages with Drinking Water Facility (2010)

District	No. of Inhabited Villages	Villages with Drinking Water Facility	Percentage of Villages with Drinking Water Facility
Bilaspur	965	963	99.8
Chamba	1118	1108	99.1
Hamirpur	1635	1632	99.8
Kangra	3619	3611	99.8
Kinnaur	234	123	52.56
Kullu	172	172	100
L&S	287	266	92.7
Mandi	2833	2833	100
Shimla	2520	2491	98.8
Sirmaur	966	951	98.4
Solan	2388	2321	97.2
Una	758	751	99.1
HP	**17495**	17222	94.7

Source: Environment Master Plan Infrastructure Sector (Baseline), Government of Himachal Pradesh Department of Environment, Science & Technology

Table 2.29: Water Purification Methods used at Household Level

Water purification Methods at Household level			
Method of Drinking Water Purification	**Urban**	**Rural**	**Total**
Strain water by Cloth	1.8	2.5	2.4
Use of Alum	0.5	0.5	0.5
Use of Water Filter	30.5	3	6
Boil water	21.7	3.6	6
Use of Electronic Purifier	1.6	0.2	0.4
Other method	1.1	2.1	2
Do not Purify Water	53.9	89.2	85.5

Source: Environment Master Plan Infrastructure Sector (Baseline), Government of Himachal Pradesh Department of Environment, Science & Technology

About 85.5 percent of households do not purify water before use. However, in rural areas this percentage is as high as 89.2 in rural areas as against only 53.9 in urban areas. About 30.5 percent of

urban households use water filter, while only 3 percent rural households use it. 21.7 percent of the urban households boil water before use, whereas 3.6 percent rural households do it (Table 2.29).

2.6.6 Gas Connection at Home

Table 2.30: District-wise Number of Consumers and Consumption of LPG

District	Number of Consumers (As on August, 2019)		
	Single Bottle Cylinder	Double Bottle Cylinder	Total
Bilaspur	46993	52465	99458
Chamba	48813	35381	84194
Hamirpur	53545	81128	134673
Kangra	251785	210079	461864
Kinnaur	14970	20707	35677
Kullu	45889	86632	132521
Lahaul - Spiti	2458	17822	20280
Mandi	109541	147538	257079
Shimla	51525	183862	235387
Sirmaur	61256	51930	113186
Solan	55283	129601	184884
Una	58902	78991	137893
HP	**800956**	**1086136**	**1887092**

Source: Director, Himachal Pradesh State Food and Supply Department, 2019

The Single Bottle Cylinder (SBC) consumers are the highest in Kangra, while the lowest are in Lahaul and Spiti. The Double Bottle Cylinder (DBC) consumers are more in number than the SBC consumers. The highest number of consumers are in Kangra (4,61,864), followed by Mandi (2,57,079) while the lowest number is in Lahaul and Spiti district (Table 2.30)

2.6.7 Transport & Communication

The importance of transport for Himachal Pradesh cannot be ignored, since it addresses the core issue of accessibility for the people. Adequate and efficient transport infrastructure lowers the transaction cost, and facilitates the integration and inter-dependence of the different sectors by aiding quick movement of people and materials. It also directly impacts the quality of life and acts as a catalyst for the growth and development of an economy. A well designed 'Transport Policy' could therefore play an important role in promoting balanced development of the State's economy.

Table 2.31: District-wise Roads in Himachal Pradesh (In Kms.) as on 2017-18

District	Total Road Length	Motorable Four Lane	Motorable Double Lane	Motorable Single Lane	Jeepable Lane	Less than Jeepable
Bilaspur	1815	5	173	1628	3	6
Chamba	3989	0	244	2842	555	348
Hamirpur	2078	0	146	1929	3	0
Kangra	5533	0	290	5224	19	0
Kinnaur	1204	0	45	908	86	165
Kullu	2104	0	118	1976	0	10
Lahaul & Spiti	1209	0	95	1069	35	10
Mandi	5785	17	153	5338	167	110
Shimla	5141	0	209	4844	83	5
Sirmaur	3417	0	179	3173	15	50
Solan	3168	23	203	2911	18	13
Una	2143	17	226	1900	0	0
HP	**37586**	**62**	**2081**	**33742**	**984**	**717**

Source: Public works Department, Himachal Pradesh

The total road length was 37,586 Kms. across districts, the longest road length is in Mandi district (5,785 kms), while the shortest is in Kinnaur district (1,204 kms.) in the year 2017-18.

Table 2.32: Year-wise Roads in Himachal Pradesh (In Kms)

Districts	Total Road Length	Motorable Four Lane	Motorable Double Lane	Motorable Single Lane	Jeepable	Less than Jeepable
2011-12	34169	-	2411	29999	276	1483
2012-13	34647	-	2415	30550	260	1422
2013-14	35142	-	2416	31075	255	1396
2014-15	35583	-	2416	31499	284	1396
2015-16	36049	-	2416	31953	284	1396
2016-17	36623	-	2453	32469	305	1396
2017-18	37586	62	2081	33742	984	717

Source: Public Works Department, Himachal Pradesh

The total road length in Himachal Pradesh has increased from 34,169 kms. in 2011-12 to 37,586 kms. in 2017-18 (Table 2.32). Motorable four lane has been added to total road length, which was 62 kms. in 2017-18. Similarly, motorable single lane saw an increase from 29,999 kms. in 2011-12 to 33,742 kms. in 2017-18.

Table 2.33: Village Connectivity with Motorable Road (as on 31.3.2017)

Village Connectivity with Motorable Road				
District	**Total no. of Inhabited Villages**	**No. of Villages Connected with road**	**No. of Villages Unconnected with road**	**Percentage of Connected Villages**
Bilaspur	953	730	232	76.60
Chamba	1110	554	559	49.90
Hamirpur	1671	1172	462	70.13
Kangra	3617	2385	1229	65.93
Kinnaur	241	67	166	27.80
Kullu	314	123	49	39.17
Lahaul & Spiti	280	127	157	45.35
Mandi	2850	1632	1191	57.26
Shimla	2705	1111	1404	41.07
Sirmaur	968	674	292	69.62
Solan	2383	1142	1236	47.92
Una	790	484	271	61.26
HP	**17882**	**10201**	**7248**	**57.04**

Source: Public Works Department, Himachal Pradesh

It can be seen from the table that in most of the districts, more than half of the villages are connected with motorable roads. Bilaspur (76.60 percent) has the maximum connectivity while Kinnaur (27.80 percent) has the least connectivity with motorable roads in terms of total villages connected by roads.

Table 2.34: Number of Motor Vehicles Registered during the year 2017

District	Buses	Trucks	Motor Cycle/ Scooter	Private Cars	Jeeps	Tractors	Petrol Tanker/ Water Carrier	Departmental Cars	Others	Grand Total
Bilaspur	11	278	3318	2075	7	0	0	3	251	5943
Chamba	41	227	3860	1829	0	35	0	0	229	6221
Hamirpur	78	0	7146	3129	0	102	0	0	486	10941
Kangra	206	75	22609	9331	73	162	1	727	578	33762
Kinnaur	31	7	69	944	0	1	0	4	104	1160
Kullu	55	0	2935	3108	0	0	0	0	762	6860
Lahaul & Spiti	14	0	106	232	4	7	0	0	45	408
Mandi	114	7	8550	5460	743	82	0	3	446	15405
Shimla	48	0	1726	328	6273	0	25	0	628	9028
Sirmaur	49	22	5929	2252	0	100	0	0	518	8870
Solan	67	0	9981	5968	0	91	0	0	1501	17608
Una	67	0	10308	2433	29	160	0	0	463	13460
HP	**781**	**616**	**76537**	**37089**	**7129**	**740**	**26**	**737**	**6011**	**129666**

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

In Himachal Pradesh, motorcycles and scooters are the highest in number (76,537), followed by private cars (37,089). Kangra has the maximum number of vehicles (33,762), with Lahaul & Spiti having the least number (408).

Table 2.35: Number of Vehicles Registered during 2010-2017

Year	Buses	Trucks	Motor cycle/ Scooter	Private Cars	Jeeps	Tractor	Petrol Tanker/ Water Carrier	Departmental Cars	Others	Grand total
2010	863	11089	40672	19134	716	1461	8	19	5023	78985
2011	737	5703	42390	20608	1111	1279	19	4	4525	76376
2012	1148	6938	41830	21986	943	1281	7	30	5720	79883
2013	258	2653	52851	25471	1619	1011	140	5	7793	91801
2016	563	2330	36390	30167	5241	1086	01	12	29205	114995
2017	781	616	76537	37089	7129	740	26	737	6011	129666

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

There has been a decline in the total number of buses and trucks from 863 and 11,089 in 2010 to 781 and 616 respectively in 2017 (Table 2.35). Motor cycles/scooters have been increased from 40,672 in 2010 to 52,851 in 2013 and decreased in 2016 (36,390), but again increased to 76,537 in 2017. The number of private cars and jeeps has increased from 19,134 and 716 in 2010 to 37,089 and 7,129 respectively in 2017. The number of Tractors has declined from 1,461 in 2010 to 740 in 2017. Number of petrol tankers has increased from 8 in 2010 to 140 in 2013 and dropped to 26 in 2017. Departmental cars have also dropped from 19 in 2010 to 12 in 2016, but increased tremendously to 737 in 2017. The possible reason for sudden jump in the number of departmental cars registered in 2017 can be that a large number of old departmental vehicles may have been replaced with the new ones as this number had been considerably low during previous years. Number of other vehicles has increased from 5,023 in 2010 to 29,205 in 2016, but decreased to 6011 in 2017.

The total number of vehicles in Himachal Pradesh has increased from 78,985 in 2010 to 1,29,666 in 2017.

2.6.8 Banking

The total banks in Himachal Pradesh as on March, 2018 are 1,532 with the maximum banks in Kangra (292) (Table 2.36). The total deposited amount in Himachal Pradesh is Rs. 85,735 crores, with the maximum amount deposited in Shimla (Rs. 18,453 crores).

Table 2.36: Total Banks and Deposit - Credit Ratio as on March, 2017

District	No. of Banks	Average Population per Bank	Deposits (Rs. in crore)	Credits (Rs. in crore)	Credit-Deposit Ratio
Bilaspur	76	5026	3729	941	25.23
Chamba	80	6489	3339	917	27.46
Hamirpur	104	4373	6602	1172	17.75
Kangra	290	5207	18209	3938	21.63
Kinnaur	29	2901	849	319	37.57
Kullu	97	4514	5190	1952	37.61
Lahaul & Spiti	15	2104	414	80	19.32
Mandi	182	5493	10439	2478	23.74
Shimla	241	3378	18453	5036	27.29
Sirmaur	100	5299	3363	2345	69.73
Solan	207	2803	9331	5783	61.98
Una	111	4695	5835	1518	26.02
HP	**1532**	**4481**	**85753**	**26479**	**30.88**

Source: DES Statistical Abstract, 2017-18

2.6.9 Telephone & Mobile Services

Telecommunication sector serves as the backbone for rapid transfer of information and data. With rapid development in the field of information and technology in the last decade, it is imperative for the Government to usher in an era of information technology in all its services. Tele-density is a good measure to gauge the accessibility of telephones and cell phones in a given area.

Table 2.37: Telephone lines and Cellular Subscribers per 100 persons

Telephone per 100 Persons			
Year	**Total**	**Rural**	**Urban**
2004	10.14	5.51	51.12
2007	29.33	11.66	179.40
2009	55.50	40.47	179.81
2010	79.35	52.53	298.15
2011	113.05	72.23	440.51
2013	104.96	75.50	334.98
2015	124.34	92.23	366.14
2017	150.44	115.22	411.17

Source: State Statistical Abstract (2013-14) and MDGs- Final Country Report of India

The tele-density in Himachal Pradesh saw a steep rise from 10.14 in 2004 to 104.96 in 2013 (Table 2.37). In the rural areas, the tele-density increased from 5.51 to 75.50 whereas in the case of the urban areas, it was 51.15 in 2004 and 334.98 in 2013.

2.7 SERVICES: Information Technology & Tourism

2.7.1 The Service Sector over the Years

The service sector in Himachal Pradesh has seen a rise in the last decade. It has a booming tourism industry, with thousands of visitors, not only from within the country, but also from outside. The Government in effect has a far greater responsibility of ensuring that the natural resources, flora and fauna and natural habitat of the State is not disturbed or disrupted in any manner, owing to the influx of visitors and migrants.

2.7.2 Performance of the State in IT

The IT sector is a booming industry in Himachal Pradesh. The State has a number of positive factors for the growth and development of IT industry, such as good climatic conditions with dust free and cool environment, good telecom infrastructure, adequate power supply, road network, hospitality industry and relatively low cost of living.

2.7.3 Tourism in the State

Table 2.38: Number of Tourists (2019)

Year/District	Domestic	Foreigner	Total
Bilaspur	16,16,925	446	16,17,371
Chamba	11,80,949	828	11,11,777
Hamirpur	9,80,611	12	9,80,623
Kangra	26,84,948	1,38,341	28,23,289
Kinnaur	4,63,771	2,609	4,66,380
Kullu	37,32,044	1,33,057	38,65,101
Lahaul Spiti	1,04,645	14,275	1,18,920
Mandi	12,31,968	10,072	12,42,040
Shimla	33,18,829	1,62,168	34,80,997
Sirmaur	9,92,352	2,522	9,94,874
Solan	12,25,105	6,454	12,13,559
Una	15,98,394	208	15,98,612
HP	1,91,30,541	4,70,992	1,96,01,533
Year-wise Number of Tourists			
2011	1,46,04,888	4,84,518	1,50,89,406
2012	1,56,46,048,	5,00,284	1,61,46,332
2013	1,47,15,586	4,14,249	1,51,29,835
2014	1,59,24,701	3,89,699	1,63,14,400
2015	1,71,25,045	4,06,108	1,75,31,153
2016	1,79,97,750	4,52,770	1,84,50,520
2017	1,91,30,541	4,70,992	1,96,01,533

Source: Directorate of Tourism, H.P., 2017-18

Kullu has the maximum number of domestic (37,32,044) and Shimla has the maximum number of foreign visitors (1,62,168) (Table 2.38). The total number of domestic visitors to Himachal Pradesh saw an increase from 1,46,04,888 in 2011 to 1,79,97,750 in 2016. The total number of foreign tourists saw a drop from 4,84,518 in 2011 to 4,52,770 in 2016. The total number of tourists saw a slight decline from 1,61,46,332 in 2012 to 1,51,29,835 in 2013. After that the total tourist inflow in the State increased in 2014, 2015, 2016 and 2017.

2.8 CONCLUDING REMARKS

Himachal Pradesh as a State has made great efforts to ensure development of its people. Endowed with rich natural resources, the State has great responsibility not only towards its people, but also towards the ecology. The Human Development has seen an improvement through Government efforts in the positive direction. However, it is yet to be seen how the State handles its green growth challenges.

2.9 ASSESSMENT OF HUMAN DEVELOPMENT IN DISTRICTS OF HIMACHAL PRADESH THROUGH HUMAN DEVELOPMENT INDEX

2.9. A : Background

India had a comfortable economic growth since the initiation of economic reforms in early 1990s. The average annual GDP growth rate increased from 5.57 percent during 1991-2000 to 7.59 percent during 2001-10 (calculations based on World Development Indicator database). However, an enhancement in the status of Human Development at the macro level has not been that impressive.
According to the UNDP (Human Development Report), India ranked in low HD category throughout nineties and managed to graduate to medium HD category only in 2002. In 2012, it held a composite HDI score of 0.554 as compared to the corresponding figure of 0.439 in 1990. India's global HDI rank has also fallen from 132 in 1999 to 136 in 2012, although the number of countries covered for HD assessment increased during this period. (UNDP, undated).

Both as a part of the Millennium Development Goals (MDGs) commitments and the unilateral efforts for augmenting education and health related achievements, a number of policy measures have been introduced in recent times. Notably, the Sarva Shiksha Abhiyan (SSA), creation of new IITs, IIMs and Central Universities with public funds, the National Rural Health Mission (NRHM, 2005-12) with the objective of reducing Infant Mortality Rate (IMR), Maternal Mortality Ratio (MMR), and ensuring universal access to public health services, the National Urban Health Mission (NUHM), Pradhan Mantri Swasthya Suraksha Yojana, Mahatama Gandhi National Rural Employment Guarantee Act (MGNREGA) (2005) and The Food Security Act (2013) etc.

2.9. B: Rudimentary Reality Check

Although these Human Development-related measures undertaken so far have helped India to improve the scenario, it has still fallen short of fulfilling several relevant MDG commitments by the stipulated deadline (i.e.2015). India needs to work harder for fulfilling a number of education (e.g. literacy rate, gender disparity in higher education) and health-related (e.g. mortality rates, attendance of skilled personnel during birth) objectives, which is a matter of grave concern (Table 2.39).

Table 2.39: Millennium Development Goals (MDGs) and Himachal Pradesh's Position

Indicator	Year (Estimated Value)	MDG Target (Value)
Proportion of under-weight children below 3 years (percent)	20.7(2015-16)	26
Net Enrolment Ratio in Primary Grade (percent)	82.10(2015-16)	100
Literacy rate of 15-24 year olds	96.41(2011)	100
Ratio of girls to boys in primary education	0.91(2015-16)	1
Ratio of girls to boys in secondary education	0.86(2015-16)	1
Ratio of girls to boys in Tertiary education	0.90(2015-16)	1
Under five mortality rate (per 1000 live births)	33(2015)	42
Infant Mortality rate (per 1000 live births)	25(2016)	27

Sources: MDGs-Final Country Report of India

A set of seventeen Sustainable Departmental Goals(SDGs) have now taken over the MDGs. These 17 SDGs have been agreed upon to be met by the year 2030 as per the United Nations declaration signed by its member countries.

In the beginning of 2001, in association with UNDP, the Government of India has started analyzing State-wise HD scenario. The data collected from different sources indicated an alarming scenario that exists in several States. Many of the States are struggling on the economic front and hence are not in a position to revitalize their financial efforts towards augmentation of Human Development. But, Himachal Pradesh is an exception to it as it is doing well in comparison to many other States of the country.

2.9. C : Human Development Achievements of Himachal Pradesh: An Overview

In this context, Himachal Pradesh has made some remarkable Human Development achievements. Some of these are:

- During the period 1993-94 to 2011, Himachal Pradesh has recorded an enormous reduction in the rural poor as the poverty level dropped from 36.8 percent to 8.5 percent. The decline has been sure and steady.
- Among the northern Indian States, Himachal Pradesh has the lowest share of individuals with no education. In 2011, less than one-third of its rural population had no education, against two-fifths or half in the neighbouring States.
- The State also had the highest proportion of residents with post-secondary education across the northern States.

- Himachal Pradesh excels in health outcomes as well, ranking third after Kerala and Tamil Nadu in reducing infant mortality, child mortality and under-five mortality and second after Kerala in post-neonatal mortality.
- At 63 percent, Himachal Pradesh has the highest rural female work participation rate, with Tamil Nadu ranking second at 43 percent.
- It stands second in urban female work participation rate (28 percent) along with Tamil Nadu, with Kerala ranking first at 29 percent.
- The State has lower levels of exclusion – in that the land distribution among different castes is more equal than in other States.
- The State has also been declared Open Defecation Free, being one of the first Northern States to be declared so.

However, the State is not without its own set of issues:

- Malnutrition levels are relatively low compared to national average, but more than one-third of the State's children are underweight or stunted.
- The "Annual Status of Education Report-2013" of Himachal Pradesh shows that while learning outcomes are better than in most States, nearly 40 percent of children in classes VI-VIII cannot perform simple division.
- Urban poverty shot up between 2004-05 and 2009-10 before declining sharply again in 2011, when poverty levels were only slightly better than in 2004-05.

2.9.D : Dissecting Human Development at District Level of Himachal Pradesh through HDI

The Human Development Index (HDI) is a summary measure of key dimensions of Human Development. It measures the average achievements in a country/State on three basic dimensions of Human Development: a long and healthy life, access to knowledge and a decent standard of living. HDI is the simple average of the Income, Social, Education, Health and Environment Sustainability indices. Since Standard Deviation (SD) is also used as a ratio apart from the deviation from the simple mean for each of the data indicators, the measure lends suitable for comparison that reflect variability as well.

Within Himachal Pradesh, the status of Human Development is an important consideration. Based on the available data, the following are the parameters by which the HDI at the district level has been calculated.

The following variables considered important while estimating a disaggregated district level Human Development index.

- **GVAP-Population Ratio:** The affordability of each of the district is reflected through GDP–population ratio. The income strength is assessed at Current 2011-12 prices for 2017-18 and arranged accordingly.
- **Poverty-Ratio**: Percentage of population below the poverty line is one of the most important indicators of Human Development. This could also reveal the district level variations in the incidence of poverty.
- **Total Enrolment** (in schools) as proportion to population: This is an important indicator of education that determines employability of the population of the districts.

- **Health Indicator**: As per the availability of data, hospital-bed per lakh population and total medical institutions as a ratio of population at the district level has been considered to estimate the health index for the districts. In the health scenario, the supply side reflects the critical resource availability factor. It exhibits the position of each of the district of the State and their relative position in providing health facilities and services. However, admitted, there are limitations but as a first step, this indicator provides the larger picture.
- **Bio-mass Stock:** Bio mass stock as an environmental indicator has been taken into consideration. It has been estimated as a distribution ratio of total forest area of each of the district.

2.9.E : Methodology for Estimating District Level HD Index

The OECD Handbook on Constructing Composite Indicators [3] offers a robust framework for constructing the index for various sub-dimensions of the pillars mentioned above. The z-score method is used here[4]. The sub-dimension broadly reflects affordability, poverty level variations, attainment of education and quality indicators of environment standardized by the z-scores= $[(xi-\mu)/\sigma i]$, where xi is the value in concern for a particular district for the reference year, μ is the mean of the entire data set for the reference year and σ is the standard deviation. A value of 0 z-score indicates that the score is identical to the mean score and it may be positive or negative. A positive value indicates that the score is above the mean and a negative score below the mean.

Most composite indicators rely on equal weighting (EW), i.e., all variables are given the same weight. This implies that all variables are "worth" the same in the composite. If each sub-dimension has more than one indicator, the z-scores are averaged and then all dimensions are averaged to construct the index. We take a simple arithmetic average to compute HDI for each of the districts.

[3]OECD (2008). *Handbook on Construction Composite Indicators, Methodology and User Guide*.

[4] After delving on the various ways of constructing an index, the z-score method was found to be the most appropriate. No statistical tests were used for this. The main challenge of a Principal Component Analysis is that it cannot be used to compare over time; also we are only considering 12 districts. Minimum and maximum values were also considered but that posed problems because the challenge was to figure out the maximum and minimum values. However, the z-score method also has disadvantages. Because it is based on the mean, it gets affected by extreme values. However, the problem of the impact of extreme values has been reduced by deflating the index with the measures of dispersion.

Table 2.40: Human Development in Himachal Pradesh: A District Level Insight

	GDP Population ratio	**Poverty ratio**	**School enrolment as proportion to Population**	**Hospital-Medical Institutions**	**Bio-mass stock (Forest land)**	**HDI**	**Rank**
	Income Index	**Social Index**	**Education Index**	**Health Index**	**Environment Sustainability Index**		
Bilaspur	-0.49	-0.24	0.48	-0.47	-0.29	-0.20	9
Chamba	-0.59	2.47	-0.18	-0.29	0.07	0.29	3
Hamirpur	-0.57	-0.47	0.91	-0.59	-0.34	-0.21	10
Kangra	-0.71	-0.34	0.53	-0.42	1.35	0.08	4
Kinnaur	0.38	-0.39	-0.92	0.70	-1.43	-0.33	11
Kullu	-0.43	-0.83	0.02	-0.54	-0.07	-0.37	12
L&S	0.55	1.54	-2.73	2.79	-1.78	0.07	5
Mandi	-0.63	-0.50	0.07	-0.35	0.92	-0.10	6
Shimla	0.02	0.28	0.29	0.39	0.72	0.34	2
Sirmaur	0.04	-0.56	0.04	-0.55	0.47	-0.11	7
Solan	2.90	-0.18	0.98	-0.51	0.37	0.71	1
Una	-0.46	-0.78	0.50	-0.16	-0.02	-0.18	8

2.9. F : The Result:

The composite Human Development Index (HDI) which is an average of parameters affecting Human Development viz. income index, social index, education index, and health and environment sustainability index is presented in Table 2.40. From the ranking of the districts arranged in the descending order with highest to the lowest HDI, it is found that district Solan is the best performer in respect of HDI followed by Shimla, Chamba, and Kangra. The lowest HDI is reported in the Kullu district being at the 12^{th} place.

CHAPTER-III
ASSESSMENT OF GREEN GROWTH IN HIMACHAL PRADESH

3.1: INTRODUCTION

The necessity for environment-friendly sustainable economic growth is emerging due to the deepening global environmental crisis and depletion of natural resources. The Inter Governmental Panel on Climate Change (IPCC) reports raise an alarm that the global average temperature has increased by 0.6℃ over the last century leading to the biggest environmental crisis that the mankind encountered. Climate change triggers a variety of meteorological disasters that cause ecosystem disturbance. As a result, the concept of 'Green Growth' has emerged as one of the alternatives to curb the problem of greenhouse gases emission and environmental pollution.

In this backdrop, an attempt is being made to build 'Green Growth' vision, assess and correspondingly unlock Green Growth potential of Himachal Pradesh.

3.2: UNDERSTANDING GREEN GROWTH

According to the definition formulated by the OECD (2011), Green Growth is about fostering economic growth and development while ensuring that the quality and quantity of natural assets that provide the ecosystem services remain intact.

In an interview, of the then Hon'ble Minister for Environment, Forest and Climate Change, Shri. Prakash Javadekar said, "Green Growth is growing in a balanced manner by reducing emissions, reducing energy consumption and efficient energy usage". He also said that growth without destruction is feasible for which the nation is taking measures. (http://www.teriin.org/projects/green/)

UNEP (2010) defined a green economy as one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". Based on this definition, the OECD has also developed an underlying measurement framework for Green Growth.

Although, the past decade of rapid economic growth has brought many benefits to India, the environment has suffered, exposing the population to serious environmental degradation. According to the assessment done by the World Bank, the annual cost of environmental degradation in India amounts to about Rs. 3.75 trillion ($80 billion) equivalent to 5.7 percent of GDP. It focused on particle pollution **(PM10)** from the burning of fossil fuels, which has serious health consequences amounting to up to 3 percent of India's GDP along with losses due to lack of access to clean water supply, sanitation and hygiene and natural resource depletion.

Himachal Pradesh attained a remarkable growth record, transforming rapidly from one of the most backward States of India to one of the advanced States. The pace of such transformation has made Himachal Pradesh a leader in Hill Area Development. Responsive administration of the State has evolved ways and means to achieve development goals that are feasible and environment friendly. Still, the State is experiencing the impact of climate change that calls for serious attention.

This chapter attempts to assess the current status of 'Green Growth' in the State of Himachal Pradesh.

3.3: ASSESSMENT OF CURRENT GREEN GROWTH SCENARIO IN HIMACHAL PRADESH

3.3. A: Green Growth Assessment Framework

Assessing the current State of development in different sectors (related to environment) of Himachal Pradesh is the starting point in a Green Growth assessment process. This is being done looking into the State's past growth trends, as well as its current policies and practices. Unless conscious changes are made, past and current growth trends are bound to substantially affect the future of the State. The growth trends will be outlined by looking at the socio-economic information and environmental data and of course, the current State of the relevant sectors of the State.

Figure: 3.1: The Green growth Assessment Framework Approach

3.4: ASSESSMENT OF THE GROWTH OF DIFFERENT SECTORS

The agriculture, industry and transport account data source for the major part of the State's total energy consumption and contribute over 70 percent of green house gas (GHG) emissions. Therefore, it is important to analyze the growth trends of these sectors.

3.4. A: Agriculture

Agriculture is the main occupation of the people of Himachal Pradesh and has an important place in the State's economy. Himachal Pradesh is the State which has 89.97 percent of its population residing in the rural areas. Therefore, dependency on agriculture/horticulture is prominent, as it provides direct employment to about 70 percent of the total working population. Engaging two-thirds of the workforce and contributing to about one-seventh of the Net State Domestic Product. Almost two-thirds of the cultivators take out their living from land holding of less than one hectare each. The stark reality is that an agricultural worker earns just one-third of what the workers in other sectors earn. The economic well-being of a vast majority of the population in the State depends on the intensification and diversification of

agriculture. A shift of the agricultural workforce from farm to non-farm employment is essential for reducing the pressure on agricultural land.

Rice, wheat and maize are important cereal crops, while potato, ginger off-season vegetables and pulses are important cash crops. During the last 65 years, the major achievements of the agriculture sector were as under;

- Food grains production increased from 200 thousand MT in 1951-1952 to 1745.01 thousand MT in the Year 2017-2018.
- Maize is the major crop of the State. The production of Maize, which was 67.3 thousand MT in 1951-1952, has gone up to 644.44 thousand MT in the year 2017-2018.
- Production of rice has gone up from 28.3 thousand MT in 1951-1952 to 117.80 thousand MT in 2017-2018.
- The production of wheat has increased to 670.00 thousand in 2017-2018 against 61.2 thousand MT during 1951-1952.
- Impressive increase has been recorded in vegetable production which was nearby 25 thousand tones during 1951-52 and has touched the level of 1691.56 thousand tones during 2017-18.

Mandi district and to some extent Paonta valley of Sirmaur district are the major producers of wheat, maize and rice, while barley is mostly grown in Shimla district. Although the State is deficit in foodgrains, it has gained tremendous success in other items of agricultural production such as seed-potato, ginger, vegetables, vegetable seeds, mushrooms, chicory seeds, hops, olives and fig which are of good quality and are a good source of income to the farmers.

Fruit cultivation has seen a rise in the State and proved to be economically advantageous to the farmers. It does not erode the soil, and has much more potential to generate employment, than conventional farming. Apple cultivation generate maximum amount of income.
The Government is making efforts to promote cultivation of apples as well as new crops like olives, figs, mushrooms, flowers, pistachio nuts and saffron, for generating income and employment.

Himachal Pradesh has rightly been named as the ‘Apple State of India’; however, apple production has lately been hit due to shifting of apple belts to higher altitudes, as a result of climate change. As a measure towards adaptation, the Horticulture department is now motivating fruits growers to replace apple with pomegranate, which is suitable for the changing climate of the lower regions. As a result, the fruit growers in Kullu, Mandi and Kinnaur districts are moving up to higher altitudes for apple cultivation, many of whom have been booked for illegal encroachment on forest land.

In its effort to promote the pomegranate, the Horticulture department is organizing training camps for pomegranate cultivation and offering grants on the basis of the area. This fruit is proving to be beneficial as it is fetching double the price of apple, in the local markets. The economy of Himachal Pradesh is undergoing a structural change with a decline in the share of agriculture and increase in the share of industries and services in the total GSDP of the State. The contribution of agriculture and allied activities in Gross State Domestic Product declined from 26.86 percent in 1990-91 to 8.84 percent in 2017-18.

The net cultivated area has also declined from 11.9 percent in 1972-73 to a little over 10 percent in 2017-18. This could be owing to the inconsistent and erratic climatic conditions because of which a large number of farmers have shifted to non-agricultural activities, leaving their lands uncultivated and

degraded over time. Another possible factor for decline in net cultivated area could be family decisions which render cultivation economically unviable as a holding smaller then a threshold size.

Water is a vital component of agriculture. However, only about 18-20 percent cultivated area of the State is irrigated and rest is rain fed. Out of the total geographical area of 55.67 lakh hectares, the net area sown is only 5.83 lakh hectares, out of which irrigation schemes have been created for 2.64 lakh hectares land. Low utilization rate due to lack of command area development activities is a matter of concern that require attention of the Government. The gross irrigation potential of the State is estimated to be 3.35 lakh hectares. Irregular rainfall and the lack of water sources have resulted in low agricultural productivity and crop failures. The State needs to identify crops that adapt to climate change and educate the farmers on pest control and management; organic farming, bio-pesticides and soil conservation methods.

The scope for organic farming is immense, as the use of fertilizers and pesticides is relatively low in the State. The State Government has touched a massive programme to adopt natural and organic farming with an objective to reduce dependence on fertilizers, pesticides and other chemicals. This programme, if implemented successfully, will contribute to reduction in soil and water pollution. Since fruits and vegetables are highly perishable, a chain of cold storages, which can preserve the freshness of fruits for long period of time, is required must for Himachal Pradesh. Equally essential is the promotion of contract farming and marketing cooperatives. The promotion of contract farming and marketing cooperatives is equally essential in Himachal Pradesh.

3.4. B: Industry

Himachal Pradesh has made significant achievements in the field of industrialization in the last few years. In the year 2019, 52,466 units were registered in the State, comprising 737 medium and large-scale industries and 51,729 small industries; with a total investment of around INR 466.59 thousand crore.

A notable feature of industrialization in the State is the virtual concentration of large and medium scale units. About 95 percent of the industries in the State are located in the districts bordering the State of Punjab and Haryana. Similarly, about 60 percent of the small scale units are in the inner districts of Himachal Pradesh. Just two districts, Solan and Sirmaur account for almost 90 percent of the large and medium scale units of the State. Industries in the periphery of these districts have come up as a result of special incentives announced by the State Government from time to time. Their proximity to Chandigarh provided an added advantage. The disturbed political situation in Punjab during the eighties may also have favoured Himachal Pradesh in attracting some of the industries towards it.

Minerals constitute a fundamental component of the State's economic base. Good quality limestone, which is one of the basic ingredients in cement manufacturing, is available in plenty in the State.

The Government of Himachal Pradesh has taken several initiatives to facilitate investment in the industrial sector. In an effort to provide infrastructure support to entrepreneurs, the Himachal Pradesh Government has developed 41 industrial areas and 17 industrial estates. Three more State of the Art Industrial Areas are coming up. Solan, Sirmour, Kangra and Una districts lead in terms of attracting investments.

The electronic industry with support from the Government has led to setting up of TV sets, electronic toys and computer parts manufacturing industries. Furniture-making, rope-making, bamboo products and specialized wood-based industrial units have also come up in the State.

Tea is traditionally grown in Kangra and Mandi districts at an altitude of 1000 to 1500 metres. With a view to encourage this industry, subsidy is being provided to growers besides facilities like chemical analysis and setting up of cooperative tea processing factories.

The impact of the new industrial package announced by the central Government for the State in January 2003 had been encouraging. During the initial nine months, from January to October 2003, 138 large and medium scale industrial units with an investment exceeding Rs. 2000 crore, and 500 small scale industrial units with an investment of around Rs. 300 crore got themselves provisionally registered with the State's Department of Industries. This promised a bright future for industry in the State.
Himachal Pradesh had however to face many difficulties in the advancement of its industrial sector. The lack of adequate and viable means of transport was one of the main drawbacks. Some other factors were the poor mineral resources of the State, non-availability of other infrastructural facilities, shortage of equipment and absence of technical skills.

Himachal Pradesh has a rich heritage of handicrafts consisting of woolen and pashmina shawls, carpets, silver and metal ware, Kangra and Gompa style paintings, wood work, wooden and metal utensils etc. However, these aesthetic crafts declined under steep competition from machine-made goods and also owing to lack of marketing facilities. The demand for these products is now gradually picking up both within and outside the country. Recently, the State Government has undertaken several steps to attract more investment into the State. Simplification of procedures, creation of new and up-gradation of existing infrastructure, provision of exemptions, incentive and concessions to existing and new industrial units and improving ease of doing business are the main features of its new Industrial Policy.

3.4. C: Energy

Consumers in India are highly dependent on fossil fuels, such as coal, wood and kerosene for fulfilling their energy requirement. Most of the crude oil consumed is imported, making it necessary for us to look for alternative energy sources for future. As per the International Energy Agency, India had more than 300 million people without electricity and more than 800 million people dependent on solid bio fuel for cooking, in the year 2012. According to Census 2011, 43 percent of the rural households used kerosene as a primary source of energy for lighting. The high use of non-renewable energy sources is a grave challenge that the Government is facing today. This situation has changed especially after the success of an ongoing programme to provide LPG connections and Stoves to all the households of the country.
It is the 'Power Sector' which is the most lucrative for the State's economic development. Himachal Pradesh State Electricity Board Ltd., which looks after generation, transmission and distribution of power, employs around 31 thousand persons. It serves around 1.5 million consumers, of which 86.8 percent are domestic, 10.6 percent commercial, 2 percent industrial and the remaining 0.4 percent agricultural and others. Household coverage in providing electricity is the highest among all States. In terms of consumption, half the power goes to industry, nearly one-third for domestic use, 1 percent for agriculture and the rest for other uses.

Electricity tariffs in the State are the lowest in the country. Despite the low cost of power generation, its actual cost is high primarily due to excessive cost of distribution. Against a per unit revenue of Rs. 2.33, the expenditure is Rs.2.70, representing a loss of Rs.0.37 on every unit distributed. The solution lies in immediate implementation of the Central Electricity Act. 2003.

The effective way could be through reducing the manpower cost rather than manpower itself. In other words, manpower efficiency is to be raised through additional power generation with the same number of

employees and rationalization of the distribution system. Voluntary Retirement Scheme can be promoted, and those opting for VRS can be invited to work with the Panchayati Raj institutions and urban local bodies for the distribution of power and maintenance of services.

Table 3.1A: Power Generation and Consumption in Himachal Pradesh

Year	Installed Capacity in H.P.HPSEB (MW)	Total Generation in the State (MU)	Total Consumption in the State (MU)Total
2005-2006	329.10	1332.4	3568.7
2006-2007	467.10	1432.4	4300.4
2007-2008	467.10	1846.9	5028.7
2008-2009	467.10	2075.1	5460.5
2009-2010	467.10	1804.1	5814.3
2010-2011	467.10	2045.3	6440.2
2011-2012	471.45	2019.95	6828.7
2012-2013	471.45	1800.19	7357.8
2013-2014	477.45	1947.36	7554.4
2014-2015	487.45	2096.823	7624.9
2015-2016	487.45	1573.103	7951.81
2016-2017	487.45	1595.917	7959.65
2017-2018	487.45	1941.321	8404.56

Source: Statistical Abstract of E&S Department, Himachal Pradesh, 2017-18

It is clear from Table 3.1A, that power generation in Himachal Pradesh has seen a rise from 1332.4 MU in 2005-06 to 2096 MW in 2014-15, but there was its fall in the years 2015-16 and 2016-17. However, in the 2017-18, it rose to 1941.321 MW. But it consumed 8404.56 MU power (2017-18) as it is not self sufficient in electricity production. It purchases power either from the Center or from other States. The State has a vast hydropower potential of 27,436 MW, out of which a potential of about 24,000 MW is harnessable in its five river basins namely Satluj, Beas, Ravi, Chenab and Yamuna. The State is leaving no stone unturned to achieve this potential. However, in doing so, it runs into the risk of being faced with impending calamities that stem from the over-exploitation of land, for the construction of multiple small hydro power projects. The State is not ready to calamities, and has faced nature's fury in the form of landslides and floods in recent times. To make matters worse, Himachal Pradesh falls in Seismic Zones 4 and 5 - a region classified as vulnerable to high-intensity quakes.

The Government has been in favour of constructing large-scale dams, which has been faced with steady opposition from the local inhabitants and social activists. In March 2015, a massive landslide triggered by heavy rains damaged the Saal Hydropower Project in Chamba district. The landslide caused the entire hill to break away, leading to more than 80 percent damage. Similar calamities have occurred in other parts of the State, damaging livelihoods, cattles and houses of thousands of people.

Solar energy too has great potential in the State, and the Government of Himachal Pradesh is targeting 250 MW Solar Power installations from 2017 to 2022.

3.4. D: Transport

The transport sector was accorded the top priority right from the First Five Year Plan of Himachal Pradesh. It can be compared with the 'Power Sector' which is presently receiving the highest attention. The State has about 34,922 km. of motorable roads. Over 90 percent of these are the State highways and the remaining central roads, including national highways and border roads. The road density is about 50 kms. per 100 km^2 of area.

In the absence of any other suitable and viable modes of transportation like railways and waterways, roadways play a vital role in boosting the economy of the hilly State like Himachal Pradesh. The passenger transport services to the people of Himachal Pradesh, within and outside the State are being provided by Himachal Pradesh Road Transport Corporation, with a fleet strength of 2,748 buses as of 2015.

The State has a total of 10,77,404 vehicles as per data gathered in 2015, out of which 5,673 are buses, 34,796 are Taxis/ Maxis Cabs, 9,236 are three wheelers, 16,565 are other transport vehicles, 22,309 are Tractor (Commercial) and 1,64,773 are goods vehicles.

3.5 ASSESSMENT OF THE ENVIRONMENTAL STATUS IN HIMACHAL PRADESH

3.5.1: Air Quality

Air is one of the five elements facilitating life on earth, in the absence of which no life would survive. Good quality of air is essential to balance all life forms, whether it is humans, vegetation, soil or wildlife.

Ambient air quality in the State is being monitored in terms of the SO_2 (Sulphur Dioxide), NO_x (Nitrogen Oxide), SPM (Suspended Particulate Matter) and RSPM (Respirable Suspended Particulate Matter) by the SPCB under the project National Air Monitoring Programme (NAMP). It is being monitored at Shimla, Parwanoo, Jassur, Paonta Sahib, Kala Amb, Baddi, Nalagarh, Sunder Nagar, Manali, Una and Dharamshala under the National Ambient Air Quality Monitoring Programme. Air quality standards fixed for 24 hour average is 100 ug/m^3 for SO_2 and NO_2 and annual average standard is 60 ug/m^3 for RSPM, 50 ug/m^3 for SO_2 and 40 ug/m^3 for NO_2.

The data collected of all the stations for the year 2015-16 scrutinized for the annual average and peak values for 22 locations and trends of annual average of SO_2, NO_2 and RSPM are shown below:

Table 3.1. B: Annual Average of SO_2 and NOx of all the NAMP Stations for the Year 2015-16

Stations	SO_2 Annual Average	NO_x Annual Average	RSPM Annual Average
Shimla I	2.0	11.0	41.2
Shimla II	2.0	16.0	68.3
Parwanoo I	2.0	11.3	57.8
Parwanoo II	2.0	11.1	67.2
DIC Baddi	2.0	29.8	154.4
AHC Barotiwala	2.0	18.1	108.3
H B Baddi	2.0	19.2	103.3
M C Nalagarh	2.0	22.4	104.1
Damtal I	2.0	12.4	77.0
Damtal II	2.0	15.4	106.5
Paonta Sahib	2.7	13.4	90.7
Gondpur	3.2	14.6	160.1
Kala Amb	3.5	13.6	139.4
Trilokpur	2.7	13.2	78.5
RO Una	2.0	5.5	77.6
DIC Mehatpur	2.0	6.2	83.3
SNR-I	2.1	9.4	77.7
SNR-II	2.1	14.6	94.8
Manali-I	2.1	13.5	54.9
Manali-II	2.0	5.7	38.9
Kotwali Bazar, Dharamshala	2.0	9.2	32.3
HPSPCB, Residential Building, Daari, Dharamshala	2.0	7.0	40.9

Source: Annual Report 2015-16, Himachal Pradesh State Pollution Control Board

Annual average values of SO_2 and NO_x at all the NAMP stations were observed well below the permissible limit for the annual average. The peak value of SO_2 was observed as high as 15.0 ug/m^3 at Bus stand Shimla NAMP station and peak value of NO_x was observed at 111.0 ug/m^3 at Sector IV, Parwanoo NAMP station.

The annual average values of RSPM of NAMP stations at Takka Bench Shimla, Sector IV Parwanoo, Manali and Dharamshala were observed well below the permissible limits for the annual average. While for the other stations at Bus Stand Shimla, Sector-I Parwanoo, DIC Baddi, AHC Barotiwala, MC Nalagarh, H.B. Baddi, Damtal-I, Damtal-II, Paonta Sahib, Gondpur, Kala Amb, Trilokpur, Una, Mehatpur, both the stations at Sunder Nagar were observed above the permissible limit for the annual average.

At the NAMP stations at Takka Bench Shimla, Station-II Parwanoo, Station-II Damtal, Paonta Sahib, Kala Amb, Trilokpur and Station-I Sunder Nagar in comparison to previous year's data, decrease in the

level of RSPM has been observed, however at NAMP stations; Bus Stand Shimla, Station-I Parwanoo, DIC Baddi, AHC Barotiwala, MC Nalagarh, HB Baddi, Station-I Damtal, Gondpur, Station-II Sunder Nagar, Station-I and Station-II Manali, RO Una, DIC Mehatpur and Station-I, Dharamshala, there is an increase in the level of RSPM in comparison to previous year's data.

It may be noted that despite the increasing vehicular traffic in the hills, the air is relatively clean in key hill stations of the State. However, the rapidly growing industries have increased the pollution level in the main industrial towns of the State.

In its annual report 2012-13, HPSPCB revealed that emission of Sulphur Dioxide (SO_2) and nitrogen oxide were high in the industrial towns, including Baddi and Nalagarh. The SO_2 emission was recorded as high as 20.8 uh/m^3at Baddi and nitrogen oxide was observed at 108.8 ug/m^3. According to the report, the ambient air quality in Shimla and other towns was below the permissible limits.

Residential: A considerable amount of air pollution results from burning of fossil fuels. Fuels consist mainly of carbon and its compounds with the household sector forming the largest group of consumers. Most of the household depend on traditional source of energy like fuelwood, dung and crop residue for cooking and heating. Burning of traditional fuel produces large quantities of CO_2 on complete combustion, but in case of incomplete combustion and oxidation, Carbon Monoxide is produced, in addition to hydrocarbons.

Industries: Industrial emissions are a major cause of concern to the State. These emissions can either be solid particles or gaseous emissions, containing toxic pollutants.

Pic:3.1 Status of Industrial Pollution in Himachal Pradesh

Transport: Vehicles are another major source of air pollution, causing much concern. The number of vehicles in the State has seen a sharp rise from 2.4 lakh in 2001 to 7.3 lakh in 2012, with two-wheelers and cars forming majority of the vehicles. They emit harmful pollutants such as Carbon Monoxide, Hydrocarbons, Nitrogen Oxides, Sulphur dioxide and other toxic substances like TSP and lead. Vehicular pollution is even more serious in Himachal Pradesh owing to certain factors:

- Poor quality vehicles producing more particulate matter as a result of partial combustion of fuel.
- Low quality fuels used produce greater amount of pollutants
- Concentration of motor vehicles in a few large cities

The high concentration of atmospheric particles over widespread urban and industrial areas can have dangerous effects on the biosphere and general surroundings. The presence of harmful pollutants in the soil can affect the plants, cattle and livestock by way of low yield of milk, sickness and poor agricultural produce. It has also been known to cause severe health damage to people, since it contains potentially carcinogenic substances similar to those that occur in cigarette smoke, causing respiratory problems, lung infection, Bronchitis, heart problems etc.

Construction: Construction activities like road, bridge, building etc. should be carried out in a planned manner and debris should be managed properly. Non-polluting technologies must be adopted by the Government, such as Vertical Shaft Brick Kiln (VSBK) for brick production. This technique is beneficial as it consumes less fuel, low Suspended Particulate Matter (SPM) emissions, can be operated throughout the year under any weather conditions owing to its protected roof and uses minimal land, thereby improving the ratio of land used to the production output resulting in better quality bricks.

3.5.1. A: Carbon Emissions in Himachal Pradesh:[5]

Himachal Pradesh is one of the few States in the country to have conducted State level inventory of Green House Gases. The first report was released in 2012 using 2008-09 activity data. The salient features of the second report prepared using year 2012-13 activity data is presented in Table 3.2.

- The net Green House Gas (GHG) emissions from Himachal Pradesh that is emissions with LULUCF, for activity data base for year 2012-13 were 9.197 million tons of CO_2 equivalents (eq) in comparison of 10.083 million tons in 2008-09. During the year 2012;
  - ✓ CO_2 emissions were 8.73 million tons;
  - ✓ CH_4 emissions were 0.134 million tons; and
  - ✓ N_2O emissions were 0.0070 million tons

Table 3.2: Green House inventory of Himachal Pradesh

	Annual CO2 emission (eq) (in thousands of metric tons) Giga Gram	**percentage of Global Total**
India	1727706.10 (2007 Level)	< 5 percent of Global
Himachal Pradesh	**9196.4748*** ~0.00134 per capita 000' tones* (2012 Level)	~0.53 percent of India*
*** Without taking into consideration emission/ removals due to hydro power generation 7957.29 MW contributed to grid as clean energy. ~ (-) 17094.74000'tonnes CO2 wq @ ~ 45Z percent operational capacity.**		

Source: Environment Report 2012-13, Govt. of Himachal Pradesh

[5] http://desthp.nic.in/publications/ghg2014_A1b.pdf

3.5.1.B Sector-wise Green House Gas Emissions (GHG) in Himachal Pradesh:

Table 3.3: Green House Gas Emissions in Himachal Pradesh (in Million Tons)

Analysed source of Emission		GHGs at National (2007, INCCA Report)	GHGs Himachal Pradesh estimates (2012)	GHGs In percent (Calculated)
ENERGY	**Electricity Generation (other than Hydro)**	719.3	0.244	2.24
	Industrial, Commercial, other energy	100.87	2.757	25.34
	Transportation	142.04	0.716	6.58
	Residential	137.84	1.405	12.91
Industries	**Cement**	129.92	5.311	48.81
	Iron and Steel	117.32	0.167	1.53
	Other Industries	165.31	0.034	0.31
Agriculture		334.41	0.248	2.28
Waste		57.73	0.00003	0.00
Total without LULUCF		1904.73	10.882	100.00
LULUCF		(-)177.03	(-)1.685	
Total with LULUCF		1727.71	9.197	

Source: Environment Report 2012-13, Govt. of Himachal Pradesh

- In Himachal Pradesh, as per 2012 data, GHG (CO_2 eq) emissions from Energy, Industry, and Agriculture sectors constituted 47.07 percent, 50.65 percent, and 2.28 percent respectively. The contribution of Waste sector is marginal**.**
- Energy sector emitted 5.15 million tons of CO_2 eq, of which 2.756 million tons of CO_2 eq were emitted from electricity consumption in Industrial, Commercial and Institutional sectors and 1.405 million tons of CO_2 eq were emitted from energy consumption in Residential sector.
- Industry sector emitted 5.57 million tons of CO_2 eq.
- LULUCF sector was a net sink. It sequestrated 1.68 million tons of CO_2 eq.
- Himachal Pradesh per capita CO_2 eq emissions including LULUCF showed a decreasing trend and were 1.341 tons/ capita in 2012 that of 1.47 tons/ capita levels in 2008-09.

3.5.2: Water Quality

Water is one of the most important natural resources of Himachal Pradesh. The State is endowed with large volume of water from the catchment areas of Satluj, Beas, Ravi and Chenab rivers. The State has huge reserves of potential water resources in the form of glaciers, surface water resources, rivers and lakes.

Provision of water has been the priority of the State Government with 45,367 habitations covered under safe drinking water facility, as per the updated survey. As per the National Sample Survey 2012, 100 percent urban households in the State have access to improved sources of drinking water, whereas 95.8

percent rural households have access to improved sources. The State has made steady progress, and is working towards providing clean water to all the rural households (Table 3.4).

Table 3.4: Percentage of Households with access to Improved Sources of Drinking Water

Year	Rural	Urban
1991	75.5	91.9
2001	87.5	97.0
2008-09	89.2	91.6
2011	93.5	97.8
2012	95.8	100

Source: NSS 2008-09, 2012

The overall proportion of households having access to improved water sources has seen a rise from 75.5 percent in 1991 to 95.8 percent in 2012 in the rural sector and from 91.9 percent in 1991 to 100 percent in the urban sector. It is clear that the disparity between the rural and urban sector was 16.4 percent in 1991, which came down to 4.2 percent in 2012.

In Himachal Pradesh, the availability of water is highly uneven and some parts have become water stressed, which may rise considerably due to a combination of climate change causing the escalation of water crisis and incidences of water related disasters, i.e. floods, erosion and increased droughts etc.

Growing pollution of water sources, especially through industrial effluents, is affecting the availability of safe water besides causing environmental and health hazards. In parts of the State, some stretches of rivers are heavily polluted and devoid of flows to support aquatic ecology. Inadequate sanitation and lack of sewage treatment are also adding to the pollution.

3.5.3: Solid Waste and its Management

Efficient garbage collection, transportation and disposal are among the vital functions of Urban Local Bodies. Despite the fact that a large number of staff is employed by them to discharge this function and a substantial portion of their annual budget is spent only on garbage collection, transportation and disposal, the situation in the towns and cities remains far from satisfactory. There is no standard system of waste collection in the urban local bodies all over Himachal Pradesh. Some urban local bodies in recent years started household level collection of waste, although in the un-segregated form.

Door-to-door collection of waste is being done in only some of the districts, and in varying degrees. This type of collection is crucial in order to ensure that the residents do not casually dump or burn their waste which is hazardous to the environment as well as the collection of maximum amount of waste for further processing. Casual dumping of waste in the open worsens the pollution level in the long run, and ruins the landscape of the State, which is a popular tourist destination. Segregation at source is a neglected practice in the State. Although it is a new phenomenon, it is beneficial in providing a more holistic solution to waste management.

Table 3.5: Municipal Solid Waste

Component	Quantity 2008-09	Quantity 2012
Urban Population	688704	710328
Waste generation rate (kg/capita/day)	0.35	0.35
MSW generated (tons)/day/capita	241.05	248.615
Quantity of waste reaching the landfill site (tons)	140.09	149.169
Dom diposed (tons)	4.512	4.778
Dom accumulated (tons)	14.2	15.0368
Dom decomposed (tons)	2.4	2.5414
Estimated Methane (CH4) emitted (tones)	2.714	2.87393

Source: Himachal Pradesh Economics & Statistic Department, ULBs

According to Table 3.5, although the urban population has increased from 6,88,704 in 2008-09 to 7,10,328 in 2012, the waste generation rate has remained constant at 0.35 (Kg/per capita/day). The MSW generated per day has increased from 241.05 tons per day in 2008-09 to 248.61 tons per day in 2012. The quantity of waste reaching the landfill site has also seen a rise from 140.09 tons per day in 2008-09 to 149.16 tons per day in 2012. The domestic waste disposed has increased from 4.512 tons per day 2008-09 to 4.778 tons per day in 2012. Similarly the domestic waste decomposed saw an increase from 2.4 tons per day in 2008-09 to 2.54 tons per day in 2012.

Table 3.6: Waste Water Generated in Major Industries in Himachal Pradesh

Sector	Waste water generated (in KLD)	
	2008-09	**2011-12**
Industrial	49144.97	52034.46
Domestic	4476.98	4813.56

Source: ULBs and Industry Dept. H.P.

It can be observed in Table 3.6 that the waste water generated from the industrial sector increased from 49144.97 KLD in 2008-09 to 52034.46 KLD in 2011-12. Similarly, the water generated from the domestic sector too saw an increase from 4476.98 in 2008-09 to 4813.56 KLD in 2011-12.

Table 3.7: Door-to-Door Garbage Collection in Himachal Pradesh

Door-to-door garbage collection		
Cities	**Door-to-door**	**Segregation at source**
Chamba	9 percent	-
Mehetpur	10 percent	-
Theog	14 percent	-
Solan	20 percent	-
Baddi	20 percent	-
Paonta	20 percent	-
Nahan	20 percent	-
Dharamshala	27 percent	27 percent
Una	30 percent	-
Mandi	38 percent	-
Hamirpur	45 percent	-
Parwanoo	55 percent	-
Shimla	90 percent	-
Manali	100 percent	-

Source: ULBs and Industry Dept. H.P.

It is clear from Table 3.7 that 6 cities (**Palampur, Jogindernagar, Kullu, Ghumarwin, Talai and Bilaspur**) do not have door-to-door garbage collection facility, reflecting a poor civic condition and management. Of all the cities, only Manali has 100 percent door-to-door garbage collection.

3.5.4: Forest Land

Forests of Himachal Pradesh known for their magnificence and beauty, comprising of 4.8 percent of India's forest cover. In order to safeguard this life supporting system from the impact of modern civilization, economic development and increasing human and cattle population, the State Government has taken various initiatives for further expansion of the green cover in the State.

As per the Indian State of Forest Report, 2015 released by Indian Institute of Forest Surveys, Dehradun, an increase of 13 square (sq.) kms. of forest land has been recorded in the forest cover of the State which was due to the concerted efforts of the State Government along with public participation in conservation and management of forest wealth.

Intensive forestry works had been started under Green India Mission in Mandi, Bilaspur, Hamirpur and Kangra districts while National Bamboo Mission was launched for development of suitable species of bamboo for Nahan, Bilaspur, Mandi, Hamirpur and Kangra districts. With the assistance of National Medicinal Plant Board, five projects were successfully implemented for development of medicinal plant forests at a cost of Rs. 24 crore in Kangra, Una, Chamba, Kullu, Sirmaur, Lahaul & Spiti and Kinnaur districts.

Table 3.8: Forest as per crown density (In Sq. Kms.)

Year of Survey	Dense Forests (Crown density > 40 percent) (in sq. kms.)	Open Forests (Crown density 10 percent - < 40 percent) (in sq. kms.)	Total Forest Cover (in sq. kms.)	Total Forest Area (in sq. kms.)
1991	8911	2869	11780	37591
1993	9565	2937	12502	35407
1995	9565	2936	12501	35518
1997	9560	2961	12521	36986
1999	9120	3962	13082	37033
2001	10429	3931	14360	37033
2003	8976	5377	14353	37033
2005	9610	5056	14666	37033
2009	9607	5061	14668	37033
2011	9605	5074	14679	37033

Source: H.P. Forest Statistics 2013

It can be observed from Table 3.8 that dense forests have declined from 10,429 sq. kms. in 2001 to 9,605 sq. kms. in 2011. Open forests, on the other hand, have seen an increase from 3,931 sq. kms. in 2001 to 5,074 sq. kms. in 2011.

The total forest cover shows an increasing trend from 14,360 sq. kms. in 2001 to 14,679 sq. kms. in 2011. The total forest area saw a decline from 37,591 sq. kms. in 1991 to 37,033 sq. kms. in 2001, which has since remained constant.

Table 3.9: District-wise Forest Area (sq. kms.) and Population (2011-12)

Name of District	Geographical area by Professional Survey (km^2)	Legal Forest Area (km^2)	Percent of Forest Area to Geographical Area in the District	Percent of Total Forest Area of the State	Population As per 2011 Census
Bilaspur	1167	428	36.7	1.1	381956
Chamba	6528	5030	77.1	13.6	519080
Hamirpur	1118	219	19.6	0.6	454768
Kangra	5739	2842	49.5	7.7	1510075
Kinnaur	6401	5093	79.6	13.8	84121
Kullu	5503	4952	89.9	13.4	437903
L&S	13835	10133	73.2	27.4	31564
Mandi	3950	1860	47.1	5	999777
Shimla	5131	3418	66.6	9.2	814010
Sirmour	2825	1843	65.2	5	529855
Solan	1936	728	37.6	1.9	580320
Una	1540	487	31.6	1.3	521173
Total	55673	37033	66.5	-	6864602

Source: H.P. Forest Statistics 2013

As can be seen from Table 3.9, the total geographical area of Himachal Pradesh is 55,673 sq. kms. Total legal forest area amounts to 37,033 sq. kms. The total percentage of forest area to geographical area in Himachal Pradesh is 66.5 percent. The total forest cover of the State has shown an increase, owing to the various measures taken by the State Government to expand the green cover.

The Table 3.10 depicts that the forest revenue for Himachal Pradesh shows an increasing trend from Rs. 2,898 lakh in 2001-02 to Rs. 10,654 lakh in 2011-12. This increase in the revenue could be owing to greater sales of forest produce. Similarly, the forest expenditure for the State has also seen a rise from Rs. 21,952 lakh in 2001-02 to Rs. 37,707 lakh in 2011-12. This increase could be due to the plantation drives and various schemes that the State Government has undertaken in order to increase the green cover and facilitate sustainable development in the State.

Table 3.10: Forest Revenue and Expenditure (1991-92 to 2011-12)

Year	Revenue (Rs. in lac)	Total expenditure (Rs. in lac)	Net surplus over Non-plan expenditure
1990-91	1451	5569	(-)510.34
2000-01	1654	22515	(-)11642
2001-02	2898	21952	(-)10038
2005-06	14963	19283	5679
2010-11	6544	36742	(-)16367
2011-12	10654	37707	(-)13181

Source: Annual Administration Reports forest Deptt. H.P.

3.6 LINKAGES BETWEEN HUMAN DEVELOPMENT & CLIMATE CHANGE IN HIMACHAL PRADESH

There is a dual relationship between Human Development and climate change. On the one hand, developmental activities for human well-being influence both the GHG emissions that are causing climate change and the vulnerability; while on the other hand, climate change influences human living conditions by causing disturbance in the natural habitat and thereby affects Human Development.

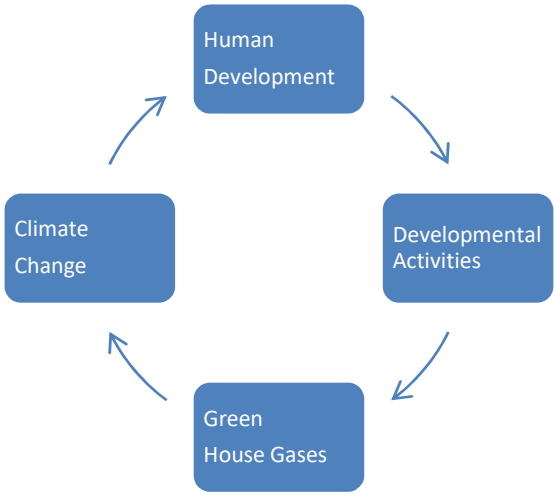


Table 3.11: Impacts of Development Activities on Environment

Development Activities	Major Impacts on environment
1.Forest clearing and Land resettlements	• Extinction of rare species of flora and fauna, creation of condition for mosquito breeding, causing spread of vector borne diseases such as malaria, dengue etc.
2.Shifting cultivation in upland agriculture	• Soil erosion in upland areas and soil fertility declines due to shorter cultivation cycle are two main problems faced by the agriculture industry today. Due to population pressure and flooding of low land areas, more land is required for cultivation. This problem could be resolved by terrace cultivation.
3.Agro industries	• Air pollution caused by burning of biogas as fuel in sugar mills, large amount of highly organic wastes polluting surface water.
4.Introduction of new Varieties of cereals	• Reduces genetic diversity from traditional species leading to instability in the local ecosystem. This results in multiplication of strains of fungus, bacteria and virus on the new variety causing their degradation.
5.Use of pesticides	The pesticides used in agriculture sometimes go into food chain or in water bodies which affects our health as well as health of the soil.
6.Timber extraction	• It degrades land, destroys surface soil, and reduces the growth of forests.
7.Urbanisation and industrialization	• Growth of population in urban areas puts huge pressure on agriculture as well as industry sector. Agriculture puts pressure on the land and water where as industrialization leads to land, air and water pollution.
8.Water resource Projects, e.g .Dam, Extensive irrigation	• The water resource projects affect the local climate of the water resource area after reservoir construction; it affects the typical wetlands and natural reserves; and also affects the water environment below the dam sites.

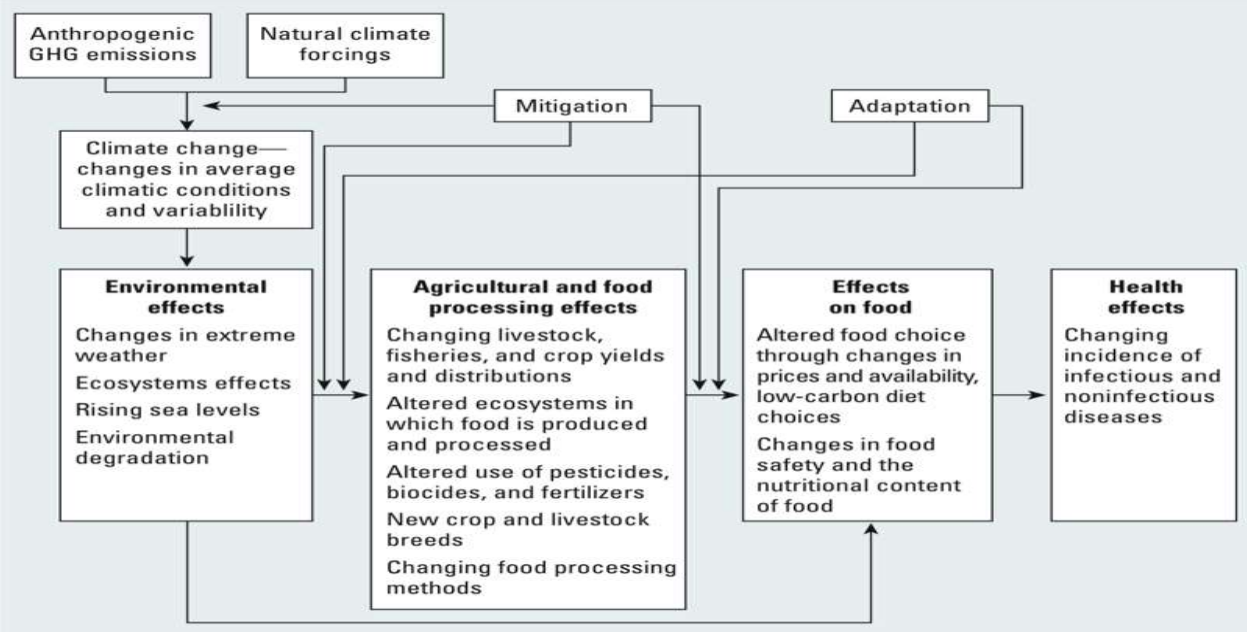
Source: Environment Statistics Division, Ministry of Statistics & Programme

Impact of Climate Change on Development:

Climate change poses a serious threat to sustainable development and will jeopardize achievement of the Sustainable Development Goals (SDGs). It affects all aspects of the development agenda, from poverty eradication to health care, and from economic growth to disaster risk reduction.

It affects agriculture, food security and water management in rural areas, which indicates that the impact would be the highest on the poorer regions and sections. The poorest and most vulnerable people globally are likely to be most affected, unless significant efforts are made to create models of development that can mitigate and adapt to the impacts of climate change. The most important actions for mitigating climate change will be increasing the use of renewable energy and reforestation, as well as halting the rate of deforestation. (Details of the impact of Climate Change on Human Development is given in Chapter IV of this report)

Figure 3.2 Presentation of Impact of Climate Change on Human Development



3.7 ASSESSMENT OF GREEN GROWTH INTENSITY OF THE DISTRICTS OF HIMACHAL PRADESH

District wise ranking of Green Growth Intensity that Combines Relative Economic Potential, Green Forest Cover, Resilience, Inclusiveness and Environmental Impact

3.7.1 Introduction

Himachal Pradesh consists of 12 districts and they reflect wide variation in terms of Human Development Indicators as well as perceptible environmental coverage. Human Development Indicators as well as the degree of environmental susceptibility are added up as a composite framework to rank the districts in terms of Green Growth Intensity (GGI). However, one should take note of the fact that the results below

are congregated in a comparative static framework based on available cross-sectional data for a period reflecting the necessary condition, but not the sufficient condition.

3.7.2 Methodology of Estimation

The following methodology is attempted while calculating the relative index:

Let Q_i be the share of the i^{th} district in the indicators of a particular State (i.e., Himachal Pradesh) and Pi, the population share of the i^{th} district, i.e.

$$Q_i = q_i/\sum q_i, \quad \text{with } \sum q_i=1 \text{ ----------(1)}$$

Where q_i is the total value generated by the i^{th} district for a particular year and $\sum q_i$ is the sum of all the districts in our sample in the indicator for the same year. Again,

$$P_i = p_i/\sum p_i, \text{ with } \sum p_i=1\text{----------(2)}$$

Where, p_i is the population of the i^{th} district in a particular year and $\sum p_i$ is the sum of the total population of all the districts in the same year. Equation (2) will act as a standardising feature to assess inter-district variation.

Finally the Relative Intensity Index of a particular district will take the following form:

$X_i = Q_i/P_i$ ---------- (3)

After deriving the relative index, the districts are ranked in terms of its position in the index. The composite ranking (sum of ranks) for all the related indicators are arranged in ascending order to arrive at the final status of the district. The lower rank-sum position indicates better positional strength of a district and vice versa.

3.7.3 Major Indicators of Green Growth Intensity (GGI)

The following are the major indicators of GGI:

Indicator 1 (Economic Growth Potential): This indicator is taken as the share of GDP of each district in Himachal Pradesh standardized by the population share. The higher the ratio, the higher is the potential and vice - versa.

Table 3.12: Economic Growth Potential of the Districts in Himachal Pradesh

Districts	Ratio of GDP Share to Population Share	Rank
Solan	6.10	1
Sirmour	2.11	2
Shimla	2.08	3
Mandi	1.17	4
Lahaul-Spiti	2.82	5
Kullu	1.45	6
Kinnaur	2.59	7
Kangra	1.06	8
Hamirpur	1.25	9
Chamba	1.22	10
Bilaspur	1.36	11
Una	1.44	12

Calculated on the basis of the district wise GDP (2017-18) and Population data of 2019 calculated) Source: GDP data (i) Economic Survey of Himachal Pradesh, Economics & Statistics Department (ii) Calculated on the basis of Population data- Census 2011

Data on GDP by districts is based on the latest availability of the official data for 2017-18. The population figure has been estimated on the basis of the census 2011 population. It may be noted that Solan has the highest ratio of 6.1 and ranked the top, while Una notched at 1.44 is ranked at the bottom.

Indicator 2 (Green Forest Cover): Green Forest Cover is the natural resources endowment and is estimated as the share of forest area to total geographical area of each of the districts. The higher the forest covers, the higher would be the orientation for green based development. The estimation is shown below:

Table 3.13: Natural Growth Potential of the Districts in Himachal Pradesh

Districts	Ratio of share in Forest Area to Geographic Area	Rank
Kullu	1.35	1
Kinnaur	1.20	2
Chamba	1.16	3
Lahaul-Spiti	1.10	4
Shimla	1.00	5
Sirmour	0.98	6
Kangra	0.74	7
Mandi	0.71	8
Solan	0.57	9
Bilaspur	0.55	10
Una	0.48	11
Hamirpur	0.29	12

Calculated on the basis of the District wise Forest Area (FA) and Geographical Area (GA)
Source: H.P. Forest Statistics 2013

In this estimation, the district Kullu ranked the top (1.35) while Hamirpur attained the lowest position (0.29).

***Indicator 3 (Resilience)*:** Resilience means the amount of climatic shocks the ecosystem can face before undergoing permanent change. The resilience reflects the average district level vulnerability index. This has been estimated for the period 2012-13 and shows the combined situation of each district in terms of exposure, sensitivity and adaptive capacity to environmental degradation. The higher the index, the higher is the vulnerability, and vice versa.

Therefore, lower value of the index reflects better position in the ranking for the districts and the reverse. The estimated results are shown in the Table below:

Table 3.14: Resilience Potential of the Districts in Himachal Pradesh based on Vulnerability Index

	Vulnerability Index	Rank
Lahaul & Spiti	0.04	1
Kinnaur	0.42	2
Bilaspur	0.55	3
Shimla	0.57	4
Chamba	0.58	5
Mandi	0.60	6
Kangra	0.66	7
Kullu	0.67	8
Solan	0.68	9
Una	0.70	10
Hamirpur	0.72	11
Sirmour	0.89	12

Source: Source: State Energy & Action Plan on Climate Change, Himachal Pradesh2012, Department of Environment, Science & Technology, Govt. of H.P.

The resilience strength is observed to be the highest for Lahaul & Spiti (0.04), while lowest for Sirmour (0.89)

Indicator 4 (Inclusive Growth): Inclusive growth reflects the capacity of the district to accommodate people in the broader fold of the development process. Without going into the nitty gritty of the debate on the issue of poverty line, the higher the effort of accommodation in this regard, the lower would be the level of poverty at the household level and vice-versa. The table below is the straight forward estimation of the Government of Himachal Pradesh for each of its districts, which are ranked accordingly. It may be noted from the table that Kullu has the lowest percentage households living below poverty line (16.24).

Table 3.15: Reflection of Inclusivity of Economic Growth in terms of the Percentage of Households living below the Poverty Line in each of the districts of Himachal Pradesh

	Percent households living below poverty line (In Percent)-Rural	Rank
Kullu	16.24	1
Una	16.92	2
Sirmour	19.44	3
Mandi	20.06	4
Hamirpur	20.37	5
Kinnaur	21.31	6
Kangra	21.87	7
Bilaspur	23.10	8
Solan	23.70	9
Shimla	29.07	10
Lahaul-Spiti	43.50	11
Chamba	54.15	12

Source: Survey on Rural Poor Families 2002-07, Himachal Pradesh.

***Indicator 5 (Environment)*:** Among the Green Growth Intensity (GGI) indicators, environment contributes the final influence on the pattern and direction. In this indicator, we had to leave out ambient air quality, emissions of SO_2 and NOx due to paucity of data at the district level. However, for Respirable Suspended Particulate Matter (RSPM), by averaging station-wise data, we can arrive at numbers that are important in assessing the intensity of environmental impact for all the districts of Himachal Pradesh. As per the TERI report of 2015, RSPM is the biggest pollutant. The reason for high particulate matter levels are the result of the emissions from auto vehicles, diesel gensets, re-suspension of traffic dust, small scale industries, biomass burning, commercial and domestic use of fuels, etc. Exposures to these factors are accountable for both acute and chronic health diseases specially affecting the respiratory system leading to impaired cardiopulmonary function, reduction of lung function and premature mortality, etc.

Table3.16: Average RSPM level in the districts of Himachal Pradesh

	RSPM Annual Average	Rank
Shimla	47.4	1
Lahaul & Spiti	51.5	2
Kinnaur	57.6	3
Chamba	71.2	4
Mandi	79.3	5
Una	79.6	6
Hamirpur	83.6	7
Solan	91.8	8
Kullu	95.5	9
Bilaspur	100.7	10
Kangra	105.9	11
Sirmour	144.3	12

Status of Ambient Air quality data
Source: http://www.hpenvis.nic.in/Database/Status_3876.aspx

It may be noted that district Shimla has the lowest RSPM level (rank 1) and Simaur has the highest RSPM level.

3.7.4 Composite Green Growth Intensity at the District Level

Composite Green Growth Intensity (GGI) is estimated by observing the rank obtained by districts in various indicators. The table below shows the rank and its summation for the different districts of Himachal Pradesh.

Table 3.17: Rank obtained by the districts of Himachal Pradesh among the indicators of GGI

	Economic Growth (1)	Natural Resources (2)	Resilience (3)	Inclusive Growth (4)	Environment (5)	Green Ranking: Sum (1) to (5)
Bilaspur	11	10	3	8	10	42
Chamba	10	3	5	12	4	34
Hamirpur	9	12	11	5	7	44
Kangra	8	7	7	7	11	40
Kinnaur	7	2	2	6	3	20
Kullu	6	1	8	1	9	25
L-S	5	4	1	11	2	23
Mandi	4	8	6	4	5	27
Shimla	3	5	4	10	1	23
Sirmaur	2	6	12	3	12	35
Solan	1	9	9	9	8	36
Una	12	11	10	2	6	41

The sum of the ranks obtained in various indicators, is the conceptual correspondence of GGI when arranged in ascending order. The lowest sum indicates higher GGI and conversely. The following Table shows the final ranking. The table also reveals the gap in the ranking level. For example, the gap analysis shows that Kinnaur is 54.5 percent better than the bottom most district Hamirpur (0), and similarly, Lahaul and Spiti (rank 2 in GGI) is 47.7 percent.

Table 3.18: GGI ranking of districts of Himachal Pradesh

Districts	Rank Sum arranged in Ascending Order	Rank	Gap Analysis
Kinnaur	20	1	54.5
Lahaul & Spiti	23	2	47.7
Shimla	23	3	47.7
Kullu	25	4	43.2
Mandi	27	5	38.6
Chamba	34	6	22.7
Sirmour	35	7	20.5
Solan	36	8	18.2
Kangra	40	9	9.1
Una	41	10	6.8
Bilaspur	42	11	4.5
Hamirpur	44	12	0.0

3.7.5 Conclusion

Himachal Pradesh is a sensitive State in terms of green growth intensity. However, the endowment and approaches of districts differ in terms of initiation and pursuance of policies to take on the challenges of GGI, which is a combination of factors linked to Human Development and environmental conjectures. Among the 12 districts, Kinnaur, Lahaul & Spiti, Shimla and Kullu are in a better position, while districts like Una, Bilaspur, Hamirpur and Kangra need special effort to improve their position. The Government of Himachal Pradesh can offer special packages for these districts that can help improve the scaling up efforts not only in terms of Human Development, but also in terms of environmental sustainability.

The State must undertake independent assessment of all the hydropower projects of the State, until which time, it must hold back commissioning of any new projects. If the Government continues with the same modus operandi, it would sure be preparing itself for a disaster bigger than that of the 2013 Uttarakhand disaster.

CHAPTER IV

CLIMATE CHANGE & ITS IMPACT ON HUMAN DEVELOPMENT IN HIMACHAL PRADESH

4.1 INTRODUCTION

Scientific research in the past decades has revealed the ways the climate change impacts the Human Development. Climate variability and extreme events obstruct development, damage natural resources, affect agricultural productivity, cause water shortages, and threaten the health of millions in the developing world.

Currently across the globe, temperatures are rising; the spatial and temporal variability of rainfall has increased and the incidence of extreme events is also on the rise. The changes have led to frequent and intense tropical storms, floods, droughts and landslides etc., resulting in severe damage to critical infrastructure and assets affecting community health and wellbeing. Such impacts also cause damage to housing, roads and other transportation means, water supply, forest produce, crop yields, and other natural resources that underpin the social fabric and economy of areas with exposure to climate change challenges (Steffen, 2009).

Himachal Pradesh is vulnerable to climate change owing to its ecological fragility. The economy of the State is dependent on sectors like hydropower generation, horticulture, agriculture, forestry and tourism etc., which are under threat due to rapidly changing climate.

4.2 CLIMATE CHANGE IN HIMACHAL PRADESH

Climate change is not just a global concern, but also poses a major challenge to mountain ecosystem, which is highly vulnerable and sensitive to climatic variations. The recent IPCC reports warn that mountain ecosystem is much more susceptible to the vagaries of climate change than the other regions on earth and the people of the mountain regions face great challenges in dealing with this global threat for sustaining their economic and social development. Mountains cover close to 20 percent of the earth's surface, sheltering approximately one-tenth of the global human population. With their steep and varied topography, and distinct altitudinal ecological zones, mountains support a huge diversity of species and ecosystems and a large percentage of global endemic species. They also provide essential resources such as timber, minerals, recreational getaways, and a significant portion of the freshwater consumed by humans.

The State of Himachal Pradesh, which forms a part of the North-Western Himalayas, is environmentally fragile and ecologically vulnerable. The occurrence of natural hazards emanating from climatic variations is a matter of immediate concern for the State, as every year the State experiences the fury of nature in the form of cloudbursts, flash floods, landslides, snow avalanches, and droughts etc.

The fragile ecology of the mountain State coupled with large variations in physio-climatic conditions has rendered it vulnerable to the vagaries of nature. The incidence of cloudbursts in the last few years has baffled scientists and the inhabitants alike. Notwithstanding continuous efforts by the State Government

to cope with such hazards through relief and rehabilitation measures, the recurrence of extreme events continues to inflict widespread damage to life and property.

The roads that are the State's lifeline are repeatedly damaged, blocked or washed away by one or more of these events. The snow fields and glaciers which are considered to be the best indicators of climate change have been affected by the rising temperature, throughout the Himalayan belt. However, the estimates on the magnitude of glacial retreat and their impact on natural resources have been varying considerably.

4.3 CLIMATE CHANGE SCENARIO IN HIMACHAL PRADESH:

The climate change scenario in Himachal Pradesh is being manifested in the following forms:

- Change in climate
- Change in rainfall trends
- Change in snowfall trends
- Change in Glaciers

These trends, which have been established based on scientific evidence, are also supported by concerns expressed by the inhabitants, such as (Source: State Strategy of Action Plan on Climate Change, HP, 2012):

- Some common birds, butterflies and insects have disappeared
- Vegetation species and crops have changed and become extinct
- Change (shift) in cropping pattern and vegetation species
- Change (shift) in apple contour
- Decline in normal winter precipitation
- Drying up of natural water sources
- Increase in incidences of diseases, pests etc.
- Change in setting of seasons

4.3.1: Temperature

Although local temperatures fluctuate naturally, over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. Carbon dioxide and other air pollutants are accumulating in the atmosphere, trapping the Sun's heat and causing the planet to warm up.

According to a major report prepared by the Potsdam Institute for Climate Impact Research (PIK) and Climate Analysts for the World Bank, the rise in temperature will trigger a series of cataclysmic changes involving extreme heat waves, declining global food stocks and rise in the sea-level affecting hundreds of millions of people. The experts are of the opinion that the trend is accelerating. The 10 hottest years on record have all occurred since 1990 and, scientists say, that unless we curb global warming emissions, average temperatures could be 3 to 9 degrees higher by the end of the century.

The following are the changes in temperature observed in the State of Himachal Pradesh (Source: State Centre on Climate Change and Climate Modeling for H.P.):

- Rise in temperature in the North Western Himalayan region by about 1.6^0C in the last century (Bhutiyani et al. 2007).
- Overall warming is expected to go up in the State with a projected increase in the mean temperature by 1.3-1.9 degree Celsius for 2021-2050
- Warming rate of Shimla was higher than Leh & Srinagar during the period from 1991-2002 as compared to the earlier decades and the gross rise in the mean air temperature during 1980-2002 in North Western Himalayas, as a whole, was about 2.2^0C (Bhutiyani et al. 2007).

Table 4.1: Seasonal Variation Max. & Min. Temperature

Season	Statistics	Max. Temperature (^{o}C)	Min. Temperature (^{o}C)
Annual	Average	22.31	10.6
	Range-average	17.3-29.7	6.2-16.2
Winter	Average	14.6	3.1
	Range-average	9.3-22.6	-1.7-8.9
Pre-monsoon	Average	23.9	10.91
	Range-average	14.6-36.2	2.6-20.91
Monsoon	Average	27.02	17.01
	Range-average	20.3-38.4	11.1-24.5
Post- Monsoon	Average	22.05	8.58
	Range-average	15.1-30.6	1.4-17.5
Annual	Range-Inter-annual variation	0.04-0.06	0.02-0.03
Winter	Range-Inter-annual variation	0.07-0.09	0.16-0.18
Pre-monsoon	Range-Inter-annual variation	0.02-0.03	0.04-0.04
Monsoon	Range-Inter- annual variation	0.01-0.03	0.03-0.05
Post Monsoon	Range-Inter-annual variation	0.06-0.08	0.04-0.06

Source: IMD Gridded Rainfall Data (1971-2005)

Providing Regional Climates for Impact Studies (PRECIS) simulations of whom for the 2030s indicate an all round warming over the Indian Subcontinent associated with increasing GHG concentrations. The annual mean surface air temperature is projected to rise by 1.7^o C to 2.0^o C by 2030. Seasons may be warmer by around 2.0^o C, towards the end of 2030. The mean annual temperature of Himachal Pradesh is projected to increase from 0.9 ±0.6 ^{0} C to 2.6 ±0.7^0 C in 2030.

4.3.2 Precipitation (Source: Climate Action Plan)

- As per climate change and precipitation variation in the NW Himalaya based on precipitation data from 1866-2006, no change in winter precipitation was observed but significant decreasing trend in the monsoon precipitation was noted (Bhutiyani et al., 2009).

- About 17 percent decrease in rainfall in Shimla was observed from 1996-2000 till 2007 (Verma et al., 2009).
- In Shimla and Solan the total snowfall received during 1973-75 was 190.53 cm. which declined to 101.9 cm. in 1986-1990. It further, declined to 78 cm. in 2006-07. It was only 15 cm. in 2009 (Verma et al., 2009).
- The decreasing trend in seasonal snowfall at Shimla has been conspicuous since 1990 and was the lowest in 2009 (Verma et al., 2009).
- The mean annual rainfall is likely to vary between 1250±225.2 and 1550±175.2 mm in Himachal Pradesh.
- The rate of increase in rainfall is more in North-western parts of the State i.e. areas of district Kangra, Chamba, Kullu, Una are likely to receive rainfall with increased intensity.
- With the predicted increase in average temperature, the High Hill areas such as Kinnaur, Lahaul and Spiti and some parts of Chamba and Kullu districts may also experience rainfall in place of snowfall with increased temperature.
- There may be decrease in snowfall patterns in mid-hills temperate agro-climatic zone.
- The number of rainy days may increase in Himachal Pradesh with decrease in average intensity.
- An increase in rainfall in the pre-monsoon and post-monsoon months with increasing incidence of storms in Himachal Pradesh.

4.3.3 Glacier Retreat (Source: State of Environment Report Himachal Pradesh)

As per the recent studies carried out on the Himalayan glaciers, most of the glaciers are receding due to climate change. Since the monitoring of these glaciers is difficult due to the rugged topographical condition, the remote sensing technology has been successfully used for the monitoring of Himalayan glaciers. Studies reveal that almost all the glaciers are receding and overall 19 percent of the glacial retreat has been observed from 1962 to 2001. Glaciers located higher than 5000 mts. have shown 24 percent loss as compared to 14 percent for those located on the altitude higher than 5400 mts., while the mean altitude of the glacier terminus has shifted upward by 88 mts. i.e. from 4482 to 4570. During the last 39 years, almost 19 percent of the glaciated area has been reduced in the Baspa basin. In addition to this, in the month of December and January, snow melting was observed in altitude range as high as 4800 mts., which will have a profound effect on the stream run off pattern of many glaciers and snow fed streams.

On the basis of ground-level observations and satellite data interpretation from the year 1963 and 1997, 650 mts glacier retreat has been observed in Janapa glacier, and 1050 mts. in Shuane Garnag glacier in the valley. Thus an overall 1.9 mts./year retreat in case of Janapa and 3.8 mts./year for Shuane Garnag glacier has been observed.

Evidences for Glacier Retreat in Himachal Pradesh (Source: Different Sources)

- Baspa is a river originating from the Baspa Hills and joining the Satluj river. Due to warmer winters, snow cover on the river is observed melting even in the months of December and January at altitude of 5400 mts. above sea level.
- Average stream run-off of Baspa river in the month of December from 1966-1992 had gone up by almost 75 percent. Steady rise in stream run-off of Baspa from 1980 onwards matches the average global temperature rise during the same period (Kulkarni et al., 2004).

- Glacial melts have given rise to the formation of new glacial lakes, with 109 new glacial lakes having formed in the State in the last 2 years.
- Glacier retreat was estimated in Chenab, Parbati and Baspa basins using topo sheets of 1962 as baseline information and satellite data of 2000-2001.
- An overall reduction in glacier area from 2077 sq.kms.to 1628 sq.kms. from 1962.
- An overall de-glaciation of 21 percent of the total glaciated area.
- GSI estimated retreat in 3 glaciers in Satluj basin, 6 glaciers in Chenab and 5 glaciers in Beas and 2 glaciers in Ravi basin.
- Prominent glaciers like Chhota Sigri show 6.81 mts./y retreat between 1962 to 1995, Bara Sigri 29.78 mts/y between 1906-1957, Triloknath 17.86 mts./y between 1968-1996, Beas kund 18.8 mts./y between 1963-2003 and Manimahesh 29.1 mts/y between 1968-2005.
- Similarly the total retreat is also being estimated in Spiti basin, Himachal Pradesh on 1:50,000 scale using 1962 (SOI), 2001 and 2007 satellite data.

Globally, the climate change is increasing the frequency and intensity of extreme weather events, such as floods, droughts, heat waves, hurricanes, and tornadoes. Other consequences include higher or lower agricultural yields, glacial retreat, reduced summer stream flows, extinction of species and increase in the range of disease vectors. The following section of the chapter presents the incidence of extreme weather events in Himachal Pradesh. It also attempts to assess the impact of climate change on different aspects of Human Development in Himachal Pradesh.

4.4 CLIMATE CHANGE AND THE INCIDENCE OF NATURAL HAZARDS IN HIMACHAL PRADESH

The State of Himachal Pradesh, owing to its geo-climatic fragility is vulnerable to climate induced natural disasters, such as earthquakes, floods and landslides. There are numerous hazards pertaining to climate change and the following table depicts the district-wise threat in Himachal Pradesh:

Table 4.2: Threat of Hazards

District	Earthquake	Landslide	Floods	Avalanche	Forest Fire	Drought	Cloud Burst
Kangra	VH	L	M	M	H	H	M
Chamba	VH	VH	H	M	H	M	H
Hamirpur	H	L	L	-	VH	M	L
Mandi	VH	H	H	-	VH	M	H
Kullu	VH	VH	H	H	H	M	VH
Bilaspur	H	M	L	_	VH	M	L
Una	H	L	H	_	M	H	L
Sirmour	H	L	L	_	VH	M	M
Solan	H	M	L	_	M	M	L
Kinnaur	H	H	H	VH	M	M	VH
Lahaul & Spiti	M	M	M	VH	M	M	H
Shimla	VH	H	H	M	H	M	H

Source: National Disaster Risk Reduction Portal

4.4.1: Floods (Source: Climate Action Plan)

Floods are one form of natural disaster that the State experiences every year. South West monsoon between the months of June and August is the dominant cause of floods, which occurs as a result of excess rainfall, i.e. 125 percent or more than the normal.

The magnitude and intensity of floods in Himachal Pradesh has gone up in recent times and so has its socio-economic impact. They occur as a result of factors such as cloudburst in the catchment region, intense and prolonged rainfall, downstream blocking of river channels by landslides or avalanches, sudden burst of artificial/natural lakes, rampant deforestation, encroachment of flood plain area, overflowing of rivers due to glacial melts etc. which are largely anthropogenic in nature. Though there may be fluctuations in the flood affected area, as per an assessment by the Central Water Commission (CWC) in 2000, the maximum flood-prone area in the State is 3.9 million hectares, which amounts to about 70 percent of the total geographical area of the State.

Flash floods are the most frequent and damaging floods that occur with little or no warning, causing immense loss of life and property. These floods usually occur when rapidly rising and flowing water reaches full peak within a few minutes, as a result of excess rainfall or failure of impoundment.

4.4.2: Glacial Lake Outburst

This phenomenon constitutes a sudden discharge of a large volume of water from glacial lakes. The frequency of such events has been increasing in the Hindu Kush-Himalayan region, since the second half of the 20th century (UNEP, 2003) due to the combined effects of climate change and deforestation. Satellite observation of the mountain top lakes in the region have revealed a steady increase in the size and volume of many of these glacial lakes at high altitudes, enhancing the possibility of a devastating outburst flood affecting sizeable population and damaging precious socio-economic infrastructure and development assets in the Himalayan belt.

4.4.3: Earthquake (Source: Earthquake Hazard Profile of the State)

The vulnerability of Himachal Pradesh to seismic hazards is on the rise and State having been struck by a large number of deadly earthquakes over the years, resulting in heavy loss of life and property. Due to its location, the State experiences dozens of mild quakes every year. The State has been hit by earthquakes with a magnitude of 4 and above on the Richter scale more than 80 times, as per records. The seismic sensitivity of the State of Himachal Pradesh is very high as over the years a large number of damaging earthquakes have struck the State and its adjoining areas.

It is also pertinent to note that the State of Himachal Pradesh is not only highly sensitive from the earthquake point of view, but the risk has grown manifold as the population and infrastructure has increased considerably over the last 20 years. Chamba, Kullu, Kangra, Una, Hamirpur, Mandi and Bilaspur districts lie in Zone V, i.e. very high damage risk zone, and may expect earthquakes with maximum intensity of MSK IX or more. The remaining districts of Lahaul & Spiti, Kinnaur, Shimla, Solan and Sirmour lie in Zone IV, i.e. high damage risk with expected intensity of MSK VIII or more.

4.4.4: Landslides (Source: Draft City Disaster Management Plan- Municipal Corporation, Shimla)

Landslide is the most common hazard in Himachal Pradesh, causing widespread loss of life, damage to houses, roads, means of communication, agricultural land etc. The fragile nature of rocks forming the mountains, along with climatic conditions and various anthropogenic activities has made the State

vulnerable to landslides. Activities such as deforestation, road construction, water-intensive agricultural practices, and possession of steep hill slopes are some factors that have led to the increase in intensity and frequency of landslides.

Experts point out that unscientific land use and unplanned expansion of urban areas is also overloading and destabilizing the slopes in towns and cities, such as Shimla. Overloaded slopes may initially cause only minor landslides, but at later stage could trigger larger landslides. The State Capital of Shimla is also sinking at several places due to digging of slopes for construction and infrastructure development.

4.4.5: Avalanches

Snow avalanches are the sudden slide of large mass of snow down a mountain. There are several factors, which can affect the occurrence of avalanche, including local weather, slope, atmospheric temperature, vegetation; terrain and general snow pack conditions. Different combinations of these factors can create low, moderate and extreme weather conditions. Most avalanches are very dangerous and cause huge loss to life and property.

4.4.6: Forest fire (Source: Draft City Disaster Management Plan- Municipal Corporation, Shimla)

The forests of the Himachal Pradesh are more prone to forest fire when compared to forests in other parts of India, due to various biotic and geographic reasons. In the State, the recorded forest area is 10,46,900 hectares, of which around 9,74,800 hectares cropped area is fire prone. In Shimla district, around 69 percent of the total area has a history of forest fires, and in Chamba, Lahaul, Spiti and Kinnaur districts, 44.9 percent of the total area experiences forest fires during summers, and 20 percent area is prone to frequent fires.

4.4.7 Drought (Source: Himachal Pradesh, National Disaster Risk Reduction Portal)

Drought is a long period with no or less rainfall than normal, in a given area. Meteorologically drought is defined as a situation when the annual rainfall over any area is less than 75 percent of the normal. It is termed as moderate if rainfall deficit is between 25 to 50 percent, and severe if it is more than 50 percent.

There is not a single district in the State which qualifies to be called a chronologically drought affected area. Incidents of widespread drought were observed in the year 1972 and 2011. In the year 2011, a total of 46.64 lakh human population and 0.88 lakh hectares cropped area was affected by drought.

4.5 VULNERABILITY INDEX

As defined in the Environment Master Plan of Himachal Pradesh, vulnerability index is a measure of the exposure of a population to the vulnerability on account of pressure on natural environment which determines the quality of life. Himachal Pradesh is one of the most ecologically fragile States owing to its location in the Himalayan region. Here the ‘index’ is designed to be used with economic and social vulnerability indicators to provide insights into the processes that can negatively influence the ‘Sustainable Development’.

The vulnerability assessment has been carried out both sectorally and geographically. The unit for assessment of geographical vulnerability is tehsil and district. Sectoral vulnerability has been assessed at tehsil level with respect to water, air, land, natural critical habitats, climate change, hazard susceptibility, spatial areas of conflict, quality of life (health) and quality of life (education). The sectoral vulnerability has been derived by adding values of each sector. With this methodology, the Vulnerability Index at the Tehsil Level and at the Sector Level is determined.

The vulnerability at tehsil/district level is expressed in terms of Vulnerability Index (VI) ranking of tehsil/district in the order of:

- High vulnerability to Very high vulnerability range (is 3 and above) and
- Moderate by high vulnerability to Very low vulnerability range (from 0 to below 3).

This allows comparison of districts with different vulnerability ranges and also gives a glimpse of vulnerability of the State. This will help in prioritizing development actions within districts and among districts in Himachal Pradesh. Table given below, ranks the tehsils/districts in the order of High vulnerability to Very high vulnerability range (3 and above).

Table 4.3: Vulnerable Tehsils (falling in High vulnerability to Very high Vulnerability Range)

Sr. No.	District	Tehsil	Vulnerability Index (VI)	Normalised VI
1	Mandi	Mandi	13086.31	5.34
2	Bilaspur	Bilaspur Sadar	12070.36	4.92
3	Sirmaur	Paonta Sahib	10937.76	4.46
4	Shimla	Shimla (Rural)	10092.86	4.12
5	Hamirpur	Tira Sujanpur	9890.36	4.04
6	Una	Una	8946.29	3.65
7	Kangra	Kangra	8319.54	3.39
8	Solan	Kasauli	8133.61	3.32
9	Lahaul & Spiti	Lahaul & Spiti	7952.12	3.24
10	Chamba	Dalhousie	7700.02	3.14
11	Kullu	Manali	7539.86	3.08

Source: Environment Master Plan: Himachal Pradesh (2012)

It can be observed in Table 4.3 that Kinnaur district does not have any tehsil in High vulnerability to Very high vulnerability range. District Mandi appears to have the highest vulnerability Index of 13086.31. Kullu appears to have the least index of 7539.86 in the High vulnerability range.

4.6 FUTURE CLIMATIC PROJECTIONS:

As per the Indian Network for Climate Change Assessment (INCCA) studies the projected changes in India, in 2030s are:

- Coupled model simulations from IPCC AR4 show large uncertainty in simulating Indian summer monsoon rainfall, however an MME of 10 selected models give reasonably good representation of monsoon.
- MME projects around 10 percent increase in the Indian monsoon rainfall over central and peninsular India in 2030s. The expected change in the rainfall is within the current monsoon variability and there are large model to model differences making these projected changes to be lesser confident.

- MME projects 1.5-2°C warming in the annual mean temperature over the Indian landmass while winter (Jan-Feb) and spring (Mar-Apr-May) seasons show higher warming.
- High resolution regional climate model 'PRECIS' shows good skill in representing smaller scale features of monsoon.
- The projections of PRECIS in 2030's indicate 3-7 percent increase in all-India summer monsoon rainfall.
- The annual mean surface air temperature may rise from 1.7°C to 2°C by 2030s, as indicated by the three simulations.
- The regional climate model simulations indicate that the cyclonic disturbances over Indian Ocean during summer Monsoon are likely to be more intense and the systems may form slightly to the south of the normal locations.
- The mean changes in the Monsoon rainfall are in the range of 2 to 12 percent while the annual temperature changes are of the order of 1.4 to 1.9^0C , however the individual simulations show large differences.

Source: INCCA REPORT #2, CLIMATE CHANGE AND INDIA: A 4X4 ASSESSMENT SECTORAL AND REGIONAL ANALYSIS FOR 2030S, Nov.2010)

4.7 IMPACT OF CLIMATE CHANGE ON ECONOMIC DEVELOPMENT (Source: State of Environment Report Himachal Pradesh)

Due to extreme climatic events, Himachal Pradesh has faced many losses from time to time, in terms of damage to life, property as well as economic development:

- Year 2005-06 (Rabi Season): The damage due to drought conditions was calculated to the tune of Rs. 366 crore which included loss of crops, IPH infrastructure, and animal husbandry
- Year 2002-03 (Kharif season): The estimated damage due to drought conditions was Rs. 707.21 crore
- Year 2000-01 (Rabi Season): The estimated damage due to drought was Rs. 360.85 crore
- Year 1999: There was widespread loss due to rains, flash floods and drought
- About 2.423 lakh hac. area under agriculture and 0.447 lakh hac. area under horticulture (total monetary loss estimated to Rs. 23,487.00 crore) was affected due to extreme events besides physical losses estimated to Rs. 19,151.67 lakh were observed
- Year 1998: The total loss (physical and crops) was assessed for an amount of Rs. 33.226.79
- Year 1997 : The estimated damage was Rs. 79,865.19 lakh
- Year 1996: The estimated damage was Rs. 47,677.28 lakh
- Year 1995: The estimated loss was about Rs. 50,599.82 lakh

4.8 IMPACT OF CLIMATE CHANGE ON AGRICULTURE

Of all human activities, agriculture is most sensitive to both weather fluctuations and climate change. Climate change affects agriculture and food production in complex ways. Agriculture is not only a source of the commodity food but, equally importantly, also a source of income. So, climate change affects food production directly through changes in agro-ecological conditions and indirectly by affecting growth and distribution of incomes, and thus demand for agricultural produce.

Changes in temperature and precipitation associated with continued emissions of greenhouse gases will bring changes in land suitability and crop yields. In many parts of the world, agricultural activities have already declined because of hot climate and little rain. A temperature rise of only a few degrees could make living and farming almost impossible.

Climate change has a more negative impact on agriculture-horticulture sector of Himachal Pradesh, owing to its vulnerability geo-climatic conditions. The State is faced with a huge challenge since over two thirds of its population is dependent on agriculture for subsistence, and any adverse impact on the sector directly affects their livelihood. The rising temperatures and erratic rainfall raise the need for irrigation facilities and the risk of crop failure, leaving the farmers vulnerable to crop losses.

Apple is the main cash crop in the State. Being India's largest producer of apples, Himachal Pradesh had three consecutive bumper crops in the years 2003, 2004 and in 2005 when the production reached an astonishing 5.4 lakh tonnes. In 2006, the production was reduced to almost half at 2.70 lakh tonnes. It peaked to 8.9 lakh tonnes during 2010-11 and then slumped to 2.75 lakh tonnes during 2011-12. After attaining a level of 7.78 lakh tonnes in 2015-16 it declined to 4.47 lakh metric tonnes during 2017-18. The apple production is entirely dependent on the climatic conditions and it has shown an erratic trend due to erratic behavior of climate. The area under apple production has recorded an increasing trend over the years recorded an increasing trend over the years indicating to a fall in the productivity. The production declined because of erratic rainfall and hailstorm, which damaged the crop considerably. A lackluster winter was followed by an erratic spring, when unexpected showers and hail storms wrecked havoc on the crops. According to one estimate, owing to the variations in the climate, rise in the maximum and minimum temperature and decline in the snowfall, productivity of apple in the State would fall by 1 percent by 2020 and 4 percent by 2030.

The growth in the flora and fauna population in the State has seen a downward trend with Kikar, Tali (Shisham), Deodar, Ban trees on a decline, while water fowls, ducks, Birds, house sparrows and vultures too have seen a drop in their numbers. Fruit crops, especially apple were a major source of income in the past. However, owing to the rising temperature, the apple growing belt in low lying valley areas like Kullu is shifting to higher altitudes, leaving the farmers with no other choice but to diversify cultivation with fruits like kiwi, pomegranate and vegetable seed. (Source: Climate Action Plan)

Around 11.61 percent of the area of the State is projected to undergo catastrophic soil erosion, out of this area 65.96 percent will have very severe soil erosion and 22.44 percent will have severe erosion. The Government must focus its efforts on soil and water conservation and catchment area development programmes, and strategically plan for strengthening these areas. (Source: Climate Resilient Green Growth Strategies for Himachal Pradesh- Towards an Inclusive Development Agenda)

Crucial sectors in the State like agriculture-horticulture, water resources, forests, hydro power generation and rural management are likely to be affected by climate change. Further, the large population of the State that mainly depends on climate-sensitive sectors like agriculture-horticulture and forests for their livelihood needs is going to get affected adversely.

4.9 IMPACT OF CLIMATE CHANGE ON HEALTH IN HIMACHAL PRADESH

Climate changes affect the human health in many ways. A qualitative assessment of PRESIS indicates that morbidity and mortality of the population of Himachal Pradesh is likely to increase with warming temperatures and variable precipitation as they have direct as well as indirect effects. Warmer temperature increases the risk of mortality from heat stress. Diseases that thrive in warmer climates, such as malaria, dengue, yellow fever, encephalitis and cholera are likely to spread due to increase in mosquitoes and other disease-carrying organisms and increased rate of transmission. Warmer and humid conditions may also enhance the growth of bacteria and moulds and their toxic products, resulting in increased amounts of contaminated and spoilt food, thus initiating food poisoning. The effects of climate change can be in terms of increase in vector-borne diseases and water-borne diseases; and, malnutrition etc.

Warmer temperatures will increase the chances of heat wave and can exacerbate air quality problems such as smog, and lead to an increase in allergic disorders. Diseases that thrive in warmer climates. By 2100, there could be an additional 50-80 million cases of malaria each year.

Climate change will result in declining quantity and quality of drinking water, which is a pre-requisite for good health, and exacerbate malnutrition - an important source of ill health among children - by reducing natural resource productivity and threatening food security. Climate change–induced droughts, flooding and other extreme weather events degrade and reduce potable water supplies and increase water-associated diseases such as cholera and diarrhoea, particularly in areas with inadequate sanitary infrastructures. Inadequate access to safe drinking water and sanitation, combined with poor hygiene practices are major causes of ill health and life-threatening diseases.

Automotive pollution constitutes almost half of the overall air pollution. There are broad range of adverse health effects from environmental problems, including gastrointestinal disease (from pathogens in drinking water), angina pain (from carbon monoxide), learning disabilities (from exposure to lead), cancer (from chronic exposure to many toxic substances), and many others. Eye infection such as conjunctivitis takes place mainly due to direct exposure to the polluted air.

Increased levels of various constituents of the atmosphere have adverse health effects on the human as explained below-

i. **Nitrogen oxides (NO_X)**: can irritate mucous membranes; aggravate existing respiratory illnesses, cause coughs, headaches and shortness of breath.

ii. **Carbon monoxide (CO):** is usually a localized pollutant, with high concentrations possible at the curbside on crowded streets during busy traffic hours and rapid declines at other times and places. Carbon monoxide reacts with hemoglobin in the blood, reducing the blood's ability to carry oxygen. At moderate levels of CO, healthy people can usually compensate for this oxygen deficit. In individuals with pre-existing heart disease, however, moderate levels of CO can cause problems associated with reduced oxygen supply to the heart.

iii. **Lead:** Virtually all petrol contains lead additives as inexpensive anti-knock agents. Lead is a widely distributed environmental pollutant that has been linked to serious adverse health effects among infants, children, men and women. Lead can affect mental development, blood chemistry, kidneys, and nervous, reproductive and

cardiovascular systems. Human exposure to lead can be gauged most accurately by measuring the level of lead in body tissues or fluids: blood, hair, bone, semen and urine. The wide range of effects, including impacts on the cardiovascular, nervous, reproductive, and excretory and digestive systems, is notable.

iv. **Ozone:** Ozone is a primary constituent of photochemical smog. At high exposure concentrations and exercise levels, it is a respiratory irritant that impairs lung functions and leads to lower respiratory symptoms such as cough and chest discomfort. High levels of ozone may increase the likelihood of chronic lung injury, leading in some cases to fibrosis, chronic bronchitis and heightened susceptibility to respiratory infections.

4.9.1 Incidence of Acute Respiratory Diseases

Climate change affects people's health both directly and indirectly. Warmer air temperatures can influence the concentration of regional air pollutants and aero-allergens resulting in heat stress and other heat-related health problems. They may also cause a sharp rise in the spread of vector-borne diseases like malaria, dengue, yellow fever and encephalitis.

Allergenic pollens grow more profusely in a warmer climate leading to respiratory disorders such as asthma, emphysema and chronic bronchitis, and allergy problems. Vehicular pollution experience heavy smog and haze resulting in asthmatic attacks.
When combined with smog and other atmospheric pollutants, illness from allergic respiratory diseases, particularly asthma, could increase. Changes in the climate also affect diseases like chronic obstructive pulmonary disease, pneumothorax, and respiratory infections in children. Various initiatives have already been taken by the Government in this direction. Introduction of electric vehicles for public transport, Mukhya Mantri Grihini Suvidha Yojana are some of them.

The quality of air is likely to decrease as surface ozone concentrations begin to rise with increasing temperatures. This will lead to an increase in the incidence of asthma and other cardiovascular and respiratory diseases. The Government must address this issue by introducing Compressed Natural Gas (CNG) for transport and replacing wood fire with Liquefied Petroleum Gas (LPG) for cooking, in the villages. Various initiatives have already been taken by the Government in this direction. Introduction of electric vehicle for public transport, Mukhya Mantri Grihani Suvidha Yojana are some of them.

Table 4.4: Total Patients Registered and Deaths Reported under National Tuberculosis Programme in Himachal Pradesh (2005-2009)

Year	Total patients Registered	Deaths	Mortality rate
2005	13697	584	0.04
2006	13303	596	0.04
2007	13611	607	0.04
2008	13618	544	0.04
2009	13743	564	0.04
2010	14179	426	0.03
2011	13501	540	0.04
2012	13615	409	0.03
2013	13691	548	0.04

Source: Health Dept., Himachal Pradesh

13,743 patients registered under the NTP in 2009, which was a slight increase from 13,697 in 2005. These numbers were 13,691 and 548 respectively, for the year 2013. Existing data also reveals that nearly three lakh TB patients have been treated and cured in Himachal Pradesh since 1997 and more still have to be treated to completely eradicate the disease under the Revised National Tuberculosis Control Programme (RNTCP). It can be observed that the number of TB patients and the mortality rate has remained constant. However, the number of TB deaths saw a negligible decline from 584 in 2005 to 564 in 2009 and to 548 in 2013.

Table 4.5: Incidence of Communicable Disease (2013-2014)

Communicable Disease	2013	2014	2016
Acute Respiratory Infection	1631779	1510915	1649023
Measles	155	268	461

Source: National Health Profile 2018, MOHFW, GOI

The number of acute respiratory infection cases saw a decline from 16,31,779 in 2013 to 15,10,915 in 2014 and again increased to 1649023 in 2016. However, there was a rise in the number of measles cases from 155 in 2013 to 268 in 2014 and to 461 in 2016.

4.9.2: Incidence of Water-Borne Diseases

Climate-change-related alterations in rainfall, surface water availability and water quality could affect the burden of water-related diseases. Excessive floods contaminate drinking water creating conditions for transmission of diarrheal diseases like cholera. They may force the communities to use contaminated water, inadequate sanitation systems or trigger migration into areas with substandard water and sanitation facilities, thereby leading to the spread of cholera.

Table 4.6: Cases of Water Borne Diseases

Water-Borne Disease	2013	2014	2016
Acute Diarrheal diseases	249904	350459	310749
Enteric Fever (Typhoid)	37128	48786	38093

Source: National Health Profile 2018, MOHFW, GOI

The number of acute diarrheal cases saw an increase from 2,49,904 in 2013, to 3,50,459 in 2014, with a similar increase in typhoid cases, from 37,128 in 2013 to 48,786 in 2014. However, total number of cases detected with both the diseases decreased in 2016 from the 2014 levels.

4.10: IMPACT OF CLIMATE CHANGE ON THE POOR & VULNERABLE

4.10.1: Impact of Climate Change on the Poor

The impact of climate change would be the harshest on the poor and vulnerable section of population including women with severe impact on their health, livelihood, food security, economic and social security, psycho-socio well being and so on. Their already vulnerable condition makes them susceptible to the vagaries of nature, much more than the rest of the population.

Himachal Pradesh is one of the most vulnerable ecosystems to experience climate change. The most vulnerable are the mountain communities, especially those who mainly depend on animal husbandry, marginal agriculture and horticulture products. In the event of any calamity resulting from the effects of climate change, they will remain at the bottom on the priority list to receive attention, assistance and relief. In the event of any displacement of inhabitants from disaster-prone areas, the poorer sections would be worst hit, since they would lack skills and resources to be able to gain employment in the region which they are displaced. They would not have land to practice subsistence agriculture, and thus they would be left with no means of sustaining themselves or their families.

The vulnerable sections residing in high-risk areas such as flood plains may be severely affected by floods and cloudbursts, with very limited access to public health infrastructure.

4.10.2: Impact of Climate Change on the Livelihoods of the Poor

Erratic climatic conditions have posed challenges to the economic viability of farming in the State. In a few districts of Himachal Pradesh, poor farmers have switched over from the agricultural profession leaving the land uncultivated. As a consequence a significant portion of farm land has been abandoned, leading to degradation. Smaller farmers are dependent on timely and sufficient rainfall during the monsoon for high crop yields. However, with the changing climate, rainfall patterns have become uncertain, leaving farmers exposed to many risks including droughts, floods, disease of both crops and animals and unpredictable market irregularities. The poor and subsistence farmers, pastoralists etc. are vulnerable to increase or decrease in river flow due to glacial melts, increased soil salinity, impact of heat on crop yields and livestock.

A study carried out by the Institute of Himalayan Bio-resource Technology (IHBT) observed that the quality of tea has been adversely affected due to less rainfall in Palampur area as it has affected the accumulation of a compound responsible for giving colour and briskness to the tea. Overall the agriculture-horticulture sector is vulnerable and requires adaptive and mitigation measures.
According one estimate, owing to the variations in the climate, rise in the maximum and minimum temperature and decline in the snowfall, the productivity of apple in the State is decreasing day by day. This is posing a great problem for the apple farmers of Himachal Pradesh.

A survey conducted by Prasad and Pratap (2007) in the Kullu valley of Himachal Pradesh concluded that climate change has forced the mountain farmers to abandon one set of crops. The mountain farmers then had to adopt new farming techniques to cope up with the unsuitable climatic conditions. The rising temperature has made it uneconomical and unprofitable for farmers to grow apples in the lower valley area; whereas, it has made it possible for farmers to grow them in the upper valley areas.

4.10.3: Impact of Climate Change on Women

Climate change is expected to exacerbate current gender inequalities. Depletion of natural resources and decreasing agricultural productivity may place additional burden on women's health and reduce time available to participate in decision making processes and income generating activities. Climate-related disasters have been found to severely impact female-headed households, particularly where they have fewer assets to start with.

Women are engaged in agricultural activities in broadly three different ways: As paid workers; workers in their own land in farming activities as unpaid workers; and like a manager for supervision of paid labourers engaged in their own land. The impact of climate change would be most severe for the landless women workers followed by women belonging to marginal, small, medium and the least with large cultivating households. The lower the size of land holding, the higher is the women's involvement in farm activities and the higher would be the impact of climate change.

Scarcity and high prices make food more inaccessible, in particular for women and girls whose health has been found to decline more than male health in times of food shortage. With loss of harvests, food price increase makes the situation worse for women.

Climate change will lead to increased hardship for the poorest women in the State especially in the rural areas. They are responsible for providing daily essentials such as food and water and also participate in farming and livestock related activities.

4.10.4: Climate Change and Migration

The consequences of climate change on migration present humans with an unprecedented challenge. The number of storms, droughts and floods has increased threefold over the last 30 years with devastating effects on vulnerable communities, particularly in the developing world. In 2008, 20 million persons have been displaced by extreme weather events, compared to 4.6 million internally displaced by conflict and violence over the same period.

The devastating effects of natural disasters/ extreme environmental events such as cyclones, flood, landslides, and earthquakes have much greater impact on the movement of people. In India too refugees from Lohachara, Ghoramara and Sunderbans are on the rise due to the impact of Global Warming.

Thus, in addition to the poor, a new class of vulnerable section has emerged, as a result of the global threat of warming, called 'environmental refugees'. They are people who are displaced from their homes as a result of expanding deserts, floods, landslides etc. Like the poor, they too, are at high risk of contracting diseases, spreading communicable diseases to new areas, vulnerable to shortage of local resources, lack of public health services etc. Their displacement undoubtedly causes severe physical, financial and emotional stress on them.

4.11: IMPACT OF CLIMATE CHANGE ON HUMAN DEVELOPMENT: AN ANALYSIS

The comparable estimates of district level GDP, Poverty, HDI and per capita CO_2 inventory shows a discernible pattern in Himachal Pradesh[6]. The following variables are considered:

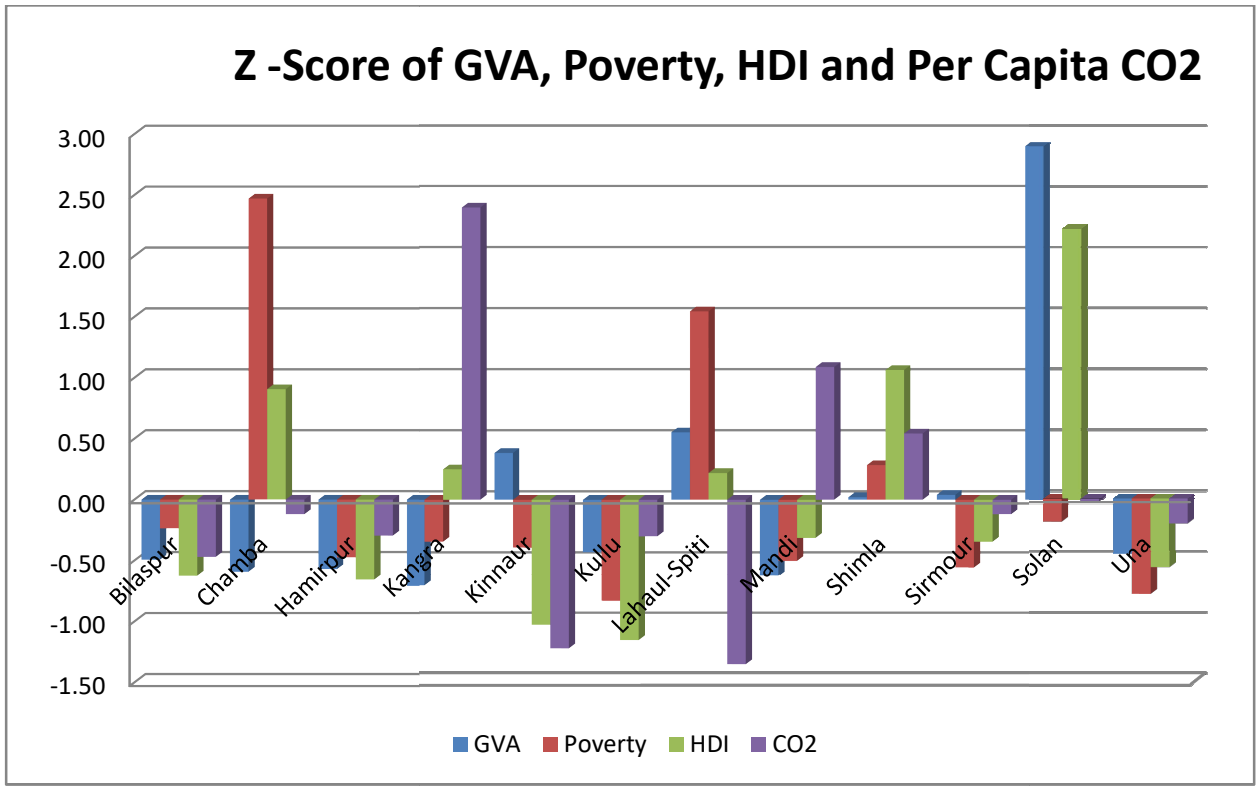
- District GDP at Constant Prices year
- Percent of population below poverty line year district wise
- Human Development Index
- Per capita CO_2 inventory level year and source. The total figure for Himachal Pradesh is distributed as per the population for each of the districts.

[6]A correlation is attempted to measure the degree of association among variables even though the estimation variable differs. The study does not say that this is a robust measure but definitely an indicative one to derive insight into the process. Moreover, the p-values are all significant at 95% level

The data was converted to standardized figure using Z-scores. The Z-score method is widely used in any standard report by the International Bodies (e.g. UNDP). Technically it's a measure combining both the measures of central tendency and the measures of dispersion. A Z-score is also known as a standard score and it can be placed on a normal distribution curve. In order to use a Z-score, one needs to know the mean μ and also the population standard deviation σ and by comparing it can throw an important insight in a cross-sectional analysis. Using the technicality of Z-score in a comparable data set, we estimated Z-score of the district level GDP for Himachal Pradesh. It is normalized using the following formula: $Z= (xi- \mu)/\sigma$, where xi is the GDP of the i^{th} district. In the case of evaluation and assessment in a comparative perspective, sometimes indicative results give insight into the process.

The simple district wise comparison is shown in Figure 4.1 below:

Figure 4.1: Standardized (Z-Score) of GDP, Poverty, HDI and per capita CO_2 Inventory in the districts of Himachal Pradesh.



It is interesting to observe a few patterns from the above figure:

- First, high GDP index[7] is associated with relatively low range of poverty and vice versa
- Second, high GDP index tends to be associated with higher spread of CO_2 inventory, which may be due to higher developmental activities
- Third, higher HDI is associated with higher spread of Poverty index

[7]District level cross-sectional

Table given below demonstrates the p-values of the correlation matrix are reported below.

Table 4.7: p-values of the Correlation Matrix

Covariance Analysis: Ordinary				
Sample: 2 12				
Included observations: 11				
Balanced sample (list-wise missing value deletion)				
Correlation				
Probability	GDP	POV	HDI	CO_2
GDP	1.000000			

POV	0.031376	1.000000		

HDI	0.649796	0.459574	1.000000	

CO2	-0.267998	-0.217440	0.119884	1.000000

Source: E-Views input

Table given below shows the positioning of indicators among the 12 districts of Himachal Pradesh. The correlation among the index values echoes the pattern depicted in the earlier chart.

Table 4.7.A: Correlation Matrix of GDP Index, Poverty Index, HDI and CO_2 Inventory Index

	GDP	**POV**	**HDI**	**CO_2**
GDP	1.00	0.03	0.68	-0.27
POV	0.03	1.00	0.42	-0.22
HDI	0.68	0.42	1.00	0.12
CO_2	-0.27	-0.22	0.12	1.00

It may be noted that CO_2 is highly correlated to Real GDP, which owes an explanation. The per capita CO_2 inventory in Himachal Pradesh is far less than the all-India average. Moreover, districts in this State depicted ample variation in terms of assimilating and accommodating economic activities, which may see an increase in the per capita CO_2 inventory level, which is well within the reach of its tolerable limit.

4.12: CONCLUSION

Climate change is a threat to sustainable development and will endanger achievement of the Sustainable Development Goals (SDGs). The most important actions for mitigating climate change will be to increase the use of renewable energy and afforestation, as well as halting the rate of deforestation. Adjusting to climate change will affect agriculture, food security and water management in rural areas, which indicates that the impact would be the highest on the poorer regions and sections. This requires that men and women understand the process of climate change, and share information on counteracting its negative impacts.

CHAPTER - V
GREEN GROWTH INTERVENTIONS AND THEIR IMPACT

5.1: INTRODUCTION

Himachal Pradesh has realized the importance of green growth long ago. In fact, it is a necessity for the State in the face of the growing crisis of climate change. The State has already initiated measures to contribute to the global goal of reducing carbon footprint, improving environmental health and biodiversity conservation. It also has in place measures to speed up the greening process and to address areas of concern that are proving to be a hindrance in sustainable development. In this chapter, an attempt has been made to discuss the policy related interventions and field-related interventions of the Government of Himachal Pradesh.

5.2: POLICY RELATED INTERVENTIONS

The State Government is now implementing policies to facilitate and monitor green growth in the State. It has instituted policies in the fields of organic farming, ecosystem services, solar power, ban on the use of plastic bags, organic/natural farming and ecotourism.

5.2.1: State Strategy and Action Plan on Climate Change

The Himachal Pradesh climate plan is a repository for sustainable development action in the State and provides a framework for coordination in the area of climate change and its implementation. The plan proposes sector-wise actions and recommendations on adaptation as well as mitigation through identified implementing institutions, with a timeframe and an estimated budget requirement for each of the sectors. Some of the key sectors identified under adaptation include tourism and eco-tourism, health, biodiversity and ecosystem, water resources, forest, agriculture and horticulture.

5.2.2: State-Centre on Climate Change

The State-Centre on Climate Change was established to synergize Himachal Pradesh Government's initiatives with the centre's initiatives. Various activities are being undertaken through the Centre such as: Launch of Geo-portal of Himachal Pradesh covering Lithology, Land use/Land cover, Multi-hazard and flood hazard mapping of Son river catchment to manage floods, estimation of carbon stock under different land use classes of Mandi, Climate change impact on the wetlands of Himachal Pradesh etc.

5.2.3: Organic Farming Policy

Himachal Pradesh has diverse agro-climatic conditions and due to its favourable positioning in the Himalayan region, has great scope of promoting of Organic/natural farming. It is one of the few Indian States where over the past few years, farmers, Government and Non-Governmental agencies have made significant contribution to the State-wide process of organic/ natural farming promotion and sustainable development.

The use of chemical fertilizers and pesticides in the State is very low and 80 percent of the area is rainfed. The State Government formulated a Policy on Organic Farming in 2010 and has covered 30,110 farmers with an area of 17,848 hectares under organic farming. During financial year 2013-14, 2000 hectares additional area was covered under organic farming and during 2015-2016 update 200 villages were converted into complete Bio-Villages. In order to promote organic farming, around 20,000 Vermi-Compost Units with 50 per cent assistance have been set up in different parts of the State. The initiative also embraces emphasis as the natural forming with an aim to make zero incremental cost for farming in the

State. The initiative also embraces emphasis on the natural farming with an aim to make zero incremental cost for farming in the State.

The experience of the farmers in the State have demonstrated beneficial effects of organic farming in reducing/replacing the use of chemical fertilizers and pesticides, reducing production costs and improving the fertility of the soil. Since this type of farming relies mainly on the use of renewable resources, it would significantly cut down the use of non-renewable energy sources, which would in turn help reduce the carbon footprint.

5.2.4: Ecosystem Services Policy

The rich and diverse mountain ecosystem of Himachal Pradesh has served the people of the State for generations. The State with its extensive reserves of natural resources has also been serving the other States of the country, mainly the neighbouring Northern States. Various crucial sectors like forestry, farming, hydropower generation, tourism, irrigation etc. all depend on ecosystem services such as availability of clean water, soil formation and conservation, biodiversity conservation, recreation and aesthetics etc.

In an effort to maintain these services, the State is implementing various schemes to promote plantation of trees, watershed management, weed control etc. The people of Himachal Pradesh have traditionally been dependant on rich and diverse mountain ecosystems. The State has a long history of engaging with communities and partnering with them in ecosystem management through a variety of approaches.

One of the ecosystem management approaches suggested in the H.P. Forest Sector Policy and Strategy, 2005, seeks to explore incentive-based mechanisms for provision of watershed services, fire management, invasive weed control, tree plantation, and to promote sustainable forestry and sustainable livelihoods. The State Government has also started such initiatives in partnership with the students.

5.2.5: Solar Power Policy

The Himachal Pradesh Solar Power Policy 2016 lays down the solar power potential and policy for the State. The National Institute of Solar Energy (NISE) has estimated the huge solar power generation capacity of the State.

Keeping in with the core development policy of the State, the solar policy aims at promoting power generation from solar energy in order to ensure energy security for sustainable development. The State aims at creating awareness among the households about the benefits of renewable sources of energy, solar in particular, as a reliable, accessible and affordable energy source. The advantage of solar power is that it is perennial, equitably distributed across the State and is easy to access in comparison to the other sources of renewable energy. It causes no environmental damage during installation and operation, making it an efficient source of energy. Roof top solar power plants with their connectivity with the power grid both in private and Government buildings are being encouraged by providing subsidy. The energy requirement in the farm operations is also being encouraged to be met through solar energy.

5.2.6: Environment Master Plans

In an effort to ensure environmental sustainability and conservation of natural resources, the Himachal Pradesh Government has undertaken the formulation of Environment Master Plan (EMP), which would serve as a strategic guide in dealing with all the environmental issues concerning the State. It would be a

platform for engagement and dialogue among developmental agencies and the Government for collective action on environmental issues of concern.

5.2.7: Practicing a Blanket Ban on Plastic Bags

Himachal Pradesh was the first Indian State to ban the production, storage, sale, use and distribution of small polythene bags, in 2004. Polythene pollution had been a major concern for the State of Himachal Pradesh, which led to the ban. These plastic bags had been littering all along the roads and mountain slopes. During the Monsoons, the rain water brought these polythene bags and other non biodegradable material down the slopes thus choking the municipal drains.

However, despite the ban, the Chandigarh garbage plant daily receives nearly 60 tonnes of garbage from Shimla, of which nearly 6 tonnes is plastic waste consisting of bags and plastic packing. But, the use of plastic is being attributed to the tourist population that visits the city throughout the year, who continue to use polythene bags despite the awareness and strict enforcement of the ban. Moreover, certain branded products are available for sale in factory packed polythene base packaging material.

5.2.8: Eco-Tourism Policy

The Eco-Tourism Policy of 2005, formulated by the Forest Department of the Himachal Pradesh Government, called for a revision of the policy, owing to the procedural requirements for obtaining clearance of the Eco-Tourism sites under the Forest Conservation Act-1980 and also due to the evolving concepts of Eco-Tourism. The revised Eco-Tourism Policy of 2016 aims at bringing rich biodiversity and ecosystems of the State of Himachal Pradesh closer to visitors while safeguarding and conserving these natural resources. The policy also aims at involving the community, thereby generating more livelihood opportunities along with their engagement in creating awareness, protection of the State's resources as well as appreciation of their natural and cultural heritage.

The State should also strive to develop an environmental code of conduct for tourists and visitors and ensure its strict implementation by monitoring, through collective participation of the Communities, Non-Governmental agencies and the Government Departments.

5.2.9: State Tourism Policy

The State plans to develop tourism related infrastructure based on expected tourist arrivals. The Himachal Pradesh Home Stay Scheme 2008, was aimed at promoting the State culture and ensuring that visiting tourists find a comfortable home stay accommodation in rural areas. It also aimed at decongesting the existing tourist destinations by developing new tourist spots through providing basic infrastructure and services. The construction of hotels was restricted so that tourism activity could spread to places outside the already developed towns and popular tourist places. The State department of tourism has made available the approved Home Stay Units, on its website.

The State Government has launched the scheme in all the 12 districts of the State. The scheme generated interest and good response from the local community. The scheme has succeeded in bringing out tourists from the traditionally popular tourist destinations to newer and untapped locations which has enabled the Government to popularize new tourist destinations, and provide an alternative source of income to the rural households. The State Government has brought at "Himachal Pradesh Sustainable Tourism Policy" in the year 2013. It aims at sustainable growth not only of the tourism but all other Sectors simultaneously in the State. The policy framework is based on the good practice at national and international levels stakeholders' engagement, situation analysis, rapid destination diagnostics and participatory planning exercises. It aims at

ensuing green growth trajectory of the Tourism in Himachal Pradesh. The State Government is now in the process of revising the Tourism Policy to ensure sustainable development of tourism in the State.

5.2.10: Policy on Mandatory Rain Water Harvesting in Newly Constructed Buildings

The Government of Himachal Pradesh has introduced a policy on mandatory rain water harvesting structures in newly constructed buildings of the State. As per the Policy, all commercial and institutional buildings, tourist and industrial complexes, hotels etc., existing or coming up, with a plinth area of more than 1000 square metres are required to have rain water storage facilities. No objection certificates required under different statutes will not be issued to the owners of the new buildings, unless they produce satisfactory proof of compliance with the new law. Toilet flush systems will have to be connected to the rainwater storage tank. It has been recommended that the buildings will have rain water storage facility commensurate with the size of roof in the open and set back area of the plot at the rate of 0.24 ft per sq.mt of the roof area.

5.2.11: Policy on Afforestation

As per the afforestation policy of the Government of Himachal Pradesh, area under forest and tree cover will be expanded through systematic planning and implementation of afforestation and rehabilitation programmes in degraded and open forests and available non-forest lands. Regeneration of felled areas will be ensured in a time bound manner and productivity of plantations will be increased through the use of improved seeds and planting stock. Monoculture especially of chirpine will be discouraged and mixed plantations of broad leaved fodder, fuel wood and wild fruit species will be promoted. Wherever feasible, plantations would follow the multi-tier and multi-use afforestation and rehabilitation strategy.

The Government is formulating strategy to improve the condition of existing open forests (below 40 percent density) through multi–tier afforestation and rehabilitation programs. Assisted natural regeneration and participatory approaches are being adopted to ensure that the productivity of plantations is maximized with an objective to involve students and local communities in afforestation activities, new initiatives have been taken by the Government. Silviculture on pilot basis has also been started with the permission of the Apex Court on robustly scientific basis.

5.2.12: Natural Capital Accounting

Himachal Pradesh's natural capital is among the highest in the country. The State Government is developing a system of natural capital accounting, by means of the economic contribution of various resources can be analyzed, and ways could be devised to maximize their contribution. For example, forest accounts linked with tourism accounts can help inform Government policy on nature-based tourism.

5.2.13: Sustainable Plastic Waste Management Plan

While indiscriminate use of plastic and plastic littering is harmful for the environment as a whole; its impact can be even more devastating for the fragile ecosystem of the Himalayas. The Government of Himachal Pradesh enacted the Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995, to deal with the menace of plastic and other non-biodegradable waste. This Act embodied a move towards scientific disposal of non-biodegradable waste and also imposed a ban on coloured plastic carry bags produced from recycled plastic. However, the Act only addressed these issues partially, and the use of plastic used in packaging in certain goods and plastic littering continued to be a challenge.

Environmental problems thus persisted, including pollution of water bodies, lowering of soil quality, choking of drains and rivers and adverse impact on the health of the people. Aiming for a systematic approach to the issue, the Government of Himachal Pradesh introduced the Sustainable Plastic Waste Management Plan in 2009. The Plan focuses on controlling the use of plastic and developing a systematic disposal mechanism. In order to achieve the objectives of its Clean Himachal Pradesh and Healthy Himachal Pradesh drive, the Government also prohibited the use of plastic cups and plates in 2011 and conducted Information, Education and Communication (IEC) activities to generate awareness about the harmful impacts of plastic waste, and encouraged citizens to stop using plastic products.

This initiative aims to establish environment-friendly plastic waste disposal solutions. In the process it seeks to ban the use of plastic bags and plastic products, and reduce plastic littering across the State. Its aim was to adopt replicable and sustainable solutions for processing household waste in cement kilns and using plastic waste in road construction.

Further, in order to ensure sustainability and continued community participation, the initiative seeks to spread environmental awareness among the local population.

The Sustainable Plastic Waste Management Plan has been implemented by the Department of Environment, Science and Technology (DEST), Government of Himachal Pradesh.

5.2.14: Municipal Solid Waste (MSW) Management Policy

The Municipal Solid Waste (MSW) management is a complex issue for Urban Local Bodies (ULBs) but it is essential and important with respect to public health, environment, and the quality of life of the citizens. The MSW (Management and Handling) Rules 2000, warrant adoption of environment friendly and cost-effective MSW management. The issue of MSW management is becoming sensitive due to various factors such as increase in population, developmental activities, changes in socio-economic scenario and improved standard of living etc.

The objective of the strategy is to create waste free cities/towns and provide clean and pollution free environment in the urban areas of Himachal Pradesh. The strategy includes:

- Highest degree of community participation and community led management of MSW
- Segregation at source
- Waste to value through maximizing recycling
- Endeavour to achieve zero land fill status
- Scientific land fill
- Polluters to pay

5.2.15: Supplementary Initiatives

The World Bank and the Government of Himachal Pradesh signed a $100 million Development Policy Loan (DPL) contract in 2012 which helped the State in various initiatives such as developing roads, apple processing and marketing, hydropower projects and Mid-Himalayan Watershed Development Project. The second DPL of $100 million was signed by both the parties in 2014, with an aim to promote inclusive and sustainable growth in Himachal Pradesh. The main objective of this initiative is to encourage improved policies for hydropower development, enhanced watershed conservation by way of educating and empowering the communities, and promotes greener methods of industrial production and eco-tourism.

5.3 MAJOR DRIVERS OF ENVIRONMENTAL SUSTAINABLITY
(Practical Interventions in the Field/Case Studies)

5.3.1: Actions to Protect Climate Change

Forests of Himachal Pradesh known for their grandeur and splendour are the green pearl in the Himalayan crown. To protect this life supporting system from the impact of modern civilization, economic development and increasing human and cattle population, the State Government has taken various initiatives for further expansion of green cover in the State.

The State also has a rich forest cover with 67 per cent of the geographical area being legally classified as forest area. As per the Indian State of Forest Report 2015, released by the Indian Institute of Forest Surveys, Dehradun, an increase of 13 Square (sq.) kms. of forest land has been recorded in forest cover due to concerted efforts of the State Government along with active public participation in conservation and management of forest wealth. With the plantation work, the citizens of Himachal Pradesh have started receiving direct benefits from the same.

Himachal Pradesh has become the first State to receive carbon credits in Asia and had already received the first installment of Rs. 1.93 Crore and distributed amongst the stakeholders associated with plantation work and Panchayats.

The State has always shown commitment towards increasing the green cover. Numerous saplings of Arjun, Harad and Amla have been planted at Neras and a target of planting one crore saplings on 15,000 hectares of forest land by spending Rs. 150 crore was set during 2016-17. Supplementing the efforts of State Government, all schools and 3,000 youth clubs across the State have been participating in plantation drive on the eve of International Youth Day every year. Similarly, all the Government Institutions, NGOs and general public have been urged to come forward to participate in the plantation drive during the rainy season to make Himachal Pradesh a green State.

It may be noted in this context that an area of 17,429 hectares was brought under forest cover in year 2013-14 by spending Rs 1.66 Crore., 12,730 hectare in 2014-15 by spending Rs. 1.35 crore and 11,449 hectare of land was covered during 2015-16 at a cost of Rs. 1.22 crore. Besides, 45.30 lakh medicinal plants were planted in year 2013-14, 46.70 lakh plants in 2014-15 and 43 lakh plants in the year 2015-16.

During the plantation drive, plantation of broad leave trees, wild and medicinal herbs and plants was done so as to generate employment opportunities for the villagers. The State Government has formulated a strategy for the plantation of various species alongside the roads constructed under “Pradhan Mantri Gram Sadak Yojna” under which one lakh saplings of Shahtoot (Mulberry), Jamun (Jambolan), Saru (Cypress), Shisham, Spheda (Ceruse), Piple, Deodar and Neem had been planted by MGNREGS workers during 2016-17.

The maintenance period in plantation areas has been enhanced from three to five years and seven years under CAT plans so as to increase plant's survival percentage and RCC fencing is being encouraged for preventing deforestation. In order to provide relief to the farmers from lantana and other hazardous weeds, the State Government had set a target to make 5,000 hectare of land lantana free with an allocated budget of Rs. 5 crore during 2013-14, 10,000 hectare with a budget of Rs.16.48 crore during the year 2014-15 and to make 13,060 hectare land lantana free during the year 2015-16 at a cost of Rs.19.29

crore, and to utilise the land for fuel wood, fodder and water conservation works, so that the local people, stray cattles and Shepherds could get relief. During 2016-17, Rs. 16.07 crore provision was made to make 13000 hectare area lantana free and re-establishing the same.

Intensive forestry work had been started under Green India Mission in Mandi, Bilaspur, and Hamirpur and Kangra districts. Under the National Bamboo Mission for the development of species of bamboos in Nahan, Bilaspur, Mandi, Hamirpur and Kangra districts, Rs. 1.49 crore was spent in the year 2014-15 and Rs. 1.29 crore in 2015-16. Under this Mission, Rs 3.24 crore were spent during the 2016-17.

With the assistance of the National Medicinal Plant Board, five projects are successfully being implemented for the development of forest medicinal plants at a cost of Rs. 24 crore in Kangra, Una, Chamba, Kullu, Sirmour, Lahaul-Spiti and Kinnaur districts. "H.P. Forest Eco-System Climate Proofing," a German Development Bank project of Rs. 310 crore had been started in April, 2015 in Kangra and Chamba districts. The MoU has already been signed for a grant of 2 Million Euros under the German aided project, and the amount would be utilized for training programme of forest officials and development of local communities.

Protection of forest wealth and efforts for environment conservation could be successful only with the active participation of citizens. In this regard, it may be noted that more than 50,000 farmers in 602 villages of Himachal Pradesh raised multiple forest plantations on degraded public land in the mid and high hills under the community-led initiative and became eligible to share cash benefits of nearly Rs. 1.93 crore earned through carbon credits. This is the first installment of the apportioned carbon credits, which the State Government has received from the Government of Spain for implementing the climate change mitigation Project under the Kyoto Protocol.

Farmers and local communities have formed groups in their areas to raise forest and other plantations on the common village land and degraded forests as part of Clean Development Mechanism (CDM), which is a first of its kind project in India under the public sector and community driven initiative in this Hill State. It may be the first, even in Asia, to successfully link the CDM plantation work on the degraded land (in 600 to 1800 meter above sea level). The financial benefits are proposed to be directly passed on to the local communities and users group as incentive for improved natural resource management practices. The project is registered under CDM provisions and subsequently a purchase agreement was entered into with the Government of Spain through the World Bank for the sale of carbon credits. The forestry plantations on 3,204 hectares raised became eligible for the first cycle of carbon credits. The verification process for the first cycle was completed in November 2014 and reported to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2014. After acceptance, the World Bank has now agreed to release the payment amounting to US$ 3,11,514 against a stored and verified 65,582 Credited Emission Reductions (CERs). The Mid Himalayan Integrated Watershed Development Project authorities received formal confirmation and the project was expected to garner a total of 8,28,016 CERs in the project area over the first crediting period of 20 years with a total gain of Rs. 20 crore. The project will turn the villagers into strategic sellers of carbon credits, in response to global demand for CER. In addition, 343 person days/hectares of employment and an additional income of Rs. 3,000 per ha per year is expected to be generated during the project period.

While mid-Himalayan Project aimed to protect watersheds and livelihood enhancement, the bio-carbon sub-project will control Green House Gases (GHG) through reforestation to generate carbon revenue for the local communities. This combination has been able to provide multiple benefits to the poor farmers through

meeting their needs of small timber, firewood, minor forest produce along with carbon credits (as cash incentive), besides providing gainful employment.

There are few States in India where Governments have banned the use of plastic bags and smoking in outdoor public spaces, and where citizens and the State jointly enforce the ban, such as in Shimla, the capital of the State.

5.3.2: Rural Tourism & Tourist Home Stays

Himachal Pradesh Government is trying to cash in on a novel idea to beat the slump in the tourism sector since 2008. In order to attract visitors, the State had introduced "Himachal Pradesh Home Stay Scheme 2008", under which tourists visiting the State would be offered comfortable home stay accommodation in rural areas. The basic idea was to promote the State culture and help tourists in getting an experience of Himachal Pradesh customs and traditions. This was aimed not only to broaden the tourism base in Himachal Pradesh but also in taking tourism to the rural and interior areas of the State. Besides, the scheme is planned to help in decongesting the urban areas and to act as an economic multiplier for people in the rural areas. The directory of approved Home Stay Units is publicized by Tourism Department, Himachal Pradesh and the list is available on its website.
The basic idea is to provide clean and affordable accommodation to foreigners and domestic tourists alike, including an opportunity for foreign tourists to stay with Himachal Pradesh families and to experience Himachal Pradesh customs and traditions and relish authentic Indian/Himachal Pradesh cuisine. Home Stay Units, approved by Department of Tourism, H.P. have been publicized. A directory of all such approved establishments is available to enable domestic as well as foreign tourists to live in a homely environment and to take advantage of the scheme. In addition to this, efforts are also made to organize short term training in hospitality trade to those who would opt for such business. Home Stay Scheme is meant to:

- Extend the stake holder's base for tourism in the State
- Yield tourism to the rural and interior areas of the State
- Decongest the urban areas, which cannot support any further tourism load
- Provide employment and economic values in the remote areas
- Bring in ecologically sustainable activities

The table given below shows the number of tourists visited and stayed in 15 home stays of Kullu region and 10 from Shimla region which were surveyed during 2010 to 2013. There were 2-3 rooms in each home stay.

Table 5.1: Number of Tourists in Home Stays

Destination	No. of Units	No. of Rooms	No. Tourists in 2011	No. Tourists in 2012	No. Tourists in 2013
Kullu	15	42	18480	21012	24864
Shimla	10	30	8100	10800	14150

Source: Economic Development through Tourism-A Case Study of Home Stay Scheme of Himachal Pradesh, Hiramani Kashyap, Himachal Pradesh University, Shimla

As per the data given above, in 2011, 15 home stay units had accommodated 18,480 tourists in Kullu. In 2012, these units accommodated 21,012 tourists and there was an increase of 12.5 percent. In 2013, it was 24,864 with an increase of 15.49 percent. In Shimla the surveyed 10 Home Stay Units had accommodated 8,100 tourists in 2011. In 2012, they accommodated 10,800 tourists and there was an increase of 25 percent

over last year. In 2013, there were 14,150 tourists with an increase of 23.64 percent. It is clear that home stay units in Kullu and Shimla are getting adequate number of tourists and locals are getting good opportunities for earning. Upto 2016, this number of Home Stay Units and rooms in district Shimla and Kullu had increased to 304 (Home Stay Units) 850 (Rooms) and 341 (Home Stay Units) 972 (Rooms), respectively.

Home Stay Unit Scheme is a tool for development in remote rural areas. It is mandatory that all Home Stay Unit owners get their unit registered with the Government. The concessions in taxes for Home Stay Tourism Units in the rural areas has been granted to diversify the tourist flow from oversaturated areas to other areas and to give a boost to tourism as one of the means of livelihoods in rural areas of the State. Home stay units are the best options for the tourists to stay in rural areas and to cherish the unique beauty of local culture and cuisine. Home stays provide essential earning to the locals.

5.3.3 Cold Desert Sustainability

Himachal Pradesh has initiated an exercise to conserve the rare biodiversity spread over an area of 7,000 sq. kms. in the cold desert of the Spiti Valley with Central Assistance. Sanction to the tune of Rs. 5.12 crore ($ 838,000) was received and a comprehensive management action plan submitted by the wildlife wing of the State Forest Department to the Ministry of Environment and Forests Government of India. In the first phase, Rs. 81.48 lakh were sanctioned for fiscal 2014-15. The Forest Department is implementing the project by involving local committees, especially women representatives from the Gram Panchayats. Spiti in Lahaul & Spiti district, the Buddhist-dominated area in the Himalayan terrain at an elevation of 15,000 to 20,000 feet above sea level, is part of 16 biosphere reserves that have been designated in the country. It is the most isolated cold desert in the identified biosphere reserves.

The components of the plan include awareness and capacity building of local communities and staff, improving infrastructural facilities, habitat restoration, biodiversity conservation, socio-economic development through promotion of farm cultivation and animal husbandry, non-conventional energy and cultivation of medicinal plants.
The Pin Valley National Park and the Kibber Wildlife Sanctuary are also part of the biodiversity programme. The cold desert supports more than 500 herbaceous and scrub species, of which 118 are of valuable medicinal and aromatic values. The notable shrubby species include juniper, hippophae, myricaria, caragna, rosa, lonicera and ephedra. The high-value medicinal species are aconitum, podophyllum, swertia, rheum, thymus and picrorrhiza. The rare wildlife species are the snow leopard, the endangered and elusive wild cat, wolf, brown and black bear, blue sheep, ibex, Tibetan gazzle, red fox, weasel, marmot, griffon, lammergeyer, golden eagle and snow cock.

Another Central Government-funded project, the ‘Snow Leopard Protection Programme’ of Rs.5.15 crore, is also under way in the Spiti Valley, which lies on the State’s northern-most part and runs parallel to Tibet. The programme is taking care of the flora and fauna in the Snow Leopard zone. Studies by the Wildlife Department show the presence of seven to eight Snow Leopards per 100 sq. kms. in the Spiti Valley. The department is already monitoring the habitat, range and behaviour of Snow Leopards in the Valley through camera traps (automatic cameras) and satellite collars. The studies and research, part of the Snow Leopard protection programme, include dissemination of practices of biodiversity conservation, monitoring of glaciers receding and climate change. Through the support of local committees in taking decisions, the forest department would endeavour to achieve the plan objectives of holistic development of the area. The training and capacity building components target staff officials, other department officials and

members of the local community and make them partners in its implementation. It may be noted that Lahaul & Spiti are inhabited mainly by Buddhists, who breed sheep and goats.

5.3.4: Use of Plastic Waste for Road Construction

The Himachal Pradesh Government has come up with a novel way of paving roads using plastic waste. As of now, all the divisions of the Public Works Department (PWD) are either using plastic for roads or home used. The State has been able to make use of this non-bio degradable waste which otherwise pollutes the environment. These roads are stronger and last longer, besides being cheaper than bitumen.

Plastic waste is shredded by a simple machine and then heated up to 160 degree centigrade after which it is used to pave roads. Himachal Pradesh is one of the first State in the country to ban the use of plastic, and has also banned the use of disposable plastic plates and cups.

The Sustainable Plastic Waste Management Plan was launched by the Government of Himachal Pradesh in 2009 to systematically and aggressively deal with the environmental threat emanating from non-biodegradable waste. The ban on the use of plastic in Himachal Pradesh has proven to be both effective and successful in developing a system of disposing of plastic and using it in construction of roads, thus making the State of Himachal Pradesh free from plastic.

The plan had a huge impact on generating awareness and securing people's cooperation and has encouraged people to take up the responsibility of cleaning their State and creating a plastic-free world. The Government has started processing plastic waste from the (ULBs), PRIs and bin pickers for using it for surfacing of roads.

Impact

Cleaner environment and reuse of waste plastic for roads: The ban on plastics and the systematic waste recycling model have not only ensured cleaner surroundings and contributed to environmental conservation but also supported infrastructure development through road construction. The institutional mechanism for collection, transportation and utilization of plastic waste has become functional and has been adopted across the State.

Key Challenges

Community interest and involvement is of paramount importance when it comes to successful implementation of any environmental initiative. Prior to the launch of the Sustainable Plastic Waste Management Plan, plastic carry bags and products were thought to be convenient and had become part of everyday life. In fact, during the initial stage of the project, people did not show much interest in waste management and plastic disposal. Convincing them about the harmful environmental impacts of plastic proved to be a challenging task. Many campaigns and IEC activities were undertaken to help create awareness that encouraged citizens to participate in the drive. Under-performance at the lower level of administration was another key problem. It resulted in disruption of activities planned as part of the campaign. Poor coordination and monitoring at the district level (in terms of campaign-related events, performance monitoring, training, capacity building and awareness generation) also hindered the initiative in its initial stages. Moreover, the non-availability of shredding machines in many districts delayed implementation. However, concerted efforts, teaming up of resources of different departments and agencies and motivation of the community brought success to the initiative. Accomplishments on this front have gone a long way in making Himachal Pradesh a cleaner, plastic-free State and reducing the health and

environmental hazards that threatened the State before the implementation of the Sustainable Plastic Waste Management Plan.

Replicability and Sustainability

The strength of the Sustainable Plastic Waste Management Plan lies in its ability to effectively bring together Government resources and community participation for long-term implementation and continuance. The environmentally sound technique of using plastic waste in road construction recommended and implemented under this Plan is sustainable and is worth replication in States across the country. Himachal Pradesh's success and the cost effectiveness of the model have inspired and attracted States such as Rajasthan, Jammu and Kashmir and Maharashtra to adopt the Plan. In Himachal Pradesh itself, the initiative has been gradually scaled up. To further increase the effectiveness and sustainability of the initiative, the State Government has imposed a ban on plastic cups/glasses and established institutional mechanisms to control the inflow of plastic from outside the State.

Thus, the Sustainable Plastic Waste Management Plan is an innovative and simple yet highly effective solution that has not only alerted the community about the menace of plastic and the need for sustained waste management practices, but also set up a robust mechanism for its achievement. The project was implemented throughout the State without any additional financial provisions, which is an indication of its financial viability. The convergence of various departments and utilization of existing resources has helped shape a high-impact initiative with limited resources.

5.3.5 CFL as Protector of Energy Usage

The Himachal Pradesh Government had launched a scheme, "Atal Bijli Bachat Yojna" in Kullu under which free eco-friendly Compact Fluorescent Lamps (CFLs) were distributed to domestic consumers. Under this scheme, four free bulbs were handed over to every domestic consumer of Dhalpur village in Kullu.

The scheme is described to be a noble effort and envisages huge saving of electricity besides earning additional income through power trading and carbon credits. The scheme was entered to the extended to the entire State helping domestic consumers in replacement of conventional incandescent lamps.

Every consumer were given four CFLs, two 15 watt and two 20 watt, free of cost as a replacement for two 60 watts and two 100 watts incandescent lamps to encourage the use of eco-friendly domestic lighting. In case any CFL turns out to be defective within one and half year of installation, it would be replaced free of cost. The scheme has approximately contributed towards saving 270 million units of energy every year. A new scheme 'UJALA' was started in place of old scheme and Himachal Pradesh Government has also launched this scheme allowing distribution of LED bulbs as a part of an initiative to promote energy saving.

5.3.6: Promotion of Wind Energy as a renewable source of energy:

Studies have found that the middle and higher elevation zone in Himachal Pradesh have relatively higher wind speeds compared to lower tropical zones, which are favourable for small wind technologies like agricultural water pumps, wind-photovoltaic hybrids, space/water heaters etc. which might help in meeting part of the energy demand sustainably. There is sufficient unexploited wind resource potential available in the hilly region which needs to be tapped for small decentralized power generation in the State. Twelve sites were identified in the past for setting up of wind energy plants in Kullu, Chamba, Kinnaur, Lahaul & Spiti and Shimla districts. The Himachal Pradesh State Electricity Board Ltd. had proposed to install a hybrid power plant of 2.5 MWp or megawatt peak at Rangrik in Kaza in the Spiti Valley. The project will

have 2 MWp solar PV installation and wind turbines of cumulative capacity of 500 KWp. However, the execution is slow. This can be one of the areas where the State can take lead.

5.3.7: Promotion of Solar Energy as a Renewable Source of Energy:

In its effort to boost the use of solar power, the State Government has installed solar street lights in different panchayats of the State. Solar lanterns have been distributed to shepherds in the State and also to the flood-affected areas in Kinnaur district free of cost. Solar plants have been installed in District Collectorates and solar photovoltaic power plants have been installed in police stations and posts.

Apart from this, dish type solar cookers are being distributed and solar water heating systems are also being installed at substantial subsidy. All the Government buildings are being provided roof top solar panels for energizing them with solar power. The domestic roof top solar panels with their connectivity with the power grid are also being encouraged at a subsidized cost.

5.3.8: Promotion of E-vehicles:

The Himachal Pradesh Government, in order to provide a sustainable and environment-friendly public transit system and to encourage the use of Electric Vehicles, has exempted electric vehicles from payment of token tax and registration fee. The State is also introducing lithium ion-powered buses in a phased manner and has become the first State to introduce zero-emission electric buses in the country.

5.3.9: Promotion of Micro-Irrigation for efficient use of water:

Himachal Pradesh Government will soon be completing implementation of a scheme to set up 4,700 poly houses and 2150 drip irrigation or sprinkler units for which Rs. 111.19 crore were allocated. Under the scheme, 85 percent subsidy is being provided to the farmers to set up poly houses and drip or sprinkler irrigation units. An area of 8.35 lakh hectare area would be brought under poly house farming while 8.20 lakh hectares of area would be covered under micro-irrigation.

The State Government has also launched a Micro-Irrigation Scheme with an outlay of Rs. 154 crore over a period of four years. Through this project, 8,500 hectare area would be brought under drip or sprinkler irrigation scheme thereby benefitting 14,000 farmers.

5.3.10: Open Defecation Free (ODF) State

Himachal Pradesh has recently been declared Open Defecation Free (ODF), making it the second State in the country after Sikkim, to achieve this feat. The availability of toilets by households in the State has increased from almost negligible provision back in the 1970s to 100 percent now.

5.3.11: Garbage Collection in Urban Areas

There are total 54 ULBs and 7 cantonment boards with a total of about 7 lakh population in the State of Himachal Pradesh. Though no serious effort has so far been made in the State to assess either the quantity or quality of the waste being generated in the State, some efforts on waste audit have been made by the Indo-German Environment Partnership for Shimla and Manali. Quality and quantity of waste generated in the State does not remain the same through all seasons but it shows steep variation during different seasons due to massive floating population the State receives due to the tourism sector.

There is no standard system of waste collection in the ULBs all over the State. Some ULBs, during the recent years have started household level collection of waste but it is in un-segregated form some initiatives

to segregate waste at the household level have been taken, however enforcement is an issue. Others collect the waste by placing big iron dust bins all over the towns. The ULBs have placed the big dustbins (Dumpers) at different locations without assessing the need, or carrying out any survey to identify the quantum of waste generation in different waste generating sources. As a result, some people use the dust bins to dispose off their waste but in other cases where waste bins/dumpers are away from their location, they dispose off the waste at un-notified locations keeping in view their convenience. In fact the location of these dust bins have been found to be the dirtiest places in the town. Since the inhabitants have not been told about the use of these bins and there is no notice/sign board on or near the dust bins indicating the norms for their use, they tend to dispose off both biodegradable and non-biodegradable waste in the same bins, without segregating.

The steps being taken for garbage collection and management

The State of Himachal Pradesh now preparing to adopt the latest technology for waste collection and underground waste bins have been placed in such a fashion that no person in the town has to walk for more than 100 metre to find a waste bin. It is ensured through effective community mobilization that people dispose of segregated biodegradable waste in the waste bin meant for it. It may be noted that the underground waste bin technology regarded as the latest State of the Art Technology in the world over, which is being adopted in Himachal Pradesh. The provision of underground waste bins will make it convenient for the community to dispose off their waste as per their own convenience and it would save the waste from being littered by stray animals.

The Government has taken steps to ensure that the waste gets recycled or used in road construction or is destroyed in kiln of cement factories established in the State. For this purpose, the Government has municipal workers have been trained to use plastic waste in road construction and coordinate with cement factories. The contact has already been established with cement factories and ACC alone has the capacity to burn 90 Tons of waste per month. Partnership has already been established with ACC Barmana and it is ready to take the polythene/plastic waste from the municipalities to burn it in the kiln as part of Corporate Social Responsibility (CSR).

For managing non-biodegradable waste (Other than Polythene), unique steps are being taken. This type of waste is being managed by, rag-pickers but since there is no organized system to collect the waste from households, less than 50 percent of the waste goes to “Kabaris”. Rest of the non-biodegradable waste goes to un-notified dumping sites selected by the community on its own, or dust bins or mixed with other waste and sent to dumping sites. The rag-pickers then collect the waste from chosen locations.

Strong partnership is planned with Kabaris, who will be equipped to collect all types of non-biodegradable waste from the source in a strategic manner. This could lead to a win-win situation for both; Kabaris and Municipality.

A special yard/environment depot has been planned to be established in all the municipalities and all kabaris shall be allotted adequate space in the yard to collect and store their waste. No kabari is allowed to litter the collected/stored waste at any location other than the space provided to them in the environment depot. The Government will purchase the waste from the bin pickers and also from the local bodies for its use in paving roads.

Kabaris are not allowed to collect or store their waste anywhere else in the town.

Deploying appropriate MSW utilization/processing/recycling technology depends on the physio-chemical characterization of the municipal solid waste. In view of this, the Directorate of Urban Development, Government of Himachal Pradesh has initiated a project and approached National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur in January, 2015 to establish physio-chemical

characterization data of the municipal solid waste samples in different seasons (Winter and Summer) at three dump sites located at Shimla, Mandi/ Sunder Nagar and Dharamshala.
The Sanitary Land-filling would be required, since 100 percent waste recycling is not possible in Himachal Pradesh. The Landfill capping, landscaping is being explored through the Trisoplast® technology (a patented technology offered by Trisoplast Mineral Liners International BV of The Netherlands), through the innovative mineral barrier for environmental protection and waterproofing.

Since the entire MSW system is to be aligned through community ownership, user charges are planned to be levied on each and every household/establishment generating waste. Past experience in few towns of the State where door-to-door collection of waste was undertaken and commitments made by the community during community mobilisation campaign in Sunder Nagar has established that people are enthusiastic to pay for waste disposal and are keen to see proper MSW system functional in their towns.

Himachal Pradesh is a hilly State, with very small and scattered towns. Therefore, town-wise MSW Plants may not be financially viable. Hence, cluster approach may be adopted which will be financially viable for the PPP Mode. Two pilot projects have already been initiated in two clusters namely; Dharamshala cluster (comprising of Dharamshala, Kangra, Palampur, Nagrota Bagwan, Jawalaji and Dehra) and Sunder Nagar cluster (comprising of Sunder Nagar, Ner Chowk, Mandi and Riwalsar). Based upon the results of these two pilot projects, rest of the ULBs too would be organised into clusters to achieve good results.

The State would, on the other hand, is keen to adopt an innovative approach to involve Gram Panchayats located in peri-urban areas too as these Panchayats are already reliant on ULBs for their waste management. These Gram Panchayats would be allowed to participate/join in the cluster through contribution of the resources available with them. Besides, efforts are on to arrange the gap funding from CSR (Corporate Social Responsibility) sources from industries located in the cluster areas.

Suggestions for further Improvement:

- As of now, there is no clarity on the type, quantum and quality of the waste being generated by different sources i.e.; households, offices, institutions, commercial establishments, dhabas, restaurants etc. So, waste audit should be undertaken.
- Bio-degradable waste has the potential of generating income through composting, biogas or any other product such as electricity through incineration. If this waste is collected in a segregated form.
- Though Himachal Pradesh has banned polythene, there still is ample plastic waste that is generated due to the sale of items with plastic packaging. This waste when mixed with bio-degradable or non-bio-degradable waste renders this waste non-recyclable. Therefore, there is a need to collect this waste in segregated form.

CHAPTER VI

GREEN GROWTH ISSUES AND CHALLENGES IN HIMACHAL PRADESH

6.1: INTRODUCTION

The importance of Himachal Pradesh in India's sustainable development is undisputed. With its rich flora and fauna and dense forests, the State is vital in terms of providing ecosystem services to the rest of the country. The State's economy has undergone a sea change from being one of the most backward States to a leader in hill region development. However, its geographical location in the Himalayan region makes it ecologically fragile and vulnerable to climate change. The State faces many issues and challenges in its endeavour to promote green growths, which are enumerated below;

6.2: GREEN GROWTH ISSUES IN HIMACHAL PRADESH

6.2.1: Agriculture

- The ratio of net cultivated area in the State to the total geographical area saw a steep fall from 19.07 percent in 1972-73 to 11.81 percent in 2015-16. This could be owing to the inconsistent climatic conditions because of which a large number of farmers have taken up non-agricultural work, leaving their lands uncultivated, which subsequently has resulted in the degradation of land over a period of time. Irregular rainfall and the lack of water resources have resulted in low agricultural and horticultural productivity and crop failures, in an otherwise agriculturally rich State.

- There has been a significant decline in the contribution of the primary sector in the State GDP, with a decline from 58.56 percent in 1970–71 to about 14 percent in 2017-18. However, the proportion of the working population engaged in agriculture (as cultivators or agricultural labourers) has not shown a commensurate decline.

- Altough the contribution of the primary sector to the GSDP has declined, but more than 55 percent of the working population is dependent on this sector for livelihood. This indicates that while there has been a transition from an agrarian economy to an economy with greater contribution from the tertiary and secondary sector, a significant proportion of the population remains dependent on the primary sector as an occupational choice. This indicates to the low productivity of agriculture in the State. Ensuring the viability of agriculture as a feasible livelihood option is a challenge faced by the policy makers of the State.

6.2.2: Industry

- The industrial sector is one of the major consumers of energy. Within energy sector, cement sector is a significant energy consumer. GHG emissions from Industrial sector were about 5.57 million tons of CO_2 in 2012, which needs to be addressed.
    - The major challenge the industrial sector is facing is the lack of awareness on Energy Efficient (EE) technologies/practices.

- The capacity of unit level workers in different industries (especially MSME) to use/deploy EE technology is limited.
- There exist limited channels of communication between MSMEs, technology providers and FIs.

6.2.3: Building

- Himachal Pradesh lags behind in the concept of 'Green Building'. The building sector in the State has become a source of revenue generation, laying very limited emphasis on sustainability. Energy consumption in building accounts for over 30 percent of electrical energy consumption in the country, and is rising annually at 8 percent.
- At the planning level, the State has drafted regulations for integrated townships, wherever there is no master plan/development plan. Slope protection, water, waste water management, storm water management, and solid waste management are increasingly important. However, despite of the appropriate legal framework, the sector faces several barriers in greening the building sector.
- The existing capacity of the local authorities to monitor the implementation of the State Energy Conservation Building Code (ECBC) is inadequate.
- Lack of knowledge amongst practitioners, architects, engineers, service providers to facilitate green growth changes in the State.

6.2.4: Transport

- Lack of adequate road connectivity and accessibility particularly to far-flung areas in the higher reaches of mountainous districts is a major challenge in the State.
- With the majority of roads being single lane and with increasing vehicle density (particularly private vehicles), the existing road network in the State faces capacity issues causing traffic congestion. As a result, problems of heavy traffic jams, pollution, loss in productivity, etc., are becoming increasingly evident.
- Lack of adequate transport adversely affects movement of passengers, agricultural and horticultural products and thereby the overall economic growth.
- Heavy inflow of tourists and tourist vehicles into the State further puts pressure on the road network. Nearly 0.2 million vehicles enter the State during tourist season, that lasts for almost nine months each year.

6.2.5: Energy

- GHG emission from the Energy Sector is around 5.15 million tons, which is about 47.29 percent of the total GHG emissions.
- Energy sector emitted 5.15 million tons of CO_2, of which 2.756 million tons of CO_2 was emitted from electricity consumption in Industrial, Commercial and Institutional sectors and 1.405 million tons emitted by energy consumption in the Residential sector.
- Out of the total energy consumption in the State, Industrial consumption accounts for around 60 percent, domestic 22 percent while the agricultural sector accounts for only 7 percent.

- It has been predicted that the demand and energy requirements in the State are expected to increase by two and half times in the next 15 years. This would give rise to increased GHG increased emissions.
- The State has a very high hydro power potential, and is leaving no stone unturned to achieve this potential. However, in doing so, it runs the risk of triggering impending calamities that stem from over-exploitation of land for construction of multiple small hydro power projects. The State is vulnerable to disasters, and has faced nature's ire in the form of landslides and floods in recent times. To make matters worse, Himachal Pradesh falls in seismic zones 4 and 5 – a region classified as highly vulnerable to high-intensity quakes. The Government has been in favour of constructing large-scale dams, but has been faced with steady opposition from the local inhabitants and social activists. In March 2015, a massive landslide triggered by heavy rains damaged the Saal hydropower project in Chamba district. The landslide caused the entire hill to break away, leading to more than 80 percent damage. Similar calamities have occurred in other parts of the State, damaging livelihood, cattle and houses of thousands of people.
- Role of technology in the provision of low cost energy alternatives also needs to be considered while making investment decisions in the energy sector.

6.2.6: Renewable Energy

- Though renewable energy sources can produce electricity below the cost of fossil-fuel based power stations, this sector has not been exploited to the fullest potential. The main issues faced by this sector are as follows;
- Role of technology in the provision of low cost energy alternatives also needs to be considered while making investment decisions in the energy sector.
- Displacement is a problem, affecting wind, solar and the small hydro sector. Lack of adequate facilities for displacement of the local inhabitants from the project areas, has led to scaling back the commissioning and partial commissioning of new projects, thereby reducing power generation during peak periods. This issue is limiting the development of small hydro projects and solar development in the remote areas of Himachal Pradesh.

  Also the banks and financial institutions are cautious in lending for renewable energy (RE) projects, given the poor state of displacement measures.

- Himachal Pradesh has adopted a single window project approval and clearance system for renewable energy. However, that is not effective enough.

- The credibility of the distribution companies is a critical issue and plays a key role in determining the dependability of a Power Purchase Agreement. In Himachal Pradesh, a very few DISCOMS are in good financial condition. When DISCOMS have poor financial health, the risk of off-taker default and delayed payments is high. Weak financial strength of DISCOMS is also affecting the implementation of instruments that have been put in place for deployment of renewables, such as the renewable purchase obligations.

6.2.7: Air Pollution

- Particulate matter (PM10) is above the annual average standard of 60 $\mu g/m^3$ in all the cities (wherever monitoring stations have been set up) of Himachal Pradesh. ™
- Household Fuel: Most of the households in the rural areas of Himachal Pradesh depend on traditional sources of energy like fuel wood, dung and crop residue for cooking and heating.

Burning of traditional fuel produces large quantities of CO_2 on complete combustion, but in case of incomplete combustion and oxidation, Carbon Monoxide is produced, in addition to hydrocarbons, degrading the quality of air as a result.

- Industries: Industrial emissions are a major concern to the State. These emissions can either be solid particles or gaseous emissions, containing toxic pollutants. The high concentration of atmospheric particles over widespread urban and industrial areas can have dangerous effects on the biosphere and general surroundings. The presence of harmful pollutants in the soil affects the plants, cattle and livestock by way of low yield of milk, sickness and poor agricultural produce. It has also been known to cause severe health damage to people, since it contains potentially carcinogenic substances similar to those that are present in cigarette smoke, causing respiratory problems, lung infection, bronchitis, heart problems etc.

- Transport: Vehicles are another major source of air pollution in the State. They emit harmful pollutants such as Carbon Monoxide, Hydrocarbons, Nitrogen Oxides, Sulphur dioxide and toxic substances like TSP and lead. Vehicular pollution is even more serious in Himachal Pradesh owing to certain factors:
  - Poor quality vehicles producing more particulates and burning fuel inefficiently
  - Low quality fuels producing greater amount of pollutants
  - Concentration of motor vehicles in a few large cities

- Construction: Construction activities related to roads, bridges, buildings etc. contribute to air pollution to a large extent, since they are in many cases carried out in an unplanned manner with mismanaged debris. The construction industry is one of the major sources of pollutants, due to lack of awareness of sustainable practices.

6.2.8: Water Scarcity and Pollution

- The availability of water is highly uneven in Himachal Pradesh, with some parts becoming water stressed. This phenomenon may rise considerably due to a combination of factors such as, climate change causing the escalation of water crisis and occurrences of water-related disasters, i.e. floods, erosion and increased droughts etc. the growing population and the increased demand for water to support modern lifestyle, raises the possibility of intensifying water conflicts among different user groups is high. Water requirement in the State is projected to rise by 14 percent by 2020. In addition, there is unjust distribution and lack of a coordinated perspective in planning, management and utilisation of water resources.

- Growing pollution of water sources, especially through industrial effluents, is affecting the availability of safe water besides causing environmental and health hazards. In some parts of the State, stretches of rivers are heavily polluted and devoid of flows to support aquatic ecology. Inadequate sanitation and lack of sewage treatment are also adding to the growing pollution crisis.

- Service delivery of water supply and sanitation schemes in both rural and urban areas is low and cost recovery is negligible.

6.2.9: Forests:

- The forests in Himachal Pradesh are under great stress due to the combined impact of globalisation, economic development and growth in human and cattle population. The open forests which constitute 35 percent of Himachal Pradesh's forest cover have undergone large scale degradation as a result of the over-exploitation of wood, fodder, timber and non-timber forest products (NTFPs). The flora and fauna are increasingly becoming endangered due to interference with their habitat, which in a lot of cases is lost altogether.
- Himachal Pradesh is contributing to the achievement of National Biodiversity Targets but at the State level, there is no mechanism to quantify the contribution being made by the State to the national efforts. In the absence of quantification, the State may lose the opportunity to bridge the gap in achieving the final outcome.

6.2.10: Environmental Distress and Climate Change

- With high dependence of the economy and livelihood on natural resources and ecologically fragile ecosystems, Himachal Pradesh is highly vulnerable to climate change. The State has been facing environmental problems such as deforestation, landslides, land degradation and desertification, which further are adding to the vulnerability of the State. According to the State Action Plan on Climate Change (SAPCC), financial constraints and limited resources have aggravated the environmental challenges being faced by the State.

- Water resources have also been facing the impact of climate change. The three major rivers of the State, Chenab, Beas and Ravi originate from glaciers, and spatial imageries show that there has been an overall reduction in the glaciated area in the State. This rise in glacial melting would lead to increase in the water level of the rivers, thereby increasing the likelihood of floods in flood-free areas and also the severity and duration of floods in currently flood-prone areas.

- Forests are being adversely impacted resulting in the shifting of the tree line to higher altitudes and movement of pine species to higher altitudes. The rural livelihoods dependent on forests for wood, fodder and Non-Timber Forest Products (NTFPs) would be adversely impacted if current trends continue.

- With high dependence of economy and livelihoods on natural resources and ecologically fragile ecosystems, Himachal Pradesh is highly vulnerable to climate change. The State has been facing environmental issues, such as deforestation, landslides, land degradation, and desertification which have added to the vulnerability of the State.

6.2.11: Waste Management

- Managing waste is a great challenge for the State. The bottle neck at source due to lack of segregation is a major hurdle.

- The towns in Himachal Pradesh are small and remotely located. Establishing waste-to-energy facilities for each town individually would require huge investment and is financially unviable.

Developing a regional waste treatment facility is a possible solution to this problem, but in Himachal Pradesh the towns are located at a distance from each other and transporting waste on hilly terrain would be a challenge.

- Getting the most credible waste inventory data is a problem. In absence of dynamic waste inventory, long-term planning for waste management becomes difficult.

6.3: CONCLUDING REMARKS

Himachal Pradesh, despite being a State rich in natural resources is facing a high risk of depletion of its resources, owing to anthropogenic actions. The increase in the demand for electricity, forest produce, bio fuel and agricultural produce has led to exploitation of natural habitats and vegetation, much beyond the advisable level.

The State must undertake independent assessment of all the hydropower projects of the State and technological advancements in the field of non- conventional sources of energy may also be considered while making investment decisions in energy sector. If the Government continues with the same policy, it may be preparing itself for a bigger disaster than that of the 2013 Uttarakhand disaster.

CHAPTER VII

SUGGESTIONS AND RECOMMENDATIONS FOR SUSTAINABLE GREEN GROWTH IN HIMACHAL PRADESH

7.1: INTRODUCTION

Himachal Pradesh faces a high risk of climate change, which poses a direct threat to its vast reserves of natural resources as well as to its inhabitants. The Himachal Pradesh Government formulated the State Action Plan on Climate Change (SAPCC) in 2012, as part of the National Action Plan on Climate Change (NAPCC). Owing to the State's ecological fragility, the effects of climate change have the greatest impact on agricultural production, forests, water resources etc, and the State has been facing environmental issues such as deforestation, landslides, land degradation and desertification, thus, adding to the already existing vulnerability. The lack of knowledge and inadequate resources further aggravate the challenges owing to environmental issues.

7.2: SUGGESTIONS AND RECOMMENDATIONS

7.2.1: Agriculture

- For the economic well-being of a vast majority of the population that depends on agriculture and allied activities for its living in the State, intensification and diversification of agriculture is required. A shift of the agricultural workforce to non-farm employment is essential for reducing the pressure on agricultural land, as nearly two-thirds of the landholdings in the State are smaller than one hectare each and hence are not economically liable.
- Emphasis must be laid on raising agricultural productivity and adding value to agricultural produce through necessary processing.
- The scope for organic farming is immense, as the use of fertilizers and pesticides is already low in the State.
- Since agricultural produce is highly perishable, its prices fluctuate widely from time to time. Therefore, appropriate technologies need to be promoted to preserve the freshness of fruits like apples etc.
- There should be laws related to land use so that the incidence of degradation of agricultural land along with the shifting of agricultural land to non-agricultural uses could be checked.
- Demonstration and effective dissemination of improved farm technology that maintains a balanced use and conservation of mountain resources such as micro-propagation, drip irrigation, greenhouse cultivation, plastic mulching, fertigation, use of bio-fertilizer and bio-control agents, vermi-culture, and organic farming need to be promoted.
- Cultivation of crops in line with soil fertility status in different agro-climatic zones, as per their suitability, must to be adopted.
- Awareness campaigns to educate farmers for promotion of bio-pesticides, organic farming, integrated pest management technology, and soil conservation measure.

7.2.2: Forests

- In Himachal Pradesh forests are a wealth whose value lies primarily in preserving and utilizing for ensuring the ecological well-being of the entire North-Western region.

- Restoring degraded forests through natural regeneration where possible and mixed plantation of local species/varieties, such as Oak, Deodar, Kharsu, Kail, and Walnut can be undertaken.
- The productivity of planting material can be increased manifold by using superior planting stock raised through tree breeding programmes, as well as through clonal technology and tissue culture.
- Forestry Sector of Himachal Pradesh has enormous scope for establishing and promoting forestry enterprises. There are various NTFPs viz. seeds from horse chest nuts, Deodar and Kail cones, Katha from Acacia catechu, wild fruits like Berberis and herbs like Dhoop, Patish, and Dioscorea.
- Medicinal plant-based enterprises have huge untapped potential in the State. The State's annual current trade is minuscule compared to world trade of US$ 1.03 billion, considering the fact that the State has more than 800 species for medicinal use.
- Community based afforestation schemes to be made more effective. This will help in protecting the saplings and checking of forest fires, which are quite a frequent menace in the State.
- Road construction inevitably depletes forest cover. To minimize such damage, it is desirable to construct roads passing protected forest area, under the supervision of the Forest Department.
- 'The Watershed Development' strategy has demonstrated itself as the most effective measure for the promotion of forestry. However, a more focused outcome based implementation from work through conveyance is required.
- To prevent individual encroachments on forest land and to inform the administration when noticed.
- Developing efficient fire detection and management system is another very important measure. The State Forest Department can work with the National Remote Sensing Agency for operationalising this. Ensuring proper sanitation measures to prevent incidence of fire is also very crucial.
- Local community involvement is also important, both in preventing fires by ensuring that accidental combustion does not take place by creating a stake in removing combustible material where feasible; and also in detecting and dealing with natural fires at an early stage.
- Climate mitigation and adaptation measures need to be built into the working plan of the State Forest Department. At the same time, the Forest Department must be educated of the vulnerability of forest ecosystems.
- Himachal Pradesh has responded proactively to the need for protecting its biodiversity, by formulating desired policies and setting targets to achieve the objectives. However, there is a need to assess the capacity of the staff to undertake the desired activities.
- There could be three major areas where the State can immediately develop a collaborative research programme with national and international agencies, viz., valuation of ecosystem services, identification of threatened flora and fauna, and sustainable and equitable utilization of biodiversity.

7.2.3: Industry

There are three factors to be considered for ensuring success of the Industrial Sector in the State:

- The first is to identify the industries which are cost effective and employment generating. Fruit processing in Sirmaur district, agricultural implements in Kangra district, shawl weaving in Kullu district and wooden products in Mandi district are possible areas.
- The second imperative is identification of optimal locations for industrial parks/ clusters for the promotion of small-scale industry, particularly in the inner districts. These clusters must offer training and marketing facilities, in addition to State-of-the-Art infrastructure.
- The third imperative hinges around the issue of encouraging the local entrepreneurs to invest in the industrial sector.

- The State Government should promote energy audits in the industries (including MSMEs) to identify the energy saving areas.
- The concept of 'designated consumers', as in large industries, should be extended to micro, small and medium enterprises (MSMEs). High energy intensive clusters should be classified as 'designated clusters' and 'cluster level programmes' should be implemented for them.
- The State industries (particularly cement) should explore fuel switch. Energy efficient lighting, energy efficient equipment such as IE motors, air compressors and pumps to reap savings of about 10–15 per cent.
- In the long run, innovation would be crucial. The Government needs to set up more 'incubation centres' and incentivize cluster level fabricators to develop local low cost technological solutions in collaboration with the private sector. Public-Private Participation is required for Research, Development, Demonstration, and Deployment for clean technologies in the MSME sector to invest in cost-effective technological solutions customized to local conditions.
- Blended cement can be manufactured from industrial wastes.
- Biomass can also be utilized during clinker burning process. Various substitute fuels need to be explored, depending on their availability in the State.

7.2.4: Building

- At the planning level, the State has drafted regulations for integrated townships. Therefore, appropriate steps should be taken towards it and for greening the building sector.
- Energy efficient green buildings must be built, keeping in mind the environmental benefits of these designs. Wastewater management, sewage treatment, slope protection, solid waste management and passive solar building designs are important measures to ensure the greening process. Solar buildings consume less water, make efficient use of energy, conserve natural resources, generate less waste and provide healthier spaces, when compared to conventional buildings.
- The regulatory frameworks for implementation of Himachal Pradesh Energy Conservation Building Code(ECBC) and its subsequent integration in the building bye-laws and specifications of materials/rates in the State public works department is yet to be done.
- The existing capacities of the local authorities to monitor the implementation of the State Energy Conservation Building Code (ECBC) are to be improved. Thus a simplified, robust framework needs to be built in order to achieve the targets as defined in the Environment Master Plan 2013 and the State Action Plan on Climate Change.
- Incorporation of green/energy efficiency features in municipal bye-laws and all related documents followed by the State Government.
- Promotion of vernacular architecture in the rural and less urbanized areas.
- Need to integrate the principles of low-impact development (such as sustainable urban drainage systems, erosion control, development conducive to slopes, green cover, application of renewable energy, etc.) at all zonal plans, neighborhood plans (new and retrofit) on a priority basis in more vulnerable areas. To begin with, a few pilot areas in the State could be taken up for implementation.

7.2.5: Transport

- Given the dominant role of the road sector, the State Government should give priority to expansion of the roads network.
- Apart from construction of new roads, straightening the curves of the existing ones is also necessary. This is with special reference to the busy corridors such as; Shimla-Dharamshala, Bilaspur-Kullu and Kalka-Shimla. This will reduce transportation cost to a great extent, while saving time and fuel.
- There is also need for ensuring maintenance of the roads.
- Though the railways play a small role in the State, yet the existing rail-routes of Kalka-Shimla (96 kms.) and Pathankot-Jogindernagar (113 kms.) can be further developed for heritage tourism in collaboration with the Central Government. The same could be carried out for Nangal Dam-Una (16 kms.) rail route, which could fetch large revenue earnings.
- Ropeways can be laid over for carriage of goods. These have a special significance for areas specializing in horticulture. Efforts must be geared towards bringing the produce from remote areas to convenient transit points on the main routes. A well designed multi-modal scheme, combining ropeways, road and rail transports can effectively serve both the economy and people of the State.
- Public transport networks should be further strengthened. For this purpose, the use of electric vehicles can be explored for local urban transportation, wherever the terrain permits.
- Use of electric mobility will have the twin benefits of reducing local emissions and also replacing diesel with clean hydro power.

7.2.6: Energy

- Despite the low cost of power generation, the actual cost of electricity per unit is high primarily due to excessive distribution cost. A desired way out is to raise manpower efficiency through additional power generation with the same number of employees and rationalization of the distribution system.
- Special focus must be on the promotion of Energy Efficient (EE) appliances in domestic households, street lightings, government and private establishments, and water pumping needs in agriculture sector.
- Provide regulatory support to small hydro power projects in terms of providing evacuation arrangement, grid connectivity, open access, and equitable wheeling tariff to make them competitive and capable.

7.2.7: Renewable Energy

- The renewable sources can produce electricity below the cost of fossil-fuel based power stations and moderate global warming affordably. The cost of producing electricity from renewable sources such as wind and solar photovoltaic (PV) has declined in the past decade by more than 70-75 percent and both these low emission renewable energy (RE) technologies have grown very rapidly. The Government must work on expanding these technologies as well as solar water heating system, solar cooker, SPV street lighting system and small hydro power initiatives in order to meet the energy demands in an environmentally sustainable manner.
- Promote solar cookers, solar-based room heating technologies, solar water heaters, solar dryers, and photovoltaic for residential as well as hospitality, commercial, industrial, and agricultural sectors.
- Conduct training and capacity-building programmes for local technicians, dealers, and manufacturers, in order to ensure proper installation and maintenance of solar lights and appliances.

- To promote solar lights at domestic households, bank credit through low interest loans should also be provided.
- Increase deployment of family and community size biogas plants run on cattle dung and alternate feed stocks.
- Promote 'farm level solar power generation' where land-owning farmers can install solar power/wind energy projects of 2–3 MW capacity. Such projects can have multiple purposes of generating clean energy, tackling the issues of land scarcity, result in additional income for the farmers.
- Develop the vast Spiti cold desert into a renewable energy hub by setting up renewable energy facility. Spiti has abundant sunshine and wind to generate energy.
- Attempts should be made to generate energy from agro-residues (briquetting of crops residues) and gasifiers run on wood pallets, crop and processing residues. Standalone power units run on small hydro and crop residues can be useful in promoting rural agro-processing industries.

7.2.8: Air Pollution

- The heavily polluting industries have to be identified and put under the heavy polluter category and the State must monitor and regulate smoke emitted by them.
- Industries must not be allowed to be set up in the already heavily polluting industrial areas. Air Pollution Control Equipment (APEC) must be installed in all industrial units with regular checks and maintenance.
- Regular vehicular monitoring is the need of the hour, looking at the growth rate of vehicles.

- The Government must take measures to improve public transport and encourage the use of cleaner fuels for both personal and public transport, for example electric vehicles.
- Non-polluting technologies must be adopted by the Government, such as Vertical Shaft Brick Kiln (VSBK) for brick production. This technique is beneficial as it consumes less fuel, low Suspended Particulate Matter (SPM) emissions, can be operated throughout the year under any weather conditions owing to its protected roof and uses minimal land, thereby improving the ratio of land used to the production output, resulting in better quality bricks.
- In order to have more regular control over air quality, monitoring stations at the district level should be established.

7.2.9: Improved Access to Clean Water

- Water needs to be managed as a common community resource under the State's control in order to achieve food security, support livelihood and ensure sustainable development for all. The predicted increase in variability of the available water owing to climate change should be dealt with by augmenting the storage of water in its various forms, including soil moisture, ponds, ground water, small and large reservoirs and their combination. Direct use of rainfall, desalination and avoidance of unintended evapo-transpiration are the new additional strategies for ensuring increase in utilisable water resources.
- Upgrading service delivery and sustainability of potable water is urgently required.
- Need to review the limiting factors and existing gaps in waste water treatment in river basin in order to reduce future challenges.
- Irrigation water use efficiency and uptake is quite low-especially critical for pumped irrigation. Upgrading the existing system for long-term sustainability of pumped irrigation is vital.

7.2.10: Waste Management

- For better planning of waste management and application for recycling and sewage treatment, information is crucial.
- The aspects of waste management which the municipalities can handle efficiently must be identified and private players must be given a chance to manage the remaining aspects. The Government must promote policies in such a way that private sector is encouraged to invest, establish, and operate facilities in the waste management sector.
- Economic incentives and disincentives serve to motivate consumers and businesses to reduce waste generation and dispose of waste responsibly.
- Technologies, such as enhanced acidification and methanation, can be used for utilizing waste. Sectors that generate organic waste in large amounts, such as food and fruit processing industries, hotels, community kitchens, and vegetable markets, can make the best use of the technology.

7.2.11: Steps to Counter Climate Change & its Impact

- In order to counter extreme climate events and impacts of climate change, the State would have to develop interventions relating to disaster risk reduction and management. The water streams, rivers and forest land must be looked over by monitoring network for quality and quantity check. Monitoring and audits of all developmental activities would ensure active engagement of the communities.

7.3: ADAPTATION AND ACTION PLAN ON CLIMATE CHANGE IN H.P.

Adaptation refers to measures that are taken to minimize the adverse effects of climate change. As noted earlier, Himachal Pradesh is facing significant exposure to current and future climate change, posing a threat to its natural resources and for the people dependent on them. Adaptation is thus imperative for coping with the observed and anticipated risks and impacts in the State.

Agriculture, water resources, forest and biodiversity are some of the key sectors that require necessary measures to facilitate adaptation. As part of the NAPCC plan, the Himachal Pradesh State Government had prepared the State Strategy and State Action Plan on Climate Change in 2012. The Action Plan has been endorsed and approved by the National Steering Committee of the Ministry of Environment, Forests and Climate Change (MoEFCC).

The plan highlights common environmental issues confronted and activities being undertaken with respect to each sector. Analysis shows that there are gaps in understanding of impacts and vulnerability of natural resources in the entire Himalayan region, and particularly for the Himachal Pradesh. One of the major points highlighted in the plan is that “across the entire region, most of the available research focuses on adverse impacts of climate change and overlooks the adaptation mechanisms that local people have developed themselves, and have evolved the potential new opportunities. The plan identifies main entry points and ongoing activities with respect to each of the eight missions under the NAPCC along with short term adaptation strategies.

The short term adaptation strategies include:

- Comprehensive State level adaptation planning
- Integration of land use planning and climate adaptation planning
- Improved emergency preparedness,
- Improved response capacity for climate change impacts strengthening of the climate change research and science programs

The strategy lists proposals for mapping a route for a greener economy through green public procurement, green jobs, and promotion of small and medium scale industries, enhancing social and environmental responsibility, conservation of State biodiversity and ecosystem, sustainable agricultural production and consumption patterns and introduction of green tax on tourism sector.

Some of the vital sectors identified include tourism and eco-tourism, health, biodiversity and ecosystem, water resources, forest and agriculture.

Mitigation refers to measures that are taken in order to reduce the causes of climate change with an aim to promote sustainable development and contribute to the national goal of reducing Greenhouse Gas Emissions.

In order to respond effectively to the challenges of climate change, the Himachal Pradesh State Government has constituted a State-Level Governing Council on climate change. The Council has representation from all relevant stakeholders. An Executive Council has also been set up for the implementation and monitoring of the Council's directives.

However, there is a significant financial gap in the plan, which is lack of convergence of allocated funds and activities for each sector. There is also a need to explore private sector funding apart from the Government funds.

7.4: HAZARD MITIGATION PLAN TO REDUCE THE IMPACT OF CLIMATE CHANGE DISASTERS:

Comprehensive emergency management is a widely used approach at all levels of Government to deal with the inevitability of natural hazards and their potential to cause disasters in a given community. The components of a comprehensive emergency management system include:

- *Preparedness* activities include development of response procedures, design and installation of warning systems, exercises to test emergency operational procedures and training of emergency personnel.
- *Response* activities occur during or immediately following the disaster that include time-sensitive activities such as search and rescue operations, evacuation, emergency medical care, food and shelter programs. Response activities are designed to meet the urgent needs of disaster victims.
- *Recovery* activities are emergency management actions that begin after the disaster, as urgent needs are met.

- *Mitigation* activities reduce or eliminate the damages from hazardous events. These activities can occur before, during and after a disaster and overlap all phases of emergency management.

The Government should prepare and adopt the plan officially through the standard legal process for adoption of regulations and policy, including any required public notice and hearings. To be most effective, the plan must be an official plan, not an internal staff proposal.

Once the plan is adopted, the real challenge of hazard mitigation planning will involve converting the plan into action. The intent of the implementation strategies is to intervene in the traditional reactive processes of response and recovery. It is the proactive nature of mitigation planning that leads to successful reduction of hazard vulnerability. Implementation strategies include holding post-disaster meetings, use of special task forces and integration of hazard mitigation activities in the work plans of other agencies or departments and involving the media to garner support and serve as an impetus for implementation in both public and private sectors.

7.5: CONCLUDING REMARKS

The efforts of both State and Centre must be coordinated on the issue of Climate Change. Roles and responsibilities among different institutions in the State must be clearly defined, which would help in achieving the objectives of the State Action Plan on Climate Change (SAPCC). Although the SAPCC has involved experts in the implementation of the strategies, however, it would be beneficial to involve more private players as well as the communities directly, in the planning and implementation process.

Insufficient data and information is a challenge faced by mountainous regions, which can be dealt with by appropriate institutional arrangements involving all the concerned stakeholders, in order to take informed decisions.

Himachal Pradesh has a framework in place to achieve the objectives of reducing the causes and effects of climate change. By aligning the developmental activities of the State to be more climate change resilient, it can better reap the benefits of sustainable development.


Annexures.....

Annexure-A

GLOSSARY OF TERMS

Births attended by trained health personnel	The percentage of births attended by physicians, nurses, midwives, trained primary health care workers or trained traditional birth attendants.
Child labourers	Working children between five and fourteen years.
Crude Birth Rate	Number of births per 1000 population in a given year.
Crude Death Rate	Number of deaths per 1000 population in a given year.
Dependency Ratio	The proportion of population below 14 years and above 60 years of working population.
Disability	Disability is a restriction or lack of ability (resulting from impairment) to perform an activity in the manner or within the range considered normal for human being. Impairment is defined as any loss of psychological, physiological or anatomical structure and function.
Dropout rate	The percentage of the number of children to total enrolment dropping out of the school system in a particular level in a particular year.
Enrolment	i. Primary education enrolment: Enrolment of student in classes I to VII. ii. Secondary education enrolment: Enrolment of student in Classes VIII to X. iii. Higher secondary enrolment: Enrolment of students in Classes XI and XII. iv. Tertiary education enrolment: Enrolment of students in Degree Colleges, Teachers Colleges, Universities and Higher Professional Schools.
Enrolment Ratios (Gross and Net)	The gross enrolment ratio is the number of students enrolled in a level of education whether or not they belong to the relevant age group for that level- as a percentage of the population to the relevant age group for that level. The net enrolment ratio is the number of student enrolled in a level of education who belong in the relevant age group as a percentage of the population in that age group.
Female-male gap	A set of national, regional and other estimates in which all figures for females are expressed in relation to the corresponding figures for males, which are indexed to 100.
Fertility Rate	Total fertility rate is the average number of children that would be born to a woman if she experiences the current fertility pattern throughout her reproductive span (15-49 years). In a mathematical form different fertility rates are defined as below:

	i. Age Specific Fertility Rate (ASFR)= Number of Live Births in a particular age group) / (Mid-year female population of the same age group) x 1000
	ii. General Fertility Rate (GER)= (Number of Live Births in a year) /(Mid-year female population between 15-49 years x 1000
	iii. Age-Specific Marital Fertility Rate (ASMFR)= (Number of Live Births in a particular age group) / (Mid-year married female population of the same age group) x 1000
	iv. General Marital Fertility Rate (GMFR) =(Number of Live Births in a year) / Mid-year married female population between 15 and 49) x 1000
Katcha	If both the wall and roof are made of katcha materials, the house could be classified as katcha.
Head Count Ratio (poverty)	The ratio of population living below the poverty line to total population.
Gross Domestic Product (GDP)	This represents the sum of the economic value of all goods and services produced within the geographical boundaries of a State or district during a given year, from which are deducted raw material, fuels, lubricants etc, consumed in the process of production. Counted within duplication. Production originates in the State or district and therefore GDP is said to be 'by origin'.
Net Domestic Product (NDP)	Net domestic product is derived by deducting depreciation from the GDP.
Immunization	Vaccination coverage of children under one year of age for the antigens used in the universal child immunization programme.
Infant Mortality Rate (IMR)	The number of infants dying under one year of age in a year per 1000 live births of the same year.
Labour Force Participation Rate	The proportion of main and marginal workers and jobseekers to total population.
Life Expectancy at Birth	Average number of years a new born child is expected to live under current mortality conditions.
Literacy Rate	It is the ratio of the number of literates above the age of seven years to the total population. Literacy is defined as the ability to read and write with understanding in any language. Till the 1991 Census, literacy was canvassed for all persons above five years of age. A significant departure was made in 1991 by canvassing the question of literacy only for population aged seven and above.

Maternal Mortality Rate	The number of deaths of women while pregnant or within 42 days of termination of pregnancy from any cause related to pregnancy and childbirth per 1,00,000 live births in a given year.
Mortality Rates	Crude Death Rate= (Number of deaths during the year)/ (Mid-year population) x1000
Safe drinking water-access	If a household has access to drinking water supply from taps, hand pumps, borewells or tubewells within or outside the premises, it is considered as having access to safe drinking water.
Sanitation-access	Households with reasonable access to sanitary means of excreta and waste disposal including outdoor latrines are considered as having access to sanitation.
Sex- Ratio	Number of females per 1000 males in a population.
Slum	Slum is a concept area with a collection of poorly built tenements crowded together usually with inadequate sanitary and drinking water facilities.
Work Participation Rate (WPR)	The proportion of total workers (main workers and marginal workers) expressed as percentage of total population is the Work Participation Rate (WPR). This is considered a very crude measure since it does not take into account the age structure of the population. For making specific comparisons, the age specific WPR would be ideal.
Under Five Mortality Rate	Number of children under five years of age dying in a year per 1000 live birth of the same year.

Annexure-B

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Annexure-C

LIST OF GRAPHS & TABLES

List of Graphs

List of Tables

Annexure-D

Additional Tables

Table – Ex.1 : Green House Gases and their Main Anthropogenic Sources

Sr. No.	Green House Gases	Sources
1.	Carbon dioxide	Fossil fuel burning, deforestation and land use changes, Cement manufacture.
2.	Methane	Rice paddy cultivation, ruminants (e.g. cows, sheep), Biomass burning and decay, releases from fossil fuel Production.
3.	Chloro fluorocarbons	Manufactured for solvents, refrigerants, aerosol spray. Propellants, foam packing etc.
4.	Nitrous oxide	Fertilizers, fossil fuel burring, land conversion for Agriculture.
5.	Precursor gases	Involved in ozone and methane chemistry
6.	Nitrogen oxides	Fossil fuel burning.
7.	Non methane hydrocarbons	Evaporation of liquid fuels and solvent.
8.	Carbon monoxide	Fossil fuel and biomass burning.

Source: Matthew Patterson, *Global Warming and Global politics.* (London: Rout ledge,) p.13.

Table EX. 2 : Some Major Pollutants and Their Sources

Sr. No.	Pollutant	Source
1.	Carbon monoxide	• Incomplete fuel combustion (e.g. two/four stroke engines).
2.	Sulphur dioxide	• Burning of sulphur containing fuel like coal in power plants and emission by vehicles
3.	Suspended particulate matter	• Smoke from domestic, industrial and vehicular sources.
4.	Oxides of nitrogen	• Fuel combustion of motor vehicles, emission from power • Stations and industrial furnaces
5.	Volatile hydrocarbons	• Partial combustion of carbonaceous fuels (two stroke Engines, industrial processes, disposal of solid wastes).
6.	Oxidants and ozone	• Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons
7.	Lead	• Emissions from motor vehicles

Source: Environment Statistics Division, Ministry of Statistics & Programme Implementation, New Delhi.

Table EX.3 : Some Impacts of Development activities on Environment

Sr. No.	Development Activities	Major Impacts on Environment
1.	Forest clearing and Land resettlements	• Extinction of rare species of flora and fauna, creation of Condition for mosquito breeding leading to infectious Diseases such as malaria, dengue etc.
2.	Shifting cultivation in Upland agriculture	• Soil erosion in upland areas, soil fertility declines due to Shorter cultivation cycle, which is practiced due to Population pressure, flooding of low land areas, The problems could be Resolved by terraced cultivation.
3.	Agro industries	• Air pollution due to burning of biogases as fuel in sugar mills, large amount of highly polluting organic wastes, surface water pollution
4.	Introduction of new Varieties of cereals	• Reduction of genetic diversity of traditional monoculture resulting in instability, danger of multiplication of local strains of fungus, bacteria or virus on new variety
5.	Use of pesticides	• Organism develops resistance and new control methods are needed (e.g. in malaria, widespread use of dieldrin as a prophylactic agent against pests of oil palms made the problem worse), creation of complex and widespread environment problems. The pesticides used in agriculture sometimes go into food chain or in water bodies • Which may result in harmful health hazards?
6.	Timber extraction	• Degrades land, destroys surface soil, and reduces production potential of future forests.
7.	Urbanization and industrialization	• Concentrations of population in urban centers make huge demands on production in rural areas and put pressures on land, air and water pollution.
8.	Water resource Projects, e.g .Dam, Extensive irrigation	• Human settlement & resettlement, spread of waterborne diseases, reduction of fisheries, siltation ,physical changes e.g. temperature, • Humidity.

Source: Environment Statistics Division, Ministry of Statistics &Programme

Table EX.4 Pollutants and Their Related Health Hazards

Sr.No.	Pollutant	Health Effects
1.	Carbon monoxide (from gasoline cars , 2wheelers, 3-wheelers)	• Fatal in case of large dose: aggravates heart disorders; effects central nervous system; impairs oxygen carrying capacity of blood
2.	Nitrogen Oxides (NOX)(From diesel vehicles)	• Irritation of respiratory tract
3.	Ozone	• Eye, nose and throat irritation; risk asthmatics, children and those involved in heavy exercise
4.	Lead (from petrol vehicles)	• Extremely toxic: effects nervous system and blood; can impair mental development of children, causes hypertension
5.	Hydrocarbons (mainly from 2-wheelers and 3-wheelers)	• Drowsiness, eye irritation, coughing
6.	Benzene	• Carcinogenic
7.	Aldehydes	• Irritation of eyes, nose and throat, sneezing, coughing, nausea, breathing difficulties; carcinogenic in animals
8.	Polycyclic Aromatic Hydrocarbons PAH (From diesel vehicles	• Carcinogenic

Source: Environment Statistics Division, Ministry of Statistics &Programme Implementation , New Delhi.

PART-I: BASIC HDI DATA

Table 1.1: State Domestic Product and Per Capita Income in Himachal Pradesh

Year	Gross State Domestic Product (Rs. in Crore)		Per Capita Income (Rs.)
	(At Current Prices)	**(At Constant Prices)**	**(At current prices)**
2005-06	27127	26107	36949
2006-07	30280	28483	40393
2007-08	33962	30916	43966
2008-09	41483	33210	49903
2009-10	48188	35897	56706
2010-11	56355	39036	67475
2011-12	63811	41939	74694
2012-13	76259	44610	85792
2013-14	85841	47376	95582
2014-15	104171	89095	124325
2015-16	113667	96289	135621
2016-17	125122	103038	149028
2017-18	138542	109747	160711

Source: Economic Survey of Himachal Pradesh 2011-12/ 2012-13/ 2013-14/2014-15/2015-16/ 2016-17 2017-18/ 2018-19 Economics & Statistics Department

Table 1.2: Demographic Features of Different Regions of Himachal Pradesh

Sl. No.	District	Total Geographical area (Sq. Kms.)	Total Population	Growth rate of Population (2001-2011)	Sex-Ratio	Density Per Sq. Kms	%age of Urban Population
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	**Bilaspur**	1167	381956	12	900	327	3.65
2	**Chamba**	6522	519080	12.6	953	80	5.25
3	**Hamirpur**	1118	454768	10.2	887	407	4.56
4	**Kangra**	5739	1510075	12.8	876	263	12.53
5	**Kinnaur**	6401	84121	7.4	963	13	
6	**Kullu**	5503	437903	14.8	962	80	6.01
7	**Lahaul-Spiti**	13841	31564	-5	1033	2	
8	**Mandi**	3950	999777	10.9	916	253	9.1
9	**Shimla**	5131	814010	12.7	925	159	29.24
10	**Sirmaur**	2825	529855	15.5	928	188	8.3
11	**Solan**	1936	580320	15.9	899	300	14.84
12	**Una**	1540	521173	16.3	875	338	6.52
	HP	55673	6864602	12.9	909	123	10.03

Source: Population Tables, 2011, Directorate of Census Operations, Himachal Pradesh.

Table 1.3: Gross Value Added at Current Prices 2011-12 to 2017-18 (Base=2011-12) (Rs. in Lakh)

Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Bilaspur	319860	376768	421027	453278	510610	522367	574797
Chamba	462020	496878	543567	624299	607228	634792	705180
Hamirpur	321330	371175	417908	473962	556391	601622	625125
Kangra	944014	1100253	1245766	1357066	1507659	1615234	1790051
Kinnaur	142908	168032	169449	196785	227956	196194	231412
Kullu	410442	493135	558132	569437	627767	631009	722624
Lahaul-Spiti	52092	65109	69858	68709	76120	80178	90271
Mandi	695182	790169	905076	993641	1107373	1153548	1302177
Shimla	1027532	1182122	1373305	1515643	1590988	1878506	1812139
Sirmour	616599	703746	829270	882679	1007691	1124256	1219643
Solan	1870158	2075425	2426693	2663419	2952260	3364708	3798551
Una	409847	459166	516365	578312	651898	709796	782271
H.P.	7271984	8281978	9476416	10377230	11423941	12512210	13654241

Source: Directorate of Census Operations, Himachal Pradesh.

Table 1.4: Projected Population for the 2018-19)

District	Male	Female	Total
Bilaspur	212790	210484	**423274**
Chamba	289528	288421	**577949**
Hamirpur	242060	257892	**499952**
Kangra	843701	847403	**1691104**
Kinnaur	46869	42598	**89467**
Kullu	259067	239837	**498904**
Lahaul-Spiti	16940	15037	**31977**
Mandi	552312	560324	**1112636**
Shimla	452561	419031	**871592**
Sirmour	297753	281268	**579021**
Solan	327097	295306	**622403**
Una	277137	266830	**543967**
H.P.	3817816	3724431	**7542247**

Source Directorate of Census Operations, Himachal Pradesh.

Table 1.5: Health Indicators in Different Regions of Himachal Pradesh

District	Death Rate (2011)	Beds available per lakh of population (2018-19)	Couple Protection Rate (2017)	IMR (2012)
1	2	3	4	5
Bilaspur	5.8	147	50.50	6.7
Chamba	5.8	214	31.22	7.5
Hamirpur	7.6	144	39.57	5.7
Kangra	7	197	26.24	9.0
Kinnaur	5.3	303	28.54	5.6
Kullu	5.7	162	35.03	7.7
Lahaul & Spiti	5.3	638	34.13	9.0
Mandi	5.9	196	36.02	7.5
Shimla	6.4	348	35.29	15.3
Sirmaur	5.6	136	30.22	8.0
Solan	5.6	150	37.12	5.3
Una	7.4	109	24.92	2.8
HP	6.3	195	33.08	8.1

Source: Health & Family Welfare Department, H.P.

Table 1.4: Rural Families Living Below Poverty Line as per 2002-07 Survey

District	Total Number of Rural Households at the time of survey	Number of households below Poverty line	percent age of households below poverty line to the total rural households
1	2	3	4
Bilaspur	75051	17337	23.1
Chamba	85676	46393	54.15
Hamirpur	95795	19514	20.37
Kangra	289185	63250	21.87
Kinnaur	13255	2824	21.31
Kullu	69388	11267	16.24
Lahaul-Spiti	5517	2400	43.5
Mandi	206096	41339	20.06
Shimla	108999	31682	29.07
Sirmaur	70439	13695	19.44
Solan	73733	17478	23.7
Una	89792	15191	16.92
HP	1182926	282370	23.87

Source: Department of Rural Development, Himachal Pradesh.

PART-II : DEMOGRAPHIC DATA

Table2.1: Sex Ratio in Himachal Pradesh

District	2001			2011			Growth Over 2001('000)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7	8	9	10
Bilaspur	992	1001	867	981	986	917	-11	-15	50
Chamba	961	969	874	986	996	865	25	27	-9
Hamirpur	1102	1124	862	1095	1109	926	-7	-15	64
Kangra	1027	1035	908	1012	1019	908	-15	-16	0
Kinnaur	851	851	–	819	819	0	-32	-32	0
Kullu	928	941	784	942	951	866	14	10	82
Lahaul-Spiti	804	804	–	903	903	0	99	99	0
Mandi	1014	1024	895	1007	1011	956	-7	-13	61
Shimla	898	947	751	915	949	818	17	2	67
Sirmaur	901	906	861	918	920	898	17	14	37
Solan	853	914	624	880	915	731	27	1	107
Una	997	1007	896	976	982	916	-21	-25	20
H.P.	970	997	997	972	986	853	2	-11	-144

Source: Census 1991 and Census 2011.

PART-III : HEALTH SECTOR DATA

Table 3.1: Comparative Vital Statistics of Himachal Pradesh

Parameter	2007		2008		2009		2010		2011		2016	
	HP	All India	HP	All India	HP	All India	HP	All India	HP	All India	HP	All India
BR	17.4	23.1	17.7	22.8	17.2	22.5	16.9	22.1	16.5	21.8	16	20.4
DR	7.1	7.4	7.4	7.4	7.2	7.3	6.9	7.2	6.7	7.1	6.8	6.4
IMR	47	55	44	53	45	50	40	47	38	44	22	-
Couple Protection Rate	48	46.2	47.1	46.5	46.3	42.9	45	41.6	42	40.4	33.08	-

*Unit Per'000

Source: (i) SRS Bulletin, Registrar General of India.

(ii) Health & Family Welfare Department, H.P.

Table 3.2: Growth of Government Medical Institutions

	2018-19	2016	1973–74	1983–84	1993–94	1999–2000
Hospital	94	74	37	37	39	50
Community Health Center	94	79	0	6	29	65
Primary Health Center	586	449	0	17	13	0
Civil Dispensaries	16	17	76	78	218	302
Sub Centres	-	2071	173	222	167	155
Bed (In position)	14703	10756	3922	4881	7060	8747

Source: Directorate of Health Services, Himachal Pradesh.

PART-IV : EDUCATION & LITERACY RATE

Table 4.1: Literacy Rate across Districts of Himachal Pradesh (1981-2011)

Districts	1981	1991	2001	2011
1	2	3	4	5
Bilaspur	44.69	67.17	77.8	84.6
Chamba	26.45	44.7	62.9	72.2
Hamirpur	52.7	74.88	82.5	88.2
Kangra	49.12	70.57	80.1	85.7
Kinnaur	36.84	58.36	75.2	80
Kullu	33.82	54.82	72.9	79.4
Lahaul-Spiti	31.35	56.82	73.1	76.8
Mandi	40.12	62.74	75.2	81.5
Shimla	42.74	64.61	79.1	83.6
Sirmaur	31.78	51.62	70.4	78.8
Solan	41.07	63.3	76.6	83.7
Una	50.05	70.57	80.4	86.5
HP	42.48	63.86	76.5	82.8

Source: Compiled from various Census Reports.

Table 4.2: Literacy Rate among Scheduled Castes and Scheduled Tribes

District	2001 Census			2011 Census		
	Male	Female	Total	Male	Female	Total
1	**2**	**3**	**4**	**5**	**6**	**7**
Bilaspur	81.4	64.3	73	88	74.2	81.2
Chamba	71.4	45	58.5	79.7	59.3	69.6
Hamirpur	86.4	72.2	79.1	91.9	80.3	85.9
Kangra	82.8	65.8	74.2	88.1	74.7	81.4
Kinnaur	81.7	61.5	72.1	85.6	69	77.3
Kullu	76.8	52.4	64.9	83.6	66.1	75.1
Lahaul-Spiti	86.2	64	76	90	69.1	80
Mandi	80	57.1	68.6	85.9	69.1	77.5
Shimla	80.6	60.2	70.7	85.9	71.4	78.8
Sirmaur	72.4	54	63.6	81.4	67.5	74.7
Solan	80.4	60.8	71	86.7	72.6	79.9
Una	84.2	67.3	75.9	90.8	78.5	84.7
H.P.	80	60.4	70.3	86.2	71.5	78.9

Table 4.3: Gross Enrolment Ratio (GER) in All Schools-SSA Data

District	Primary	Upper Primary	Secondary	Higher Secondary	Total
Bilaspur	104.50	106.10	100.60	96.30	**407.50**
Chamba	104.00	103.20	103.20	77.70	**388.10**
Hamirpur	105.00	100.00	107.50	107.20	**419.70**
Kangra	104.50	99.80	104.70	99.90	**408.90**
Kinnaur	103.60	100.50	92.50	71.30	**367.90**
Kullu	104.60	104.50	105.30	79.10	**393.50**
Lahaul-Spiti	96.90	100.20	70.90	50.40	**318.40**
Mandi	103.20	103.70	102.30	86.30	**395.50**
Shimla	105.60	100.20	104.80	91.20	**401.80**
Sirmour	105.40	102.80	105.10	80.70	**394.00**
Solan	104.50	101.40	118.60	95.70	**420.20**
Una	105.80	102.60	105.10	94.00	**407.50**
Total	**1247.60**	**1225.00**	**1220.60**	**1029.80**	**4723.00**

PART-V: LAND UTILIZATION & FOREST

Table 5.1: Biophysical Zones of Himachal Pradesh

Zone	Biomes	District	Total Area (Sq. Km.)	Population
A	Sub-Arctic, Alpine, Cold Temperate	Kinnaur, Lahaul & Spiti	20,242	115685
B	Alpine, Cold Temperate, Warm Temperate	Kullu, Chamba	12,025	956983
C	Cold Temperate, Warm Temperate	Shimla, Kangra	10,870	2324085
D	Warm Temperate, Sub-Tropical	Sirmaur, Solan, Bilaspur, Una, Hamirpur, Mandi	12,536	3467849

Source: Census of India-2011, H.P.

Table 5.2: Geophysical Profile of the Districts of Himachal Pradesh

Districts	*Altitude (Height from MSL in metres)*	*Climate*	*Biome/ Zone*
1	2	3	4
Bilaspur	300 to 600 and 1200 to 2100	Warm temperate and Sub-tropical	D
Chamba	1000 to 5000	Alpine, Cold temperate and Warm temperate	B
Hamirpur	300 to 600 and 1200 to 2100	Warm temperate and Sub-tropical	D
Kangra	500 to 1000 and 3000 to 6000	Cold temperate and Warm temperate	C
Kinnaur	1800 to 4800	Sub-arctic, Alpine and Cold temperate	A
Kullu	1500 to 4800	Alpine, Cold temperate and Warm temperate	B
Lahaul-Spiti	3000 to 4500	Sub-arctic and Alpine	A
Mandi	1200 to 3000	Warm temperate	D
Shimla	1500 to 3200	Cold temperate and Warm temperate	C
Sirmaur	300–450 and 3000–3300	Warm temperate and Sub-tropical	D
Solan	300–2100 and 150 to 1500	Warm temperate and Sub-tropical	D
Una	300 to 600 and 1200 to 2100	Warm temperate and Sub-tropical	D

Table 5.3: Land Utilization of Himachal Pradesh 2009-10

	LAND UTILIZATION OF HIMACHAL PRADESH 2009-10		*(Area in km²)*
		2009-10	**1999-00**
1	Geographical Area (by professional survey)	55673	55673
2	Area by Village Paper (Revenue Record)	45590	
3	Forest Area (As per Forest Record)	37033	35427
4	Land put to Non-agricultural uses	3486	
5	Net area sown	5384	
6	Fallow Lands (Current & other fallows)	821	
7	Culturable Wastes	1282	
8	Land under misc. tree crops not included in cultivation	684	
9	Permanent pastures & other grazing lands including alpine pastures, barren & un-culturable wastes etc.	6983	10262

Source: H.P. Forest Statistics, 2013

Table 5.4: Land Use 2009-10 (Percent of total geographical area)

District	Forest land	Misc. Tree crops & Groves (Not included in net area sown)	Permanent pastures & other grazing lands	Culturable waste	Land put to non agricultural uses	Barren and Unculturable land	Current Fallows	Other Fallows	Net area sown	Area sown more than once	Total cropped area
Bilaspur	12.5	0.1	35.4	5.5	14.2	3.8	1.5	0.9	26.1	24.0	50.1
Chamba	39.3	0.0	50.4	1.0	2.2	0.7	0.3	0.1	6.0	3.7	9.8
Hamirpur	16.5	0.0	10.4	10.2	12.0	12.6	4.8	1.4	32.0	29.7	61.7
Kangra	40.3	1.4	15.2	4.9	13.4	2.6	2.0	0.2	20.0	18.4	38.4
Kinnaur	6.2	0.0	51.6	0.5	18.9	21.2	0.3	0.0	1.3	0.2	1.5
Kullu	3.9	5.9	6.1	2.0	12.3	5.0	4.2	0.7	59.8	31.3	91.1
Lahaul-Spiti	15.1	0.0	23.2	0.1	1.8	59.4	0.0	0.0	0.4	0.0	0.4
Mandi	44.0	0.1	24.2	1.1	4.2	2.2	2.3	0.1	21.8	17.9	39.6
Shimla	25.6	2.3	44.5	4.2	3.3	3.1	2.9	1.3	12.9	4.2	17.1
Sirmaur	21.5	16.1	26.1	5.3	4.7	3.8	1.9	2.6	18.0	15.1	33.1
Solan	11.2	0.3	46.4	5.3	6.9	6.5	1.6	1.1	20.7	14.9	35.5
Una	10.7	4.4	8.7	15.1	17.8	15.6	2.6	1.4	23.7	23.0	46.7

Source: Annual Season and Crop Report 2009–10, Directorate of Land Records, Government of Himachal Pradesh

Table 5.5: Forest Area and Population (2011-12)

District	Geographical area by professional survey (km2)	Legal Forest are a (km2)	Percent of Forest area to Geographical area in the District	Percent of Total Forest Area of the State	Population As per 2011 Census
Bilaspur	**1167**	**428**	**36.7**	**1.1**	**381956**
Chamba	**6528**	**5030**	**77.1**	**13.6**	**519080**
Hamirpur	**1118**	**219**	**19.6**	**0.6**	**454768**
Kangra	**5739**	**2842**	**49.5**	**7.7**	**1510075**
Kinnaur	**6401**	**5093**	**79.6**	**13.8**	**84121**
Kullu	**5503**	**4952**	**89.9**	**13.4**	**437903**
Lahaul-Spiti	**13835**	**10133**	**73.2**	**27.4**	**31564**
Mandi	**3950**	**1860**	**47.1**	**5**	**999777**
Shimla	**5131**	**3418**	**66.6**	**9.2**	**814010**
Sirmour	**2825**	**1843**	**65.2**	**5**	**529855**
Solan	**1936**	**728**	**37.6**	**1.9**	**580320**
Una	**1540**	**487**	**31.6**	**1.3**	**521173**
Total	**55673**	**37033**	**66.5**	**100**	**6864602**

Table 5.6: District Wise Forest Cover of Himachal Pradesh: As Per FSI Report 2017 (Area in Km2)

District	Geographical Area	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	%age of Total Geographical Area of District	District wise Population (2018)	District wise Share of MtCO2e in 2012
1	2	3	4	5	6	7	8	9
Bilaspur	1167	23	161	191	375	32.13	423274	0.516
Chamba	6522	775	986	682	2443	37.46	577949	0.705
Hamirpur	1118	39	86	188	313	28.00	499952	0.610
Kangra	5739	297	1274	626	2197	38.28	1691104	2.062
Kinnaur	6401	79	266	278	623	9.73	89467	0.109
Kullu	5503	582	843	562	1987	36.11	498904	0.608
Lahaul- Spiti	13841	15	31	147	193	1.39	31977	0.039
Mandi	3950	368	722	671	1761	44.58	1112636	1.357
Shimla	5131	736	1039	624	2399	46.76	871592	1.063
Sirmaur	2825	131	568	688	1387	49.10	579021	0.706
Solan	1936	46	426	394	866	44.73	622403	0.759
Una	1540	19	303	234	556	36.10	543967	0.663
Grand Total	**55673**	**3110**	**6705**	**5285**	**15100**	**27.12**	**7542246**	**9.197**

PART-VI ENERGY- WATER & ELECTRICITY

Table: 6.1: Primary Source of Energy

Renewable Resources	
Hydro-Power	Yes
Biogas	Yes, Limited
Solar	Yes
Wind	Negligible Potential
Geo-Thermal	Yes
Tidal	No
Non-Renewable Resources	
Coal	No
Oil	No
Gas	No (Not economically Viable)

Table: 6.2: Hydro Potential of Himachal Pradesh

Hydro Potential	**In MW**
Projects under Operation (i/c HIMURJA Projects)	6370.12
Projects which are under execution/allotted and planned for 11th Plan Period	5744.1
Projects which have been allotted/under process of allotment and expected to yield benefit during the 12th Plan period	5615.5
Projects which would have to be re-advertised	1481
Projects which have been abandoned due to environmental considerations	435
Projects under investigation for preparation of DPR	46.5
HIMURJA Projects proposed/under execution){750-26.60} [Under Operation - 26.60 MW	723.4
TOTAL POTENTIAL	20415

Sources: Environment Master Plan Infrastructure Sector (Baseline), Government of Himachal Pradesh Department of Environment, Science & Technology

Table: 6.3: Year - wise installation of Hydro & Diesel Power Stations By HPSEB (M.W.) in Himachal Pradesh.

Year	Hydro	Diesel	Total
1	2	3	4
2000-01	326.2	0.133	326.333
2001-02	326.2	0.133	326.333
2002-03	326.2	0.133	326.333
2003-04	326.2	0.133	326.333
2004-05	329.2	0.133	329.333
2005-06	328.95	0.133	329.083
2006-07	466.95	0.133	467.083
2007-08	466.95	0.133	467.083
2008-09	466.95	0.133	467.083
2009-10	466.95	0.133	467.083
2010-11	466.95	0.133	467.083
2011-12	471.45	0.133	471.583
2012-13	471.45	0.133	471.583
2016-17	487.45	-	487.45
2017-18	487.45	-	487.45

Source: - Himachal Pradesh State Electricity Board

Table: 6.4 Basin - wise Hydro Potential

Sr.No.	River Basin	Total Hydro -Potential (MW)	Catchment area (Km2)
1	Satluj	9450.25	20398
2	Beas	4604	13663
3	Ravi	2359	5528
4	Chenab	3032.3	7850
5	Yamuna	591.52	5872
6	Mini-Micro Project	750	
	Total	**20787.07 equivalent to 21000.00**	

Source: Status note by HPSEB

Table: 6.5: Power Generated/Purchased in Himachal Pradesh over the Year

Generation Year	Generation MU	Electricity Purchased MU
1	2	3
1980-81	245.07	265.41
1985-86	596.83	392.12
1990-91	1262.4	1058.69
1991-92	1050.37	1200.72
1992-93	1087.38	1256.16
1993-94	976.6	1338.98
1994-95	1131.69	1685.43
1995-96	1285.42	1926.35
1996-97	1251.93	2065.58
1997-98	1306.008	2287.61
1998-99	1484.493	2333.831
1999-2k	1201.319	2520.149
2000-01	1153.321	2539.338
2001-02	1149.501	2588.836
2002-03	1277.929	2882.881
2003-04	1356.953	3936.958
2004-05	1295.41	4296.838
2005-06	1332.375	4918.951
2006-07	1432.375	5056.951
2007-08	1864.943	5433.371
2008-09	2075.138	6047.497
2015-16	1573.103	11168.582
2016-17	1595.917	11378.988
2017-18	1941.321	11282.370

Sources: HPSEB

PART-VII: ROAD & COMMUNICATION & SME's

Table: 7.1: Village Connectivity with Motorable Road (as on 31.3.2017)

District	Total no. of inhabited villages	No. of villages connected with road	No. of Villages unconnected with road	Percent of connected villages
Bilaspur	953	730	232	76.60
Chamba	1110	554	559	49.90
Hamirpur	1671	1172	462	70.13
Kangra	3617	2385	1229	65.93
Kinnaur	241	67	166	27.80
Kullu	314	123	49	39.17
Lahaul & Spiti	280	127	157	45.35
Mandi	2850	1632	1191	57.26
Shimla	2705	1111	1404	41.07
Sirmaur	968	674	292	69.62
Solan	2383	1142	1236	47.92
Una	790	484	271	61.26
Total	**17882**	**10201**	**7248**	**57.04**

Table: 7.2: Year wise details of units registered in the Small Scale Sector (Status: as on 31-03-2011)

Years	No of units set up	Investment (Rs. In lakh)	Employment generated
Up to 02-03	30176	70977.48	129871
2003-04	663	3708.48	3769
2004-05	913	8891.44	6412
2005-06	914	12217.3	6611
2006-07	952	45272.78	10665
2007-08	842	70637.33	11302
2008-09	909	73795.48	10939
2009-10	1032	75320.01	10011
2010-11	963	96539.36	10002
Total	37364	457359.66	199582

Sources: Environment Master Plan Infrastructure Sector (Baseline), Government of Himachal Pradesh Department of Environment, Science & Technology

PART-VIII : ENVIRONMENT

Table: 8.1: Assessment of Carbon Stock from Forests:

	India		HP	
	2005	**2007**	**2007**	**2011**
Forest Cover (KM^2)	690200	691600	14668	1467900
Growing Stock (000, m3)	4729540.05	4739100.67	289920.5	321314
Bio Mass (000, tones)	2610357.11	2615651.95	124694.03	138196.5
Carbon (000, tons)	1181080.31	1183479.75	57295.65	57710.2

Source: FSI Report

Table: 8.2: Municipal Solid Waste

Component	**Quantity 2008-09**	**Quantity 2012**
Urban Population	688704	710328
Waste generation rate (kg/capita/day)	0.35	0.35
MSW generated (tones)/day/capita	241.05	248.615
Quantity of waste reaching the landfill site (tons)	140.09	149.169
Dom diposed (tons)	4.512	4.778
Dom accumulated (tons)	14.2	15.0368
Dom decomposed (tons)	2.4	2.5414
Estimated Methane (CH_4) emitted (tones)	2.714	2.87393

Source: Himachal Pradesh Economics & Statistic Department, ULBs

Table: 8.3: Waste water generated in major industries in Himachal Pradesh

Sector	**Waste Water Generated**	
	2008-09	**2011-12**
Industrial	49144.97 KLD	52034.46 KLD
Domestic	4476.98 KLD	4813.56 KLD

Source: ULBs and Industry Dept. H.P.

Table: 8.4: Comparison of CO_2eq emissions by sector from Himachal Pradesh with National estimates for 2007 (INCCA Report) in million tons

Analyzed Source of Emission	GHGs at National (2007, INCCA Report)	2009		2012	
		GHGs Himachal Pradesh estimates	%age of Nation (Percent)	GHGs Himachal Pradesh estimates	%age of Nation (percent)
1	2	3	4	5	6
Electricity Generation Other than H dro	719.3	0.359	0.1	0.244	0.034
Transportation	142.04	0.667	0.47	0.716	0.5
Residential	137.84	1.81	1.31	1.405	1.02
Industrial, Commercial, Mics. Other Ener	100.87	3.23	3.2	2.757	2.73
Cement	129.92	5.17	3.98	5.311	4.09
Iron & Steel	117.32	0.281	0.24	0.167	0.14
Other Industries	165.31	0.034	0.021	0.034	0.021
Agriculture	334.41	0.165	0.049	0.248	0.074
Waste	57.73	0.00001	0.00002	0.000003	5.2E-06
Total without LULUCF	1904.73	11.716	0.615	10.882	0.57
LULUCF	-177.03	-1.633	-	-1.685	-
Total with LULUCF	1727.71	10.083	0.584*	9.197	0.53

* Estimates are without the Emissions/ Removals from Hydro Power Generation.

Source: Environment Report 2012-13, Deptt. of Environment, Science & Technology, Govt. of H.P.

Table: 8.5: Energy Generation and Consumption

Sl.No.		Quantity	
		2008-09	**2011-2012**
1	Total Generation (Hydro Power only)	6419 MW	7957.29MW
2	Captive Generation and Consumption	100 MW	68MW
3	Electricity purchased from BBMB & other States	6047.497MU	7957.290 MU
4	Energy Consumed by the State:	6958.716MU	6633.045MU
	(a) Domestic	1089.118	1578.482
	(b) Non Domestic & Non-Commercial	80.585	103.924
	(c) Commercial	274.663	398.971
	(d) Public lighting	13.013	13.602
	(e) Agriculture	28.738	45.05
	(f)Industries	3385.303	3852.34
	(g) Govt. Irrigation & Water Supply Scheme	389.331	447.328
	(h) Temporary Supply	22.705	23.918
	(i) Bulk & Misc.-Tourism	1675.26	167.591
5	Fuel Consumption	530400 KL	5,41,112 KL
	(a) Diesel *	244800 KL	272073 KL
	(b) Petrol*	86000KL	65324KL
	(c) Kerosene*		
	**As per total sale/ consumption in Himachal Pradesh*		
6	Transport (Vehicles registered) ± Tourist Taxis.	5,38,341Nos.	5,87,122 Nos
7	LPG (including DBG) Approx.		
	Indian Oil Corpn.	76800MT/annum	782123 MT
	Hindustan Petroleum	56100MT/annum	572013 MT

Source: Himachal Pradesh Economics and Statistics Department, Indian Oil Corpn, Himachal Pradesh Oil Corporation, and Transport Department

PART-IX : MISCELLANEOUS

Table: 9.1: Proportions of District-Wise Incidences of Crimes (2004-2012)

District	2004	2005	2006	2007	2008	2009	2010	2011	2012	2016
Bilaspur	8.1	8.7	8.2	7.0	7.2	7.4	7.9	6.5	6.9	6.9
Chamba	5.3	4.6	4.6	5.5	5.7	5.7	5.4	5.2	5.2	5.4
Hamirpur	6.5	7.2	7.4	7.3	6.3	6.6	7.2	5.3	6.5	5.0
Kangra	17.9	17.9	17.7	16.3	16.5	18.8	19.4	18.2	22.0	20.0
Kinnaur	1.4	1.7	1.6	1.5	1.2	1.6	1.5	1.8	1.5	1.5
Kullu	7.1	7.2	7.6	8.5	9.1	8.6	7.0	11.6	6.6	6.3
Lahaul-Spiti	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.9
Mandi	13.5	13.6	14.3	15.0	15.3	14.4	14.2	10.7	13.6	13.9
Shimla	14.3	14.6	13.7	13.9	13.4	12.8	13.2	17.5	11.9	15.7
Sirmour	6.1	6.2	6.1	5.7	6.3	6.3	6.4	5.9	7.2	6.2
Solan	10.2	9.7	10.2	10.8	9.8	9.2	8.7	9.9	10.4	10.2
Una	8.8	7.8	7.9	7.7	8.3	7.7	7.9	6.4	7.3	8.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Himachal Pradesh (Total Nos. of Crimes)	17029	16836	18096	17887	18043	17418	16809	18875	15937	17249

Source:-Police Department, H.P.