

State Action Plan on Climate Change



'Inclusive Growth for Improved Resilience'

Supported by United Nations Development Programme



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Foreword

To be written by GoCG

Acknowledgements

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Abbreviations/Acronyms

Acronym	Expanded Form
ADB	Asian Development Bank
AI	Artificial Insemination
AIBP	Accelerated Irrigation Benefit Programme
ANC	Antenatal Care
ANM	Auxiliary Nurse Midwife
API	Annual Parasite Incidence
ARC	Administrative Reforms Commission
ARV	Anti-Retroviral
AT&C	Aggregate Technical and Commercial
ATDC	Apparel Training and Design Centre
AWC	Anganwadi Centre
AWS	Automatic Weather Stations
BALCO	Bharat Aluminium Company
BCM	Billion Cubic Metres
BMC	Biodiversity Management Committee
BPL	Below Poverty Line
BRTS	Bus Rapid Transit System
CAGR	Compounded Annual Growth Rate
CBDA	Chhattisgarh Biofuel Development Authority
CBO	Community Based Organisation
CCD	Conservation cum Development
CECB	Chhattisgarh Environment Conservation Board
CDM	Clean Development Mechanism
CDP	City development Plan
CFL	Compact Fluorescent Lamp
CGMFPF	Chhattisgarh Minor Forest Produce Federation
CHC	Community Health Centre
CIAE	Central Institute of Agricultural Engineering
CMFRI	Central Marine Fisheries Research Institute
CNG	Compressed Natural Gas
CPSU	Central Public Sector Undertakings
CREDA	Chhattisgarh Renewable Development Authority
CRIDA	Central Research Institute on Dryland Agriculture
CRMM	Chhattisgarh Rajya Matsya Mahasangh
CSAPCC	Chhattisgarh State Action Plan
CSEB	Chhattisgarh State Electricity Board
CSFDC	Chhattisgarh State Forest Development Corporation
CSIDC	Chhattisgarh State Industrial Development Corporation
CSMPB	Chhattisgarh State Medicinal Plants Board
CSPGCL	Chhattisgarh State Power Generation Company Limited
CSR	Corporate Social Responsibility
DDG	Decentralised Distributed Generation
DMRC	Delhi Metro Rail Corporation
DSM	Demand Side Management
EPC	Energy Performance Contracting
FDI	Foreign Direct Investment
FSIR	Forest Survey of India Report
FYP	Five Year Plan
GDI	Gender Development Index
GDP	Gross Domestic Product
GEM	Gender Empowerment Measure
GER	Gross Enrolment Ratio

Acronym	Expanded Form
GHG	Greenhouse Gas
GHI	Global Hunger Index
GIS	Geographical Information System
GoCG	Government of Chhattisgarh
GSDP	Gross State Domestic Product
HDI	Human Development Index
IARI	Indian Agricultural Research Institute
IAY	Indira Awas Yojana
ICAR	Indian Council of Agricultural Research
ICDS	Integrated child Development Services
IDSP	Integrated Disease Surveillance Programme
IHDI	Inequality Adjusted Human Development Index
IHSDP	Integrated Housing and Slum Development Programme
IIDC	Integrated Infrastructure Development Centre
IIHR	Indian Institute of Horticultural Research
IIIT	International Institute of Information Technology
IMR	Infant Mortality Rate
IPP	Independent Power Producer
ITDP	Integrated Tribal Development Project
ITI	Industrial Training Institute
JFMC	Joint Forest Management Committee
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KM	Knowledge Management
KVK	Krishi Vigyan Kendra
KYSK	Krishi Yantra Seva Kendra
LAPA	Local Action Plan on Adaptation
LED	Light Emitting Diode
LHW	Local Health Worker
LRTS	Light Rail Transit System
LWE	Left Wing Extremism
MBBSY	Mukhyamantri Bal Bhavishya Suraksha Yojana
MNRE	Ministry of New & Renewable Energy
MNREGA	Mahatma Gandhi National Rural Employment Generation Act
MPI	Multi Dimensional Poverty Index
MPSRTC	Madhya Pradesh Road Transport Corporation
MPW	Multi-Purpose Worker
MSME	Micro, Small and Medium Enterprises
NAIS	National Agriculture Insurance Scheme
NAPCC	National Action Plan on Climate Change
NDP	Net Domestic Product
NDRI	National Dairy Research Institute
NFHS	National Family Health Service
NFSM	National Food Security Mission
NGO	Non-Governmental Organisation
NHM	National Horticulture Mission
NICRA	National Initiative On Climate Resilient Agriculture
NMPB	National Medicinal Plants Board
NRCAF	National Research Centre for Agro forestry
NRHM	National Rural Health Mission
NRLM	National Rural Livelihoods Mission
NRW	Non-Revenue Water
NSDP	Net State Domestic Product
NTFP	Non-Timber Forest Produce
NTPC	National Thermal Power Corporation
O&M	Operation and Maintenance

Acronym	Expanded Form
PDS	Public Distribution System
PESA	Panchayat Extension to Scheduled Areas
PHC	Primary Health Centre
PLF	Plant Load Factor
PMGSY	Pradhan Mantri Gram Sadak Yojana
PPP	Private Public Partnership
PRI	Panchayati Raj Institution
PSP	Private Sector Participation
PUF	Plant Utilisations Factor
PVTG	Particularly Vulnerable Tribal Group
RE	Renewable Energy
REDD	Reducing Emissions from Deforestation and Forest Degradation
RGVY	Rajiv Gandhi Gram Vidyutikaran Yojna
RKBY	Rashtriya Krishi Beema Yojna
RKVY	Rashtriya Krishi Vikas Yojana
RMSA	Rashtriya Madhyamik Shiksha Abhiyan
RSBY	Rashtriya Swasthya Beema Yojana
SAIL	Steel Authority Of India Limited
SAM	Severe Acute Malnutrition
SAPCCs	State Action Plans for Climate Change
SC	Scheduled Caste
SCERT	State Council for Educational Research and Training
SERC	State Electricity Regulatory Commission
SEZ	Special Economic Zone
SIHFW	State Institute For Health and Family Welfare
SIPD	State Investment Promotion Board
SJSRY	Swarna Jayanti Shahri Rozgar Yojna
SLB	Service Level Benchmarking
SPV	Solar Photo Voltaic
SRI	System of Rice Intensification
SSA	Sarva Shiksha Abhiyan
SSC	State Steering Committee
ST	Scheduled Tribe
SWAN	State Wireless Area Network
T&D	Transmission and Distribution
TB	Tuberculosis
TBO	Tree Borne Oilseeds
TOF	Trees Outside Forests
TSP	Tribal Sub Plan
UGS	Underground Sewerage
UIDSSMT	Urban Infrastructure Scheme for Small and Medium Towns
ULB	Urban Local Body
UMTA	Urban Metropolitan Transport Authority
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WBCIS	Weather Based Crop Insurance Scheme
WSHG	Women's Self Help Group
WUA	Water User Association

Introduction

Background and Context

Climate change will have wide-ranging effects on the environment, and on socio-economic and related sectors, including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity and coastal zones. Changes in rainfall pattern are likely to lead to severe water shortages and/or flooding. Melting of glaciers can cause flooding and soil erosion. Rising temperatures will cause shifts in crop growing seasons, which affects food security, and changes in the distribution of disease vectors putting more people at risk from diseases such as malaria and dengue fever. Temperature increases will potentially severely increase rates of extinction for many habitats and species (up to 30 percent with a 2°C rise in temperature). A rise in extreme events will have effects on health and lives as well as associated environmental and economic impacts.

Because of the speed at which change is happening due to global temperature rise, it is urgent that the vulnerability of developing countries to climate change is reduced and their capacity to adapt is increased and national adaptation plans are implemented. Future vulnerability depends not only on climate change but also on the type of development path that is pursued. Thus adaptation should be implemented in the context of national and global sustainable development efforts. The international community is identifying resources, tools, and approaches to support this effort. Adapting to climate change entails taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes. There are many options and opportunities to adapt. These range from technological options such as increased sea defences or flood-proof houses on stilts, to behaviour change at the individual level, such as reducing water use in times of drought and using insecticide-sprayed mosquito nets. Other strategies include early warning systems for extreme events, better water management, improved risk management, various insurance options and biodiversity conservation.

The National Context

India's economy and a majority of its population are highly dependent on climate sensitive sectors such as agriculture, animal husbandry, fisheries, tourism, etc. Since climate change is expected to impact natural and human systems adversely by inducing changes these systems, India can be considered highly vulnerable. Climate change is only likely to exacerbate India's already high physical exposure to climate-related disasters (65 percent of India is drought prone, 12 percent flood prone, and 8 percent susceptible to cyclones). As a consequence, climate change is highly likely to impact livelihoods by disrupting social, cultural, economic, ecological systems, physical infrastructure, and human assets, accentuating health risks, and as such, posing severe risks to the development of the country.

Since climate change impacts are felt at multiple levels from the global to the local, responses to climate change too need to be at multiple levels, calling for strategic interventions at local, sub-national, national, and global levels. At the global level, India's contribution to multilateral negotiations in the United Nations Framework Convention on Climate Change (UNFCCC) has been significant and it continues to advocate for effective, cooperative, and equitable global approaches based on the principle of 'common but differentiated responsibilities and respective capabilities'. At the national level, India has developed the National Action Plan on Climate Change (NAPCC), 2008, and comprising eight national missions (see Box I below) at its core, addressing various sectoral aspects of climate change. The NAPCC seeks to promote understanding of climate change, adaptation, mitigation, energy efficiency and natural resource conservation while pursuing overall economic growth – i.e., measures that promote development objectives which also result in co-benefits for addressing climate change.

At the same time, recognising that the impacts of climate change will vary across states, sectors, locations, and populations, and that different approaches will need to be adopted to fit specific sub-national contexts and conditions, all Indian States have been asked to prepare State Action Plans for Climate Change (SAPCCs) in line the NAPCC. It is in this context that the Chhattisgarh State Action Plan (CSAPCC) for Climate Change has been prepared.

Box 1: National Missions Under the NAPCC

- **National Solar Mission** (renamed as Jawaharlal Nehru National Solar Mission) aims to promote the development and use of solar energy for power generation and other uses with the ultimate objective of making solar energy competitive with fossil based energy options.
- **National Mission for Enhanced Energy Efficiency** recommends mandating specific energy consumption decreases in large energy consuming industries. It also recommends financing for public-private participants to reduce energy consumption through demand side management programs
- **National Mission on Sustainable Habitat** aims to promote energy efficiency as a core competent for urban planning. The plan calls for a greater emphasis on urban waste management and recycling including production of power from waste.
- **National Water Mission** sets a goal of 20 percent improvement in water use efficiency through pricing and other measures
- **National Mission for Sustaining the Himalayan Ecosystem** aims to conserve biodiversity, forest cover and other ecological values in the Himalayan region
- **National Mission for a Green India** aims at Increased forest/tree cover on 5 m ha of forest/non-forest lands and improved quality of forest cover on another 5 m ha (a total of 10 m ha), improved ecosystem services including biodiversity, hydrological services, and carbon sequestration as a result of treatment of 10 m ha.
- **National Mission for Sustainable Agriculture** aims to support climate adaptation in agriculture through the development of climate resilient crops and appropriate agricultural practices
- **National Mission on Strategic Knowledge for Climate Change** is for gaining a better understanding of climate science, impacts and challenges. It envisions improved climate modelling and increased international collaboration to develop adaptation and mitigation technologies.

The Chhattisgarh Context

As is the case with many other States with high dependence on natural resources and in similar developmental contexts in India, Chhattisgarh too faces the threat of climate change and its impacts. Available evidence shows that there is high probability of increase in the frequency and intensity of climate related natural hazards due to climate change and hence increase in potential threat due to climate change related natural disasters. In the (relative) absence of state level climate models and/or vulnerability studies, as well low community awareness, Chhattisgarh is potentially highly sensitive and vulnerable to climate change and its impacts.

Chhattisgarh -- 'Inclusive Growth for Improved Resilience'

Among the three new States that were carved on the map of India in November 2000, Chhattisgarh has raced ahead and made good all-round progress in the last one decade. The trends and progress of the last two plan periods indicate that by the end of the 12th Five Year Plan (FYP) Chhattisgarh will have performance indicators comparable with the better performing states of the country, and the State is putting in significant efforts to reduce disparities through greater people's participation and bring about development using low carbon strategies that marry ecological conservation with economic growth. This hard work has borne fruit- the 11th Plan period (2007-12) was marked by an impressive compounded annual growth rate (CAGR) of 8.4 percent against a target of 8.6 percent for the plan period, fiscal deficit of under 2.8 percent, doubling of the plan size, sharp increase in per capita income and reduction in debt from 19.11 to 16 percent of Gross State Domestic Product (GSDP) between 2007 to 2011.

On the other hand, development challenges faced by Chhattisgarh are diverse and numerous- ranging from low social and human development, high incidence of poverty- especially among women and tribal, inequity in access to resources and services, high proportion of vulnerable population, sub-optimal economic productivity, poor social and physical infrastructure, rich natural resources but locked by national policies and the constraints imposed by widespread Left Wing Extremism (LWE). Each of these is equally critical for inclusive and accelerated growth in the next plan.

On human development indicators, the State has been working hard to come at par with national averages. The State's economy grew at an impressive pace in the last decade, but not all sections of the society were able to reap its benefit. Despite targeted efforts at reducing deprivation, limited success was achieved in ensuring equity in redistribution of benefits. The Inequality-adjusted Human Development Index (HDI)-- using 2004-05 data -- that looks at disparities among social groups in attainment of key human development indicators suggests high variation within the State in terms of incomes, education, and health. This disparity is highest on education and health parameters, which, when adjusted for inequality, erodes the State's absolute HDI value by nearly 35 percent. Differences have narrowed over the past few years, but are still significant and their reduction will be a priority for the 12th Plan.

Large investments have been made for developing the physical and industrial infrastructure, but Chhattisgarh still falls short of the national averages. Road and rail infrastructure is one of the poorest among major States, which inhibits accelerated industrial development. Additional investments will be required for further improving them to boost the primary and secondary sectors. Chhattisgarh has vast mineral and natural resources, but compared to its potential the contribution to State's economy is barely significant. This is because most of these resources go out of the state as unprocessed raw material and their value addition takes place elsewhere. The sub-optimal use of its comparative advantage for local processing/manufacturing and thus creating wealth within the State will be a challenge to meet in the next plan.

The 12thFYP of Chhattisgarh will aim at addressing these development challenges for reducing inequality and deprivation and fostering an accelerated and inclusive economic growth. It will work across all sectors to further promote human development that impacts and improves the life's of all- marginalized, women, old-aged, minorities and the differently-abled. Venturing on this path to foster human development through good governance, the state aspires to see a significant reduction in these inequities across social groups, regions, and gender by the end of the 12th Plan.

The Approach paper to the 12thFYP for Chhattisgarh also explicitly articulates the need to mainstream climate change concerns into development. It acknowledges that rural areas are most vulnerable to impacts of disasters and climate change. With a significant population dependent on rain-fed agriculture, animal husbandry, fisheries, and forest-based livelihoods, any change in precipitation and temperature patterns could significantly impact lives of the vulnerable. With variations in recent years manifesting as droughts and floods, the State needs advance preparation to counter such threats and minimize its impact on people and bio/ natural resources. In line with the NAPCC, the potential climatic change impacts on the region are currently being assessed for developing a SAPCC. Based on these threat assessments, in the 12th Plan period most vulnerable sectors- agriculture, forestry, mining and energy will mainstream these climate change concerns in planning and implementation, taking into account their impact on the most vulnerable and women. Local mechanisms like climate change adaptive planning will also be put in place to help adaptation at the local level.

In line with the above, the Chhattisgarh is adopting the motto "Inclusive Growth for Improved Resilience" for the CSAPCC, to highlight the State's commitment to building resilient human development while maintaining a high economic growth.

CSAPCC Preparation Process

A timeline of processes undertaken in the CSAPCC formulation process is given below:

Table 1: Timeline of CSAPCC formulation Process/Activities

Month/Dates	Process/Activity
September 2010	National Workshop on Climate Change; initial discussions at State Level for SAPCC
	Initial notification for setting up of State Steering Committee (SSC) issued
April 2011	Establishment of Sectoral Core Working Groups for identified sectors for SAPCC
	Nomination of Nodal Officer for Climate Change for the State
September 2012	UNDP Consultant for CSAPCC appointed; initial visit to State by Consultant for discussions and collection of secondary information/data
November 2012	Initial Draft CSAPCC (for discussion) developed
January 2013	Regional Consultation Workshops held (Bilaspur – 21 January; Raipur – 22 January; Jagdalpur – 24 January)
February 2013	Penultimate Draft CSAPCC developed
May 2013	Inputs received from focus sector Departments, etc. Final Draft Developed

Supported by the United Nations Development Programme (UNDP), the state government initiated processes towards the preparation of the CSAPCC, in September 2010, when the State hosted a National Workshop on Climate Change, and initial discussions were held at the state level for development of a CSAPCC. An initial notification for setting of the State Steering Committee (SSC) headed by the Chief Secretary and including representatives from relevant government departments for this purpose was issued. The SSC was mandated the role of overseeing all aspects of the state's preparations and initiatives to address climate change and its impacts. Sectoral Core Working Groups were formed in April 2011, and a Nodal Officer, Dr. Arvind Boaz, Additional Principal Chief Conservator of Forests (APCCF) of the State Forest Department was nominated to coordinate and oversee the CSAPCC formulation process in consultation with various line departments and other relevant stakeholders.

UNDP appointed a technical team at the end of September 2012 to assist the state government with carrying out this process. A secondary review was carried out by the technical team, and based on the initial inputs from the State towards the CSAPCC, recommended (a) the need

for a more structured framework for the CSAPCC, (b) the need for the CSAPCC to articulate an overarching state-level vision and commitment and the institutional architecture to guide, govern, support, coordinate and monitor implementation of the plan across various sectors and (c) the need to incorporate additional elements in the plan including for example, bringing in additional sectors, articulating the roles of the private sector, financial institutions, civil society and approaches to gender mainstreaming. A first draft of the full CSAPCC was developed in November 2012 by the UNDP technical team and was circulated to various stakeholders for inputs.

One-day regional stakeholder consultation workshops were held at Bilaspur (northern agro climatic region), Raipur (central agro climatic region), and Jagdalpur (southern agro climatic region) on January 21, 22, and 24 respectively. The workshops were focussed on seeking voices/inputs from grassroots communities, dialogue with scientific and academic institutions, government departments, industries and private sector representatives, as well as with civil society groups/organizations, with a view to soliciting inputs on climate change and its impacts and possible responses for inclusion in the CSAPCC. Brief summary notes of the proceedings from these workshops are given in Annexure I.

Figure 1: Bilaspur Consultation Workshop, 21 January 2013



Figure 2: Raipur Consultation Workshop, 22 January 2013

Figure 3: Jagdalpur Consultation Workshop, 24 January 2013



The inputs received from the above processes have been used to revise the initialDraft of the CSAPCC and create this Final Draft in February 2012.

Part A: General and Climate Profile - Introduction

1 State Profile

1.1 Location and Physiography

Chhattisgarh is a state in Central India and was formed on November 1, 2000 by partitioning 16 Chhattisgarhi-speaking southeastern districts of Madhya Pradesh. Chhattisgarh borders the states of Madhya Pradesh in the northwest, Maharashtra in the west, Andhra Pradesh in the south, Orissa in the east, Jharkhand in the northeast and Uttar Pradesh in the north.

Figure 4: Map showing location of Chhattisgarh

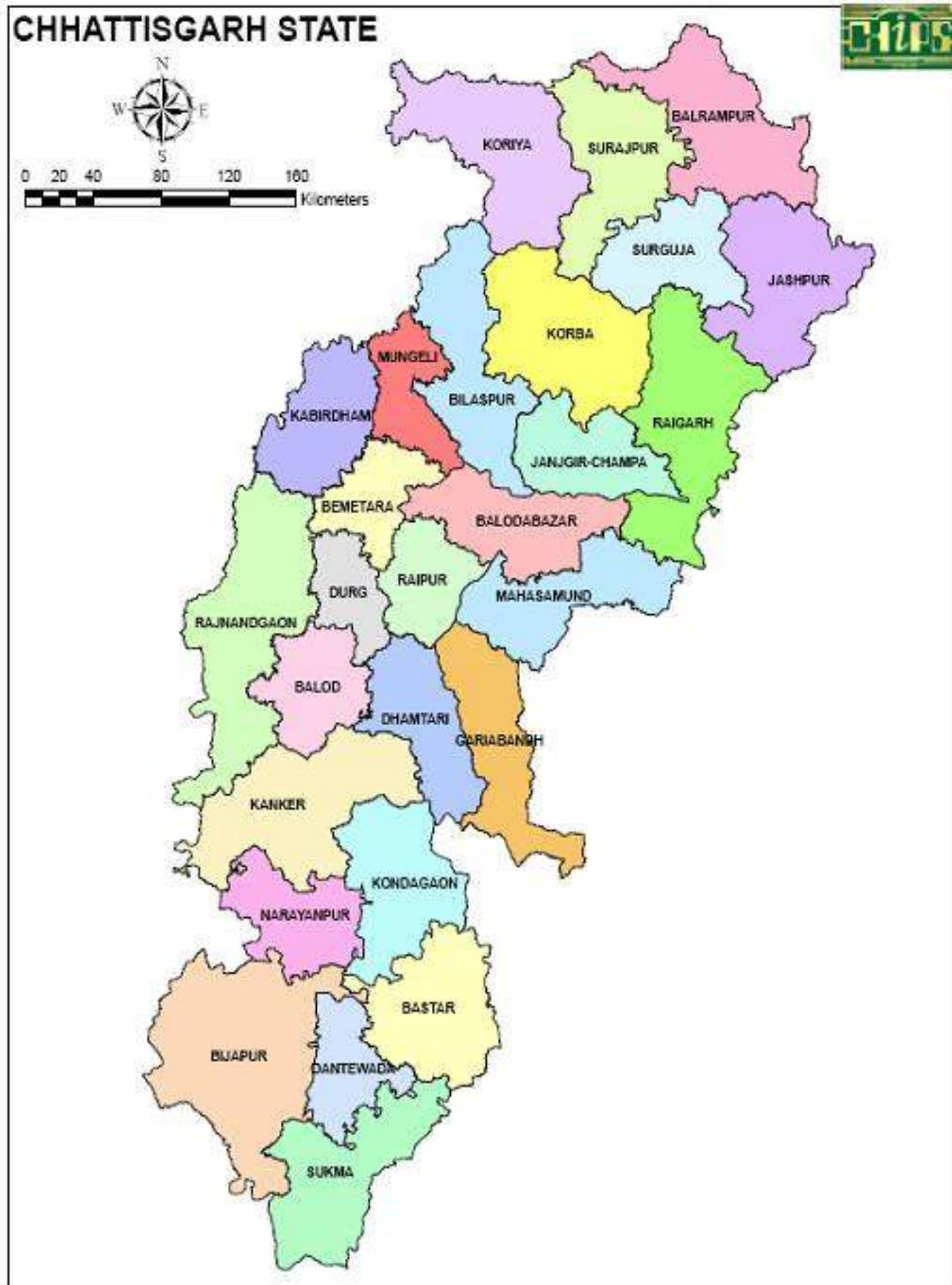


Raipur is the capital of Chhattisgarh, which is the 10th largest state in India, with an area of 135,190 km² (52,200 sq mi). The northern and southern parts of the state are hilly, while the central part is a fertile plain. Deciduous forests of the Eastern Highlands Forests cover roughly 44 percent of the state. In the north lies the edge of the great Indo-Gangetic plain. The Rihand River, a tributary of the Ganges, drains this area. The eastern end of the Satpura Range and the western edge of the Chota Nagpur Plateau form an east-west belt of hills that divide the Mahanadi River basin from the Indo-Gangetic plain. The central part of the state lies in the fertile upper basin of the Mahanadi River and its tributaries. This area has extensive rice cultivation. The upper Mahanadi basin is separated from the upper Narmada basin to the west by the Maikal Hills (part of the Satpuras) and from the plains of Orissa to the east by ranges of hills. The southern part of the state lies on the Deccan plateau, in the watershed of the Godavari River and its tributary, the Indravati River. The Mahanadi is the chief river of the state. The other main rivers are Hasdo (a tributary of Mahanadi), Rihand, Indravati, Jonk, Arpa, and Shivnath.

The climate of Chhattisgarh is tropical. It is hot and humid because of its proximity to the Tropic of Cancer and its dependence on the monsoons for rains. Summer in Chhattisgarh is from April to June and temperatures can reach 48°C (110°F). The monsoon season is from late June to October and is a welcome respite from the heat. Chhattisgarh receives an average of 1,292 millimetres (50.9 in) of rain. Winter is from November to January and it is a good time to visit Chhattisgarh. Winters are pleasant with low temperatures and less humidity. The temperature varies between 30 and 47°C (86 and 117°F) in summer and between 5 and 25°C (41 and 77°F) during winter. However, extremes in temperature can be observed with scales falling to less than 0°C to 49°C.

Chhattisgarh has 27 administrative districts. Out of these two new districts (Bijapur and Naryanpur) were carved out on May 11, and 9 new districts on Jan 1, 2012. The new districts have been created by carving out the existing districts to facilitate more targeted, focused, and closer administration. These districts have been named Sukma, Kondagaon, Balod, Bemetara, Baloda Bazar, Gariaband, Mungeli, Surajpur, and Balrampur.

Figure 5: Districts of Chhattisgarh



On the basis of regional topography Chhattisgarh region is divided into three agro-ecological regions, the Northern Hills, the Central Plains and the Bastar Plateau.

Figure 6: Chhattisgarh – agro-climatic zones



Northern region: The districts that are part of this region (Korea, Surguja, Jashpur, Raigarh, and Korba) have similar geographical, climatic, and cultural contexts and harbour dense forests, hills and water reservoirs. It is home to several indigenous tribal communities such as Paharikorba and Pando, etc. Governed largely by tribal customs, culture and traditions, in the rural areas of the region, people are dependent largely on agriculture and non-timber forest produce (NTFP). The level of migration from this region is comparatively limited. The urban centres are limited to Korba and Ambikapur. Korba is the largest town, and the limited industry is concentrated here. There are coalmines in Surguja and Korea districts.

Central plains region: Raipur, Bilaspur, Janjgir-Champa, Kabirdham, Rajnandgaon, Durg, Dhamtari, and Mahasamund are the districts that fall in the central plains. Mahanadi is the primary source of water for irrigation and domestic use. Owing to the presence of large number of indigenous varieties of rice, the central plains of Chhattisgarh are known as the 'rice bowl' of Central India. Bhalai and Durg are well known urban areas, both with large steel plants. Rural craft is well developed in the region and well known (e.g. the silk weavers of Janjgir-Champa). The region is densely populated with Raipur and Durg account for almost half the total urban population of Chhattisgarh.

Southern region: The districts in this region (Kanker, Bastar and Dantewada) are known for its varied and rich forests, diverse tribal population, and unique culture. These districts are bordered by the States of Maharashtra, Andhra Pradesh, and Orissa. The people of the region are dependent on traditional agriculture and forests for their livelihood. The Bailadila mines in Dantewada district represent the limited industry in the region.

Table 2: Agro-climatic zones and details

Agro Climatic Zone	Districts Included	Total Geo. Area	Net sown area	Soil Type	Irrigation %	Cropping Intensity
C.G. Plains (15 Districts)	Raipur, Gariaband, Balodabazar, Mahasamund, Dhamtari, Durg, Balod, Bemetara, Rajnandgaon, Kabirdham, Bilaspur, Mungeli, Korba, Janjgeer, Raigarh & a part of Kanker Districts (Narharpur & Kanker Block)	68.49 lakh ha. (50%)	32.95 Lakh ha.	Entisol (Bhatha) -- 36 %; Alfisol (Matasi) -- 21 %; Inceptisol (Dorsa) -- 22 %; Vertisol (Kanhar) -- 8 %; Alluvial (Kachhar) - 3 %	43 %	139
Bastar Plateau (7 Districts)	Jagdapur, Narayanpur, Beejapur, Kondagaon, Dantewada, Sukma and the remaining part of Kanker Districts	39.06 lakh ha. (29%)	6.40 Lakh ha.	Entisol -- 26 %, Alfisol -- 25 %, Inceptisol -- 34 %, Vertisol -- 10 %, Alluvial -- 5 %	5 %	122
Northern Hills (5 Districts)	Sarguja, Surajpur, Balrampur, Korja, Jashpur & Dharamjaigarh Tehsil of Raigarh Districts	28.47 lakh ha. (21%)	8.35 Lakh ha.	Entisol -- 3 %, Alfisol -- 29 %, Inceptisol -- 28 %, Vertisol -- 28 %, Alluvial-- 2 %	11 %	135

1.2 Demographic and Human Development Profile

As per details from Census 2011, Chhattisgarh has population of 2.55 Crore, an increase from figure of 2.08 Crore in 2001 census. Total population of Chhattisgarh as per 2011 census is 25,540,196 of which male and female are 12,827,915 and 12,712,281 respectively. In 2001, total population was 20,833,803 in which males were 10,474,218 while females were 10,359,585. The total population growth in this decade was 22.59 percent while in previous decade it was 18.06 percent. The population of Chhattisgarh forms 2.11 percent of India in 2011. In 2001, the figure was 2.03 percent. Some of the important economic and development indicators of Chhattisgarh are given below:

Table 3: Economic and human development indicators¹

		Chhattisgarh	India
Demographic Indicators		2011	2011
1	Total Population (In Millions)	26	1210
2	% Contribution to national population	2.11	100

¹ Sources: Indicators 1-4, 20-22 -- Census of India 2011, Provisional Tables, Registrar General of India, http://www.censusindia.gov.in/2011-prov-results/prov_results_paper1_india.html; indicators 5-10 -- RBI Handbook of Statistics on Indian Economy and Economic Survey of India 2010-11 <http://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Handbook%20of%20Statistics%20on%20Indian%20Economy>; indicators 11-12 -- India Human Development Report 2011, IAMR and Planning Commission; indicators 13-16 -- Gendering Human Development Indices: Gendering Human Development Indices: Recasting the Gender Development Index and Gender Empowerment Measure for India, Ministry of Women and Child Development, GOI http://undp.org.in/sites/default/files/GDI_and_GEM_Report.pdf; indicators 17-19 -- Inequality Adjusted Human Development Index for India's States 2011, UNDP, www.undp.org.in/sites/default/files/reports_publication/IHDI_India.pdf; indicators 23-24 -- Tendulkar Committee Report 2009, Planning Commission, http://planningcommission.gov.in/reports/genrep/rep_pov.pdf; indicators 25-27 -- MPI data and updates for 2011, OPHI, <http://www.ophi.org.uk/policy/multidimensional-poverty-index/mpi-data-methodology>; indicators 28-31 -- India State Hunger Index 2009, IFPRI, <http://www.ifpri.org/publication/comparisons-hunger-across-states-india-state-hunger-index>

		Chhattisgarh	India
3	Sex Ratio (females per 1000 males)	991	940
4	Under 6 sex ratio(females per 1000 males)	964	914
Economic Indicators		2009-10	2009-10
5	Net domestic Product (at factor cost) (Rs crores) (For state)	63297	4493743
	Gross Domestic Product (at factor cost) (Rs crores) (For India)		
6	Contribution of Agriculture to NSDP/GDP (%)	18.65	14.62
7	Contribution of Industry to NSDP/GDP (%)	31.74	20.16
8	Contribution of Services to NSDP/GDP (%)	49.61	65.22
9	Per Capita Net State Domestic Product (factor cost) (Rs) (for State)	25835	33731
	Per Capita Net National Product(factor cost) (Rs) (For India)		
10	NDP Growth rate (%) (ForState)	12.37	8
	GDP Growth Rate (%) (For India)		
Human Development Indicators		2007-08	2007-08
11	Human Development IndexValue (HDI)	0.358	0.467
12	HDI Rank (out of 23)	23	
		2006	2006
13	Gender Related Development Index (GDI)	0.542	0.590
14	GDI Rank (out of 35)	30	122
15	Gender Empowerment Measure (GEM)	0.464	0.497
16	GEM Rank (out of 35)	19	
		2011	2011*
17	Inequality Adjusted Human Development IndexValue (IHDI)	0.291	0.343
18	Inequality Adjusted Human Development Index Rank (out of 19)	18	
19	Loss in HDI due to Inequalities (%)	35.14	32
20	Literacy Rate (%)	71.04	74.04
21	Male Literacy Rate (%)	81.45	82.14
22	Female Literacy Rate (%)	60.59	65.46
* Value differs from India IHDI in Global HDR 2011 due to different data sources.			
Poverty and Hunger Indicators		2009-10	2009-10
23	Poverty Headcount Ratio (%)	48.7	29.8
24	Total number of poor (in millions)	12.19	354.68
		2005	2005
25	Multidimensional Poverty Index (MPI)	0.367	0.283
26	Multidimensional Poverty Headcount (%)	69.7	53.7
27	Number of Multidimensional Poor (in millions)	17.9	612
		2007	2007
28	Global Hunger Index (GHI)	26.63	23.3
29	GHI Rank (out of 17)	14	
		2005-06	2005-06
30	Prevalence of calorie undernourishment (%)	23.3	20
31	Prevalence of Underweight Children under 5 years of age (%)	47.6	42.5

In the eleventh plan period a number of successful initiatives were started for improving enrolment among girls and the marginalized through a two-fold increase in investments in education, work on food and nutrition security for all- especially children and the poor, enhanced outreach of health services, better rural connectivity and energy access. Increase in paddy production was the fastest in Chhattisgarh among states in 2010-II and there was an overall increase of 11 percent in food grain production between 2007-08 and 2010-II.

On the other hand, development challenges faced by Chhattisgarh are diverse and numerous- ranging from low social and human development, high incidence of poverty- especially among women and tribal, inequity in access to resources and services, high proportion of vulnerable population, sub-optimal economic productivity, poor social and physical infrastructure, rich natural resources but locked by national policies and the constraints imposed by widespread LWE. Each of these is equally critical for inclusive and accelerated growth in the next plan.

On human development indicators, the State has been working hard to come at par with national averages. Differences have narrowed over the past few years, but are still significant and their reduction will be a priority for the 12th Plan. Vulnerability is very high and half the state's population (nearly eleven million) lives below poverty line. The combined Scheduled Tribe (ST) and Schedule Caste (SC) population is 43.37

percent -- one of the highest among major States and the difference among them and other social groups in terms of assets, attainment, and access to entitlements is stark. Geographical isolation and social exclusion compound the problems in mainstreaming these vulnerable communities. Small and marginal farmers who constitute nearly three-fourths of the total cultivators undertake subsistence agriculture on small under-productive holdings. Agricultural productivity is nearly half the national average, predominantly rain-fed and irrigation covers just 31 percent of the sown area. The MPI (2005), which measures deficits in critical areas to understand the intensity of deprivation, ranks Chhattisgarh as a State with acute deprivations in terms of continued access to education, mortality, nutritional status, access to basic services like water, sanitation, energy and asset ownership. According to UNDP, 69.7 percent of state's population is multi-dimensionally poor and suffers various intensities of deprivations, compared to 53.7 percent for the country. As per assessments on human development, the State ranked the lowest on Human Development Index (HDI) -0.358 among 23 States (India Human Development Report 2011) indicating unequal access and high exclusion. On the measures assessing deprivation of women with respect to rest of the population- GDI (2006), Chhattisgarh had a low GDI of 0.542, placing it 30th among 35 States-suggesting wide disparities in the quality of life among men and women.

The State's economy grew at an impressive pace in the last decade, but not all sections of the society were able to reap its benefit. Despite targeted efforts at reducing deprivation, limited success was achieved in ensuring equity in redistribution of benefits. The IHD (using 2004-05 data), which looks at disparities among social groups in attainment of key human development indicators suggests high variation within the State in terms of incomes, education, and health. This disparity is highest on education and health parameters, which, when adjusted for inequality, erodes the State's absolute HDI value by nearly 35 percent.

1.3 Economy

In the past decade Chhattisgarh focused attention on areas where it had historically lagged - development of physical and social infrastructure, administrative re-organization to bring governance closer to people, strengthening and expanding its development cadre to ensure provision of basic services to all, improving service delivery by targeting key flagship programmes, creating an industry-friendly environment to attract the much needed private investments, fiscal consolidation, and initiatives aimed at winning back the confidence of some sections of society that had been alienated. This hard work has borne fruit- the 11th Plan period (2007-12) was marked by an impressive CAGR of 8.4 percent against a target of 8.6 percent for the plan period, fiscal deficit of under 2.8 percent, doubling of the plan size, sharp increase in per capita income and reduction in debt from 19.11 to 16 percent of GSDP between 2007 to 2011.

Large investments have been made for developing the physical and industrial infrastructure, but Chhattisgarh still falls short of the national averages. Road and rail infrastructure is one of the poorest among major States, which inhibits accelerated industrial development. Additional investments will be required for further improving them to boost the primary and secondary sectors. Chhattisgarh has vast mineral and natural resources, but compared to its potential the contribution to State's economy is barely significant. This is because most of these resources go out of the state as unprocessed raw material and their value addition takes place elsewhere. The sub-optimal use of its comparative advantage for local processing/manufacturing and thus creating wealth within the State will be a challenge to meet in the next plan. As noted by Planning Commission's Approach paper '*the 12th Plan will be launched in a less benign and a more uncertain macro-economic environment...*' owing to the aftershocks of the global crisis, economic slowdown, fluctuating currency and surging inflation-driven by high fuel and food prices.

Fiscal Performance

These macro-economic factors have impacted the State's focus on inclusion and to some extent eroded its investments in social security, as the effect of inflation has been severest on the vulnerable. Despite this inhibiting environment Chhattisgarh has been able to achieve a CAGR of 8.4 percent in the Eleventh Plan and a growth of 9.4 percent from 2000-01 to 2010-11 (second fastest among major States). As a result, the State's per capita income has increased from ` 10,808 to Rs. 28,296 from 2001 to 2010-11 (AE 2011-12 at constant prices 2004-05). Plan size has doubled within the Eleventh Plan from ` 7,414 crore to ` 16,701 crore (AE 2011-12) primarily owing to higher revenue receipts - 62 percent. Current social sector spending stands at around 45 percent of plan expenditure, with an additional 20 percent being spent on agriculture, irrigation, rural development, and subsidies.

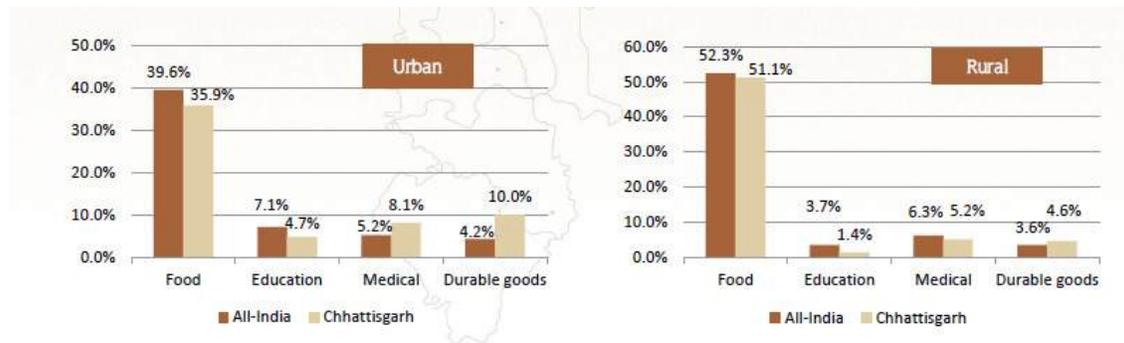
Financial Management

Attempts to have an inclusive focus in Chhattisgarh are challenged by high inflation as well as the State's spatial characteristics and challenges of governance in LWE affected areas. This has led to a shrinking State Plan outlay as a percentage of its overall budget. To be able to free resources for the much needed development, in the last plan State embarked on long-term fiscal consolidation by curtailing non-plan revenue expenditure- limiting non-development schemes, creating a corpus for meeting future pension liabilities, reclassifying posts; and increasing resource mobilization through improved realization of tax revenue and attracting outside investments. There has been a consistent increase of 15 percent in Tax Revenue Receipts in past five years and high interest debts have been replaced.

Consumer Expenditure

Chhattisgarh is ahead as compared to all-India in share of per capita expenditure on durable goods. With regards to share of expenditure on food and medical services, the state is comparable to the all-India level.

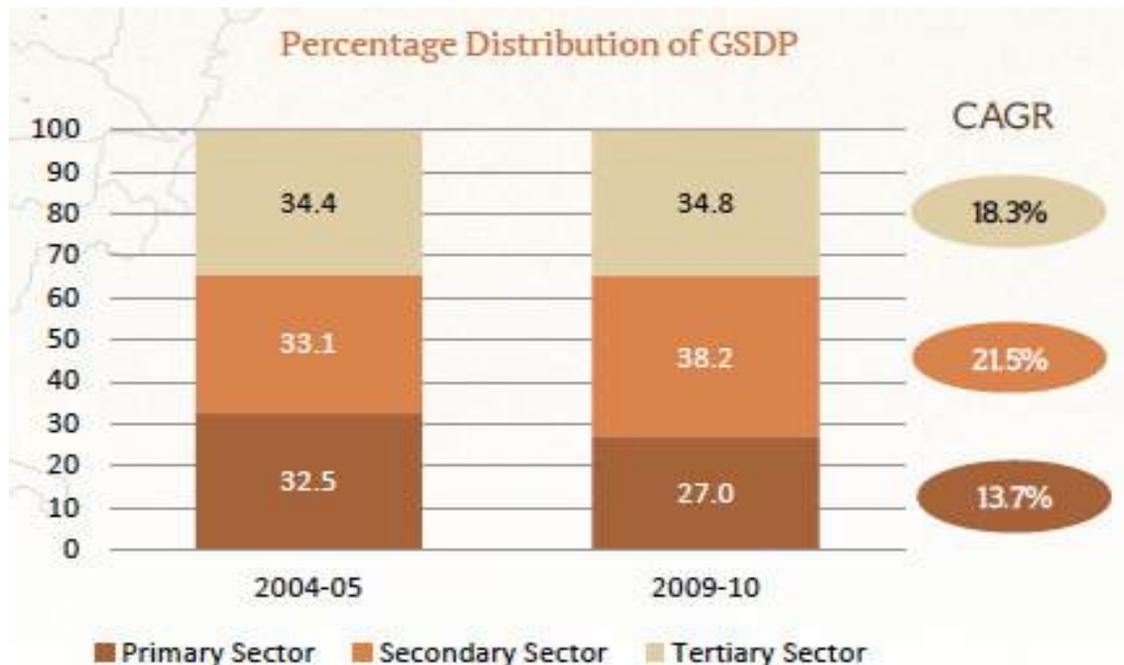
Figure 7: Share of average per capita monthly expenditure on household goods and other services²



Sector-wise Performance

While all three sectors of the economy have grown at healthy rates, this is not enough to propel growth that the State aspires to. Within the primary sector much of the growth has been fuelled by mining as compared to agriculture. Secondary sector has not been able to achieve growth targets of the current Plan and emphasis will be to encourage job creation through industrial growth with large private investments, as well as incentives for micro, small, and medium enterprises (MSMEs). Expansion of the service sector is encouraging and has received a push through investments in training and technical institutions. In 2009-10, the secondary sector contributed the highest to Chhattisgarh's GSDP, at current prices, at 38.2 percent. It was followed by the tertiary sector, contributing 34.8 percent and the primary sector, contributing 27.0 percent.

Figure 8: Chhattisgarh – percentage distribution of GSDP³



³ Source: Data from Centre for Monitoring of Indian Economy (CMIE); graph produced by IBEF

At a CAGR of 21.5 percent, the secondary sector has been the fastest growing among the three sectors from 2004-05 to 2009-10. It was driven by manufacturing, construction and electricity, gas and water supply. The tertiary sector grew at a CAGR of 18.3 percent between 2004-05 and 2009-10. The growth has been driven by trade, hotels, real estate, banking, insurance, transport, communications, and other services. The primary sector grew at a CAGR of 13.7 percent between 2004-05 and 2009-10.

Growth Targets

In the 12th Plan the State will target an overall GDP growth of 10 percent. The sector wise growth targets will be 4 percent for agriculture and allied sectors, 11 percent for industry and minerals, and an 11 percent growth for the services sector. This will be propelled by equitable investments in all three sectors and by creating special incentives for sub-sectors with potential for amplifying growth.

While this may look ambitious, trends of past few years (marked by high inflation) suggest that for real-term growth to happen a higher growth target is imperative. Increasing resource availability to meet the requirements for heavier investments in infrastructure, social sector and overall development will be a priority. Government alone cannot finance economic growth and increased private investments will be required. Apart from attracting private investments, the State's public finances- debt at 16.04 percent, fiscal deficit at 2.78 percent of GSDP and a continuing revenue surplus give it the necessary buffer to increase borrowings in future to incur higher capital expenditure.

Impact of External Environment

Volatility of global markets, and reforms being considered by national government to counter them, pose an uncertain resource scenario for States and may have a likely impact on grant assistance. Changes in the pipeline such as legislations on Goods and Services Tax and Land acquisition may also have adverse implications on the State's economy. The challenge before Chhattisgarh will be to optimize benefits for all through equitable allocation of this scarce resource.

With a large part of the population involved in rural farm and non-farm sector, for faster inclusive growth, it will need more funds for the agriculture sector to increase productivity and support infrastructure.

Constraints to Growth

Nearly fifty-six percent of State's geographical area comes under forests and its economic growth is handicapped by limited availability of land for improving physical infrastructure (especially connectivity within and with neighbouring states) and for setting-up industrial zones. Thirteen out of twenty seven districts of Chhattisgarh are threatened by LWE and costs of development/infrastructure projects in affected areas increase manifold when the security, insurance, project delay related cost overruns are factored in. Bulk of the profit from mining goes outside and the State exchequer receives only 7.5 percent of the gross revenue earned by Central Public Sector Undertakings (CPSUs).

1.4 Infrastructure

One of the pre-requisites for social progress and economic development of a region is the availability of quality infrastructure to increase access and improve the mobility of factors of production. Chhattisgarh still has a huge backlog with respect to infrastructure, and large resources and efforts have been invested for ushering in economic growth and reducing disparity between the State and other regions.

Physical Infrastructure - Roads

The eleven National Highways of Chhattisgarh together constitute 2,225 km of roads in the state. The State Highways and major district roads account for another 8,031 km. While all district headquarters, tehsils, and development blocks are connected with good all weather roads, the network in Chhattisgarh is relatively one of the poorest in the country. Compared to the national average of 74.90 km per 100 sq km of, the State average is just 24.73 km; less than 40 percent of the national average. Substantial resources, including loans, have been galvanized to bridge this infrastructure gap, take road connectivity to all habitations, and compensate for the poor rail network. Priority was placed on first reaching the hitherto unconnected habitations. In 2008-09, 2,811 km of roads and 68 bridges were constructed. As of 2008-09, the total road length in the state was 45,988 km. From 2001 and early 2011 rural roads measuring 17,668 km and 20,870 bridges/ culverts have been constructed. To facilitate smoother inter-State and internal traffic State highways and district roads have also been upgraded. As of November 2011, several PPP projects in the roads sector were underway.

Table 4: Roads sector PPPs in Chhattisgarh (as of November 2011)⁴

Contract Authority	Project	Investment (US\$ million)	Project Type	Status
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⁴ Source: pppindia database.com

Contract Authority	Project	Investment (US\$ million)	Project Type	Status
National Highways Authority of India (NHA)	Aurang – Raipur	41.3	Road, BOT-Toll	Under construction
	Durg Bypass	15.2	Road, BOT-Toll	In operation
	End of Durg Bypass on Chhattisgarh – Maharashtra Border	100.9	Road, BOT-Toll	Under construction
	Raipur – Durg Expressway	24.8	Road, BOT-Toll	In operation

With Chhattisgarh's commitment to accelerate the pace of development, 12th Plan will be the time to rollout a coordinated strategy to improve the quality of road infrastructure. A specialized agency will be created to provide end-to-end solutions for improving roads right from their conceptualization, clearances, financing, execution, and maintenance. Thrust will also be on linking industrial areas with nearest railhead and national highways through state roads of quality standards.

Physical Infrastructure -- Railways

Chhattisgarh's railways sector falls under the jurisdiction of the South East Central Railways. The state is well connected to the rest of the country via the railways. Raipur and Bilaspur are the two major railway stations. The significant mining and industrial activity in the state was a major reason behind the setting up of the South East Central Railways in 1998, headquartered in Bilaspur. The state has the highest freight loading capacity in the country and one-sixth of Indian Railway's revenue comes from Chhattisgarh. The length of rail network in the state is 1,108 Kms. Direct trains to many cities like Ahmedabad, Allahabad, Varanasi, Bengaluru, Cochin, Pune, and Hyderabad are also available.

Physical Infrastructure -- Airports

The state has two domestic airports; one at Raipur and the other at Bilaspur. Chhattisgarh also has seven air strips located at Bhilai, Korba, Raigarh, Jagdalpur, Ambikapur, Jashpur Nagar and Sarangarh. Raipur is linked by regular flights with New Delhi, Mumbai, Kolkata, Bhubaneswar, Nagpur, Bhopal, Indore, Ahmedabad, and Hyderabad. The Raipur Airport received 532,323 passengers during 2010-11, and a new terminal building is nearing completion.

Physical Infrastructure -- Telecommunications

The state is in the process of implementing the State Wireless Area Network (SWAN), which will be a hybrid of wireless and wire-line access – supporting voice, data, and video traffic. According to the Department of Telecommunications, Government of India, Chhattisgarh had 1.2 million wireless connections and 152,100 wire-line subscribers, as of December 2010. The total number of broadband users, as of November 2010, was 418,091 (including Madhya Pradesh). As of December 2010, Chhattisgarh had 580 telephone exchanges.

Other Physical Infrastructure Sectors

Other core physical infrastructure sectors such as transport, urban infrastructure, power, and water sector will be discussed separately in subsequent Sections of this report.

1.5 Rural Development and Social Sectors

Literacy and Education

Looking at the last decade the State has been able to achieve some measure of success in the area of basic education. As compared to Census 2001 its total literacy has increased from 64.66 to 71, male literacy from 77.4 to 81.45 percent and female literacy from 51.9 to 60.59 percent. This has come at the cost of tremendous financial burden. Over the plan period State's spending on school education has doubled from 13.66 in 2007-08 to 26.08 percent of Plan Expenditure in 2010-11. In terms of quality and its related indicators, the State has seen enrolment increase to 31.17 lakh in Primary, 16.21 lakh in Upper Primary, 8.33 lakh in High School, attendance from 63 percent to 78.1 percent and net enrolment from 73 percent to 87 percent between 2002 to 2011. Closer monitoring of schools by Community/Panchayats /Block Resource Centres has also led to increased teacher attendance, which is now 82.9 percent for primary and middle schools. Though the State's education indicators have improved, so have the national averages. More attention will be required to bridge the gap between national and State level. New (9596) primary schools and 8600 new middle schools have been opened since 2001 as part of Sarva Shiksha Abhiyan (SSA) and Rashtriya Madhyamik Shiksha Abhiyan (RMSA) to provide equitable access to education for all. In the eleventh plan alone nearly 1682 High school and 457 Higher Secondary schools were opened and 1342 Upper primary schools upgraded to High School. State will now make efforts to bring the same level

of infrastructure- classrooms, drinking water, kitchen-sheds, and toilets- to all schools, including additional provisions for schools not covered by SSA/RMSA.

In the current plan period several State-sponsored schemes have been launched to increase enrolment and retention- free bicycles for girl students, free textbooks, and school uniforms, financial incentives to students of vulnerable groups. Success of the Mid-Day Meal programme has also significantly contributed to school attendance and retention, though scope for further improvement by raising the quality of meals remains. Out of school children are major concerns and nearly 2.4 percent children in 6-14 age group are not in school. As part of Right to Education, emphasis is being laid on involvement of community in identifying challenges and priorities for school improvement. The State would like to see that by the end of 12th Plan all children, including those from disadvantaged groups & differently-abled enjoy equal access to education.

While incentives have led to an overall increase in girl-boy ratio at secondary level from 0.65 to 0.80 the difference is significant in rural areas and acute among vulnerable groups. Literacy amongst ST and SC women is much lower than among other social groups. The State's experience is that in tribal areas, with its dispersed habitation and competing demands for children's time, especially girls- the most effective strategy to ensure quality and continuous learning is education at residential schools. Currently 2584 residential schools and hostels run in tribal areas, which enrol around 1.35 lakh students and an additional 429 hostels for students belonging to Scheduled Caste and Other Backward Classes. In the next plan large residential schools will be set up with priority to LWE affected areas. The pilots on education in LWE affected areas have shown encouraging results and will be up-scaled as part of Mukhyamantri Bal Bhavishya Suraksha Yojana (MBBSY).

Despite heavy teacher recruitments, which saw the number of teachers increase from 1.08 lakh to 2.18 lakh between 2002 and 2012, there is a shortage of teachers, especially for science and mathematics at the secondary and higher secondary level in tribal areas. A long-term strategy is required to fill this gap and the State is considering incentives to performing students opting for mathematics, pure science, and commerce in higher secondary and graduation to create a potential faculty pool for Fifth Schedule areas. For other subjects it is proposed to strengthen the teacher base by opening new teacher training institutions and through distance learning. Chhattisgarh has successfully piloted tutorial classes in remote tribal residential schools for relatively difficult subjects and this will be expanded in coming years. In order to remove the backlog of untrained teachers, Chhattisgarh State Council for Educational Research and Training (SCERT) has already developed a plan to train untrained teachers through distance mode and this will soon be rolled-out.

The State's infrastructure for higher education is growing, with seven State universities & a Central University. Spending on higher education has also increased substantially- mainly for revamping existing infrastructure and setting up new ones. Emphasis in coming years will be on increasing the number of institutions offering higher education, equipping them with modern facilities and helping increase employability. The State has very few National institutions of excellence and the establishment of IIM and AIMS will give a boost to higher education in the state in 12th Plan period. For technical education there are 154 Industrial Training Institutes (ITIs - 108 Govt. and 46 Private), 23 Polytechnics, 51 engineering colleges (4 Govt., 3 Autonomous Self financing and 44 Private), 11 institutes offering courses on pharmaceuticals and 34 offering management-MBA/computer education-MCA. Seeing the encouraging response to them, new agriculture -ITIs and girl's polytechnics will be opened to meet the requirements of the agriculture sector and reduce gender gap in organized sector.

Shortage of medical professionals is acute and hampers the effectiveness of health services. The problem is mainly due to limited medical colleges in Chhattisgarh. The State has just five medical institutions and one dental college. Private investments for setting up medical colleges and Public Private Partnership (PPP) based institutions are being encouraged and investments will be welcome in this area in the next FYP. With a surge in private institutions and industry's demand for quality professionals, mechanisms have been put in place for quality control and would be further strengthened to bring in a culture of continued innovation. State Private Sector Universities Regulatory Commission, Swami Vivekananda Technical University and Quality Control Cell in the Department of Higher Education will create benchmarks for private, technical and higher education institutions respectively to help these institutions ensure quality. Closer working between the State's Technical University and Industry Associations will be encouraged to strike a balance with their human resource requirement.

Women's Empowerment

Women in Chhattisgarh are visible in every walk of life, be it in agriculture, and collection and processing of the State's rich forest wealth or in construction/wage work in urban areas. Contrary to the situation in many parts of the country, Chhattisgarh enjoys a comparatively favourable position in terms of women's population reflected in the Sex ratio i.e. 990 per 1000 males. However, the sustenance of this women's proportion is a challenge.

The State recognises the need for increased participation of women for achieving rapid social, economic, and cultural development of the state, which is one of the stated agenda of Vision 2010. The effective integration and participation of women in the process of development would be guided by political will and commitment. In order to achieve this the State would have to address a number of issues including gender based occupational stereotyping, male selective in-migration in the context of industrialisation, female illiteracy, impeding cultural practices and attitudes, dominance of women in marginal employment, lack of access to basic facilities, discrimination against the girl child etc.

The Government of Chhattisgarh (GoCG) has adopted a Women Empowerment Policy based on the state's specific geographical, social, and cultural characteristics. This policy seeks to address the unique situation and issues facing women in Chhattisgarh across urban, peri-urban,

rural, and tribal areas. It is based on a comprehensive analysis of the best practices of other Indian states and countries from where positive elements have been culled out and suitably incorporated keeping in view the State's unique features. The Constitution of India not only grants equality to women but also empowers the State to adopt measures and frame policies of positive discrimination in favour of women. Therefore, this policy aims to create an environment, which enables women to effectively contribute in the process of economic and social transformation and not be merely a passive beneficiary. Accordingly, the objectives of this policy are to:

- Facilitate a conducive environment to enable women to realise their full potential and promote self reliance;
- Achieve equality in access to economic resources including forests, common property, land and other means of production;
- Ensure participation of women in social, political and economic life of the state; and
- Encourage non-governmental organisations (NGOs) and women's groups to effectively participate in the developmental process.

To meet these objectives, the State has identified specific initiatives, which include:

- Creating a responsive statutory and institutional mechanism;
- Integrating gender perspective in economic development; and
- Creating an enabling environment for social development of women.

The State will set up a Committee for policy review and implementation to be headed by Minister-in-charge with representatives from the Department of Women and Child Development, State Women Commission, NGOs, community based organisations, other Government departments, etc. This committee would work in coordination with various departments to draw up detailed action plan for every sector in line with the initiatives outlined in this policy. In order to create a non-discriminatory as well as gender sensitive legal environment and strengthen the institutional mechanism to elevate the status of women, the State would take measures that include legal measures, institutional capacity building; integration of gender perspectives into economic development, including specific measures in various economy sectors such as agriculture and allied sectors, water and sanitation, industry, forests, etc. An implementation outline has also been developed including enabling environments for social development, health care and nutrition, planning especially in the rural and tribal areas, education, housing and shelter, social welfare and cultural aspects, etc.

Panchayat and Rural Development

Dense forests, undulated topography, dispersed population and poor infrastructure characterizes the rural landscape of Chhattisgarh. Complex institutional, structural, geographical, and social-economic barriers play in rural areas leading to low levels of human development. Such a complex problem demands equally comprehensive solutions that pack gainful employment with improved infrastructure and quality services. Despite large number of programmes designed and launched to make a dent on rural poverty, rural-urban gap in incomes and other elements of human development persist and mainly stems from lack of effective implementation, oversight, and support infrastructure. Incomes from rural farm/non-farm sector are meagre with poor price realization due to high levels of intermediation and information asymmetry.

Emerging from a situation where service delivery was a major challenge, Chhattisgarh worked to create access and outreach and take responsive governance to the remotest corners of the state. Seeing rural connectivity as a bottleneck, efforts and resources have been channelized to improve road infrastructure and strengthen the cadre of development workers for taking basic services to every village. Nearly 5,919 habitations have been connected with rural roads and about 19,000 villages electrified till last year. Additional resources will be committed in the 12th Plan for repair and maintenance of productive assets created in rural areas. The strategy for improving farm productivity has already been spelled out in the latter section on Agriculture. Additionally, convergence of the Mahatma Gandhi National Rural Employment Generation Act (MGNREGA) with watershed development and Pradhan Mantri Gram Sadak Yojana (PMGSY) will be encouraged for soil-water conservation and improved rural connectivity.

Rural incomes are inextricably linked to farm productivity, and in a State where nearly three-fourth of the population lives in rural areas; urgent attention is being called for improving productivity. Rising food prices, which have a negative impact on the most vulnerable demand immediate steps for increasing income and employment. Rural wage employment has increased in recent years, though women's participation is still low at 45 percent and in the low paying sub-sectors.

For non-farm sector additional local self-employment opportunities will be created through skill building and linkage with markets/ financial institutions, especially to improve employability of youth between 18-25 years in sectors that have high absorption capacities. To harness the efforts being made towards financial inclusion, special efforts will be made in remote and inaccessible areas to link first generation entrepreneurs with national schemes such as Swabhiman and Rashtriya Swasthya Bima Yojana (RSBY). To raise rural incomes the state has identified 30 development blocks for launching the VIHAAN project under the National Rural Livelihoods Mission (NRLM) and will link available opportunities like abundant natural resources and existing low levels of value-addition in agricultural commodities, NTFPs, horticulture and sericulture to strengthen livelihoods. Economic empowerment of women in rural areas will be promoted through incentives for Women's Self

Help Groups (WSHG) engaged in processing activities. An enabling environment will also be created to nurture small industries/producer companies and provide a state-wide umbrella branding for these products.

Most of the vulnerable population in Chhattisgarh is concentrated in rural areas and efforts to reduce their deprivations and risks require measures for social protection. The state has worked for effective social protection through strengthened social safety nets and programmes for food and nutritional security. While continuing work in these areas, programmes for improved employment- rural and unorganized, housing, insurance will be strengthened for risk and poverty reduction. Under MGNREGA nearly 591 lakh person days of work has been generated in the eleventh plan and performance of several districts has been nationally recognized. Despite this rural out-migration has increased in the recent years, suggesting the higher risks faced by the vulnerable rural populations. Strategies will be worked out to equip the migrants with skill and information at source and for their continued access to services and entitlements at the destination. For rural housing, under Indira Awas Yojana nearly 2.2 lakh houses have been constructed and considering the wide gap between the demand and Indira Awas Yojana (IAY) norms, it is being complemented by a state scheme to target the most vulnerable - LWE affected and title holders under the Forest Rights Act. Implementation experience shows that programmes like MGNREGA and Rashtriya Krishi Vikas Yojana (RKVY) which aims at convergence of schemes and local level planning have significant impact in rural areas. These learnings will be taken into the larger planning process and Gram Sabhas capacitated to get involved in inclusive planning and community monitoring of programmes.

Capacities of line agencies working in rural areas will be strengthened in participatory processes to facilitate greater ownership of Panchayati Raj Institutions (PRIs) in implementation of flagships and local planning. Involvement of responsible civil society Institutions will be sought to meet this capacity challenge. Availability of untied funds for rural development has had good impact and will be up-scaled. The State would advocate for greater resources and role for PRIs to enable them to prepare need-based plans and implement them.

Greater use of information technology will be encouraged for transparency and to streamline implementation of public services for rural housing, drinking water, roads, electrification and sanitation by targeting the most vulnerable and improving the outreach of government schemes. In last plan period all Janpad Panchayats were connected through SATCOM (Satellite Communication) for greater information sharing and involving local governments in decision-making process. National e-Panchayat network, Panchayat help-lines and other State initiatives will help further deepen PRI involvement. These outreach mechanisms will be used for improving capacities of elected representatives in local planning and monitoring.

LWE is rooted in the larger historical and spatial challenges affecting the rural areas of Chhattisgarh. All possible help and significant resources are required to address this national concern and bring development to LWE affected areas. Scheme-based response to the needs of these areas has not been effective as seen in the low penetration of MGNREGA in LWE affected districts; a different development paradigm is required. Infrastructure improvement has to go hand in hand with softer interventions that address awareness, low skills, underemployment and human development and the State has been galvanizing resources from all quarters to accelerate development and mainstream the people living in affected districts- a strategy that will be continued in the coming years.

Tribal Development

Chhattisgarh has been grappling with the challenge of narrowing the ever-widening infrastructure gap between tribal areas and rest of the state. Significant resources have been invested since its formation on improved connectivity that becomes a vehicle for inclusive growth. For strengthening the administrative machinery in Fifth Schedule areas two Regional Tribal Development Authorities have been created for northern and southern tribal areas to beam efforts and resources on these areas. The strategy has been effective and will be further strengthened in next plan period. The purpose is to fast-track decision-making and speed up development through coordinated implementation and regular monitoring of development projects implemented in these areas.

Despite these efforts, progress has been slow due to difficult terrain, policy constraints, security concerns, shortage of private vendors and high project costs. While the health and education indicators among the tribal communities have improved in the last decade, the gap is still significant. As per the National Family health Survey 3 (NFHS-3), 74 percent ST women suffer from anaemia as compared to the State average of 63.1. Likewise, Infant Mortality Rate (IMR) for ST children was 90.6 against the State average of 71 per 1000 live births.

Tribal literacy is low compared to State average, despite improved outreach and heavy incentive structures built around enrolment and retention. The Gross Enrolment Ratio (GER) among ST students at primary level is 132.8, higher than the State average of 125.5 in 2007-08, but drops significantly at the upper primary level to 75 against 89.8 for Chhattisgarh as a whole, suggesting poor retention in the higher classes. Out of school ST children are also more than the State average and this difference is sharper in case of girl students - 24.4 percent against state average of 19.8 percent. The dropout rates among tribal students are 13 percent at upper primary level as compared to State average of 7.2 percent (2009). Factors like lower retention in higher classes, poor examination results, and lack of quality education that contributes to poor tribal education will be targeted now. Teacher attendance, expansion of residential facilities in LWE districts, increased use of vernacular medium at the primary level, skill/ life-skill education, review of current incentives and up-gradation of existing schools in scheduled areas will be a priority for tribal education in the next plan.

Targeted interventions for addressing nutritional deficiencies and health problems among tribal communities, especially the Particularly Vulnerable Tribal Groups through effective human resource management, revival of indigenous knowledge and packaging health solutions into

the agriculture strategies through greater convergence will be given priority. Fifth Schedule areas are spread over 65 percent of Chhattisgarh's landmass but as per population norms Tribal Sub-Plan (TSP) allocation is only 32 percent of the total plan budget. With a large area to cover with limited resources, recent initiatives have aimed at tracking the impact on tribal population and encouraging outcome-budgeting in all sectors contributing to tribal development, so as to maximize benefits accruing to tribal populations. This will be further formalized in subsequent years and systems put in place for better human resource management and collection of tribal and gender disaggregated data for regular analysis and corrective interventions. TSP fund utilisation has improved in recent years- 85.2 percent in first three years of 11th Plan, but there are inherent difficulties in the existing TSP delivery mechanism that hinder optimal use of TSP resources. In the 12th Plan steps will be taken to revamp TSP implementation through greater involvement of Integrated Tribal Development Projects (ITDPs) in fund utilization and delivering outcomes—a shift from co-ordination to implementation. State will develop guidelines for fund utilisation and preparation of annual plans that determine local and State sector share of programmes for fixing accountability. Periodic outcome evaluations of major programmes will also be initiated to look at their impact on tribal communities.

The new delivery mechanism will work to improve employment and income generating opportunities for tribal youth through beneficiary-oriented schemes that link tribal students (and also drop-outs) with vocational institutions and private industries. Preference will be given to local populations for vocational training and employment in these industries.

While the rural and urban unemployment of other social groups has come down between 2004-2008, unemployment rate among STs has increased from 4.2 to 5.8 (rural) and 12.9 to 19.9 percent (urban). Local income earning opportunities are essential to arrest the recent increase in rural out-migration. A sizeable tribal population is involved in collection of NTFPs (including medicinal plants) and small local interventions can help transform NTFP collection from a coping strategy to a profitable economic activity. The annual estimated trade of non-nationalised NTFPs in the State is 55,000 MT valued at approximately Rs. 300 crore – more than the quantity of nationalized NTFPs traded in the state. The most vulnerable are involved in NTFP collection and Chhattisgarh has been long demanding national price support for NTFPs to counter imperfections of NTFP market and for economic inclusion of the NTFP collectors. With huge scope for value-addition, the skills of primary collectors will be developed around pre-harvest, harvest and post-harvest management with a product focus.

It is also important to promote strategies that maintain a balance between the use of key natural resources – forest, land (for agriculture), and water. A landscape approach would be applied to natural resource management, keeping the needs of tribal and the poor at the centre.

The Forest Rights Act has recognized the resource and land rights of more than two lakh forest dwellings families and the State will work to increase their ownership and stake in conservation and protection of the forest resources. It will endeavour to optimize the benefits accruing through sustainable harvest of these resources to ensure larger and direct benefits to the vulnerable population. Emphasis will be on capacity building of Forest Rights Committees and Gram Sabhas to conserve and sustainably manage the common resources and make individual resources more productive. While the state has already been taking steps to strengthen the livelihoods of title-holders by targeting them for support through provision of seeds, mini-kits and rural housing, linkages with other schemes and financial institutions will also be facilitated for meeting their credit requirements.

Panchayat Extension to Scheduled Areas (PESA) Act has a significant bearing for a State like Chhattisgarh, two-thirds of which falls under the Fifth Schedule and is home to one-third of its population and most of its rich natural resources. The shift towards customary rights and self-governance, that the legislation enables, provides the right platform for the State's efforts to counter discontent and alienation. Realizing this, many Subject Acts related to Mines and Minerals, Excise, Revenue, Land Acquisition has been amended and the Panchayati Raj legislations brought in consonance with PESA. However, awareness and understanding about the spirit of the Act, the rights, and duties conferred on Gram Sabha and its implications for responsive governance are limited. In this context, capacities of elected representatives, panchayat functionaries, and government officials will be built for strengthening PESA implementation. The State would also request Government of India to make PESA the administrative responsibility of tribal welfare for a more coordinated and sensitized approach to tribal empowerment.

The most vulnerable and deprived among STs - the Particularly Vulnerable Tribal Groups (PVTGs) - rank the lowest on human development indices among social groups and live in the most inaccessible areas. Chhattisgarh has five PVTGs and looking at their vulnerable status two tribes Pando and Bhuiya have been adopted as State PVTGs. Recent assessments have noted an increase in PVTG population from 1.24 lakh to more than 1.5 lakh and a general improvement in their health, education and income standards, including a shift towards stable livelihoods. This has been mainly possible due to the doorstep delivery of basic services like mobile-clinics, health check-up and monitoring camps, educational bridge courses, residential schools and distribution of agriculture kits. The increasing prevalence of sickle-cell anaemia among many PVTGs is a cause of great concern and the state will facilitate more state-specific research to address it. The Conservation cum Development (CCD) Plans for each PVTG will continue to address specific health issues around mortality reduction, fertility increase, creation of livelihood support infrastructure and innovative interventions that meet the twin-concerns of development and conservation.

The State also has the responsibility of preserving the rich cultural heritage of tribal areas. In recent years, steps were taken to promote and showcase the rich tribal heritage of Chhattisgarh at various platforms, support artists, artisans, and artist groups. It proposes to set-up a State museum soon to sensitize people on this valued heritage. Support will be continued for relevant research including ethnographic studies, documentation, and mapping of cultural practices and indigenous knowledge.

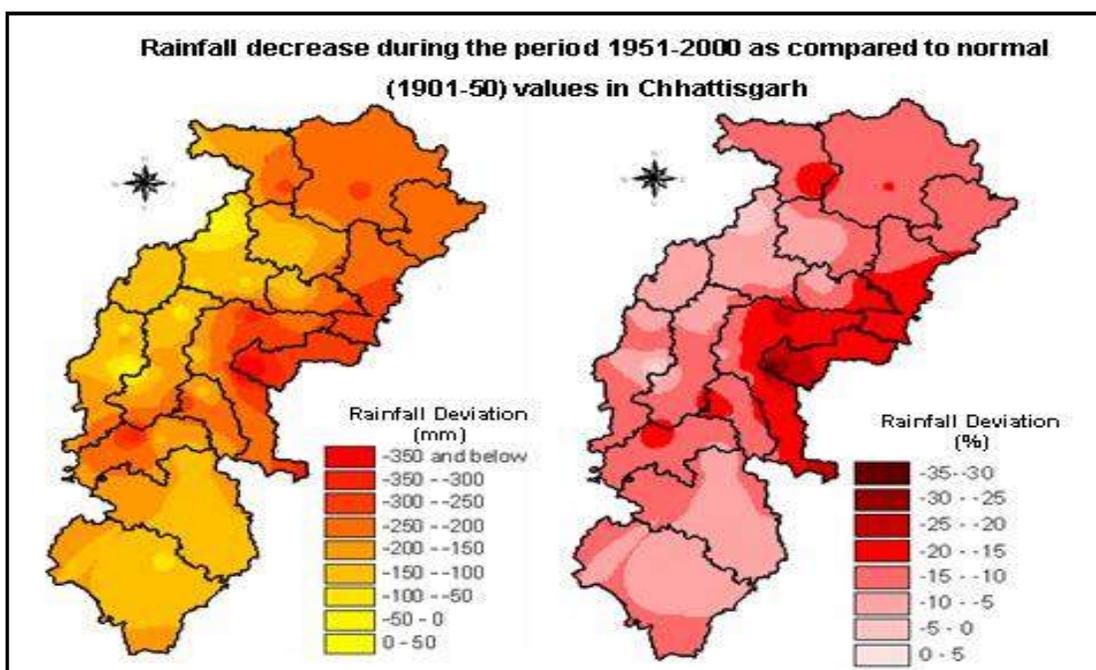
2 Climate Profile and Vulnerability

2.1 Climatic Conditions in Chhattisgarh

Rainfall and Monsoon

The rainfall variability during past century in Chhattisgarh was studied using rainfall statistics of 100 years i.e. 1901-2000. About 40 rain gauge stations located in different districts of Chhattisgarh were considered for study. For understanding the rainfall pattern difference between average rainfall during 1900-1950 and 1951-2000 were worked. A GIS map was generated using GIS tools and the same are shown in enclosed figure. It was found that in some districts like Raipur, Mahasamund, Raigarh the decrease in rainfall quantity is the other hand the decrease in rainfall.

Figure 9: Decrease in rainfall during 1951-2000 in Chhattisgarh



Presently, daily rainfall data from 116 stations, for different durations are available. In the case of the plains, which were considered actively by irrigation planners in the past, records are available for forty to fifty years. These are also the areas where most of the stations are concentrated. In the other areas, data is available for 20 to 30 years. For almost all the blocks, we have monthly rainfall data for at least 10 years from the district administration (Revenue Department). Rainfall in June is extremely important for commencement of sowing. The type of paddy grown in areas without supportive irrigation facilities has a lot to do with expectations and experiences around rainfall. For long duration paddy, weeding and biasi operations as well as plant growth need at least 50mm rain per week, without a gap of more than 7-9 days between the rainy days, through the months of June-September.

Table 5: Annual rainfall and distribution during cropping season in Chhattisgarh⁵

Station	Annual Rainfall (mm)	Kharif (Jun.-Oct.) (mm)	Rabi (Nov.-Mar.) (mm)	Summer (Apr.-May) (mm)
Chhattisgarh Plains				
Raipur	1304.6	1191.8 (91)	71.6 (5)	41.2 (3)
Durg	1283.1	1168.8 (91)	77.9 (6)	36.4 (3)
Rajnandgaon	1346.4	1243.5 (92)	67.4 (5)	35.5 (3)
Mahasamund	1342.1	1248.8 (93)	53.4 (4)	39.8 (3)

⁵ Source: State Biodiversity Action Plan, Chhattisgarh

Station	Annual Rainfall (mm)	Kharif (Jun.-Oct.) (mm)	Rabi (Nov.-Mar.) (mm)	Summer (Apr.-May) (mm)
Raigarh	1514.3	1397.6 (92)	74.5 (5)	42.2 (3)
Bilaspur	1383.3	1233.6 (89)	93.1 (7)	56.7 (4)
Janjgir	1500.8	1357.4 (90)	109.8 (7)	33.7 (2)
Korba	1397.3	1302.1 (93)	71.8 (5)	23.4 (2)
Kawardha	1159.1	1002.0 (86)	104.4 (9)	52.8 (5)
Kanker	1297.8	1180.3 (91)	67.1 (5)	50.3 (4)
Dhamtari	1288.7	1192.4 (93)	52.4 (4)	43.9 (3)
Bastar Plateau				
Jagdalpur	1509	1315.0 (97)	72.0 (5)	122.0 (8)
Dantewada	1365	1280.1 (94)	34.7 (3)	50.1 (4)
Northern Hills				
Ambikapur	1534.6	1393.4 (91)	94.1 (6)	47.0 (3)
Baikunthpur	1374.1	1266.6 (92)	84.7 (6)	22.8 (2)
Jashpur	1885.1	1704.8 (90)	113.3 (6)	67.0 (4)
Chhattisgarh	1405.3	1279.9 (91)	77.6 (6)	47.8 (3)

Drought and Drought Risk

A study carried out in 2002⁶ by the Institute for Human Development, New Delhi has identified several drought prone districts and blocks for priority attention:

Table 6: Typology of Blocks Requiring Priority Drought Proofing

DistrictName	BlockName
Bastar	Londigura
	Kondagaon
	Keshkal
	Narayanpur
	Orchha
	Makdi
Bilaspur	Kota
	Gourela-2
	Gaurela-1
	Marwahi
Dantewada	Dantewada
	Bijapur
	Katekaleyan
	Bheramgarh
	Asur
	Konta
	Sukma
	Gedam
Dhamtari	Sihawa(Nagri)
Durg	Doundi
	Gurur
Jashpur	Bagicha
	Pathalgaon
Kanker	Kanker
	Charama

⁶Smita Gupta, Water Policy for Drought Proofing Chhattisgarh, Institute for Human Development, 2002. Sponsored by Planning Commission of India.

DistrictName	BlockName
Kawardha	Sarana(Narharpur)
	Pandariya
	SahaspurLohara
Korba	Bodla
	Korba
	Katghora
	Pondi
	Pali
Korea	Kartala
	Sonhat
	Baikunthpur
	Manendragarh
	Khadgawan
Mahasamund	Bharatpur(Janakpur)
	Bagbahara
	Pithora
Raigarh	Basna
	Kharsia
	Lailunga
Raipur	Tamnar
	Kasdol
	Bilaigarh
	Gariyaband
	Chhura
	Mainpur
	Deobhog
	Chhuriya
	Chhuikhadan
	Dongargarh
Rajnandgaon	Mohla
	AmbaChauki
	Manpur
Surguja	Rajpur
	Lakhanpur
	Lundra
	Sitapur
	Batauli
	Mainpat
	Surajpur
	Odgi
	Bhaiyathan
	Ramanujnagar
	Premnagar
	Ramchandrapur
	Balrampur
	Kusmi
Shankargarh	

2.2 Future Climatic Projections and Vulnerability

Currently, no detailed studies/modelling on future climatic projections exist. Meanwhile, some initial conclusions can be drawn from various other studies. For instance, a study by Karen O'Brien and others⁷ used the example of Indian agriculture to examine regional vulnerability to climate change in combination with other global stressors. Their approach used four main steps:

- (i) Developing a national vulnerability profile for climate change at the district level;
- (ii) Developing a national vulnerability profile for an additional stressor at the district level;
- (iii) Superimposing the profiles to identify districts in India that are "double exposed"; and
- (iv) Conducting case studies in selected districts.

Some of the findings from the study are presented below as analytical geographical information system (GIS) maps. The figures show analyses based on a Climate Sensitivity Index that measures dryness and monsoon dependence. The figures clearly show medium to high observed sensitivity to climate change in Chhattisgarh, while Exposure is high to highest, with central parts of Chhattisgarh showing highest exposure.

Likewise, the resulting climate vulnerability map represents current vulnerability to future climate change across districts. The map depicts the range of relative climate vulnerability at the district level in India. It is important to note that the districts with the highest (or lowest) climate sensitivity under the scenario of climate change used here are not necessarily the most (or least) vulnerable. The map clearly shows high to highest vulnerability for Chhattisgarh, with parts of the central areas of the state and the northern regions being most vulnerable as the result of low adaptive capacity.

Figure 10: District-level mapping of climate sensitivity index (CSI) for India (a) based on observed climate data (1961–1990) and (b) based on results from the HadRM2 model. The districts are ranked and presented as quintiles. The same quintile breaks used in (a) were used in (b) to demonstrate absolute changes in climate sensitivity.

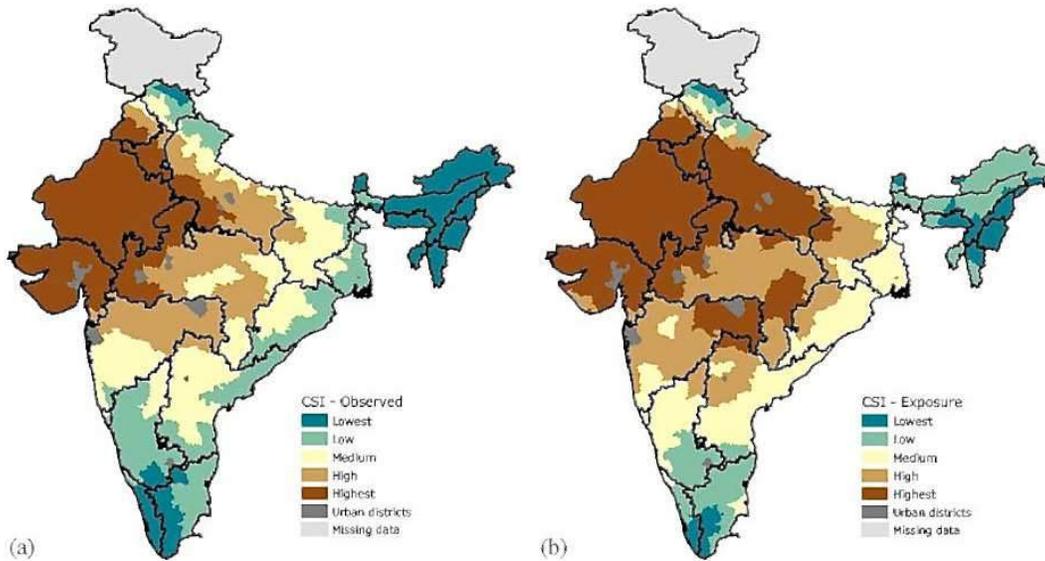
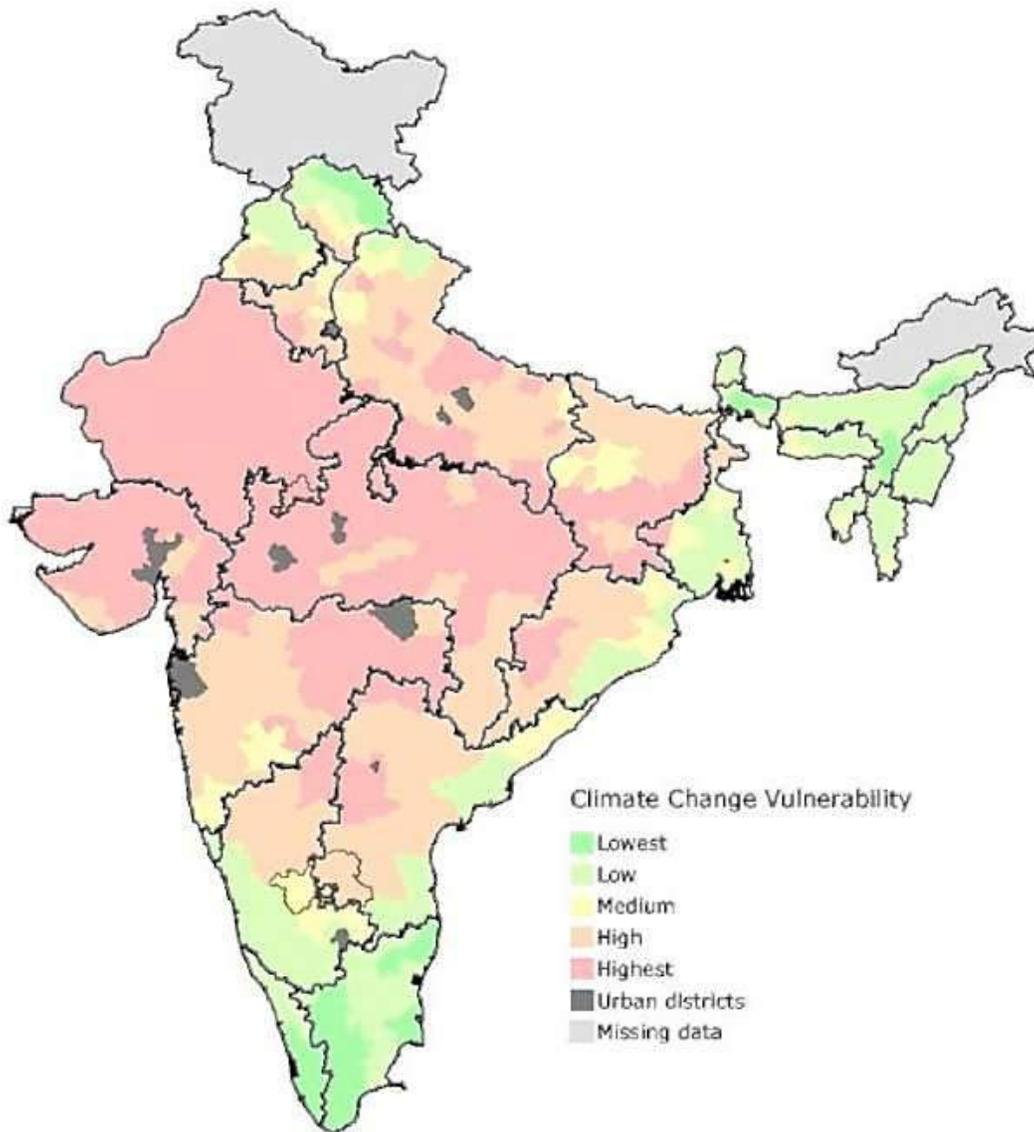


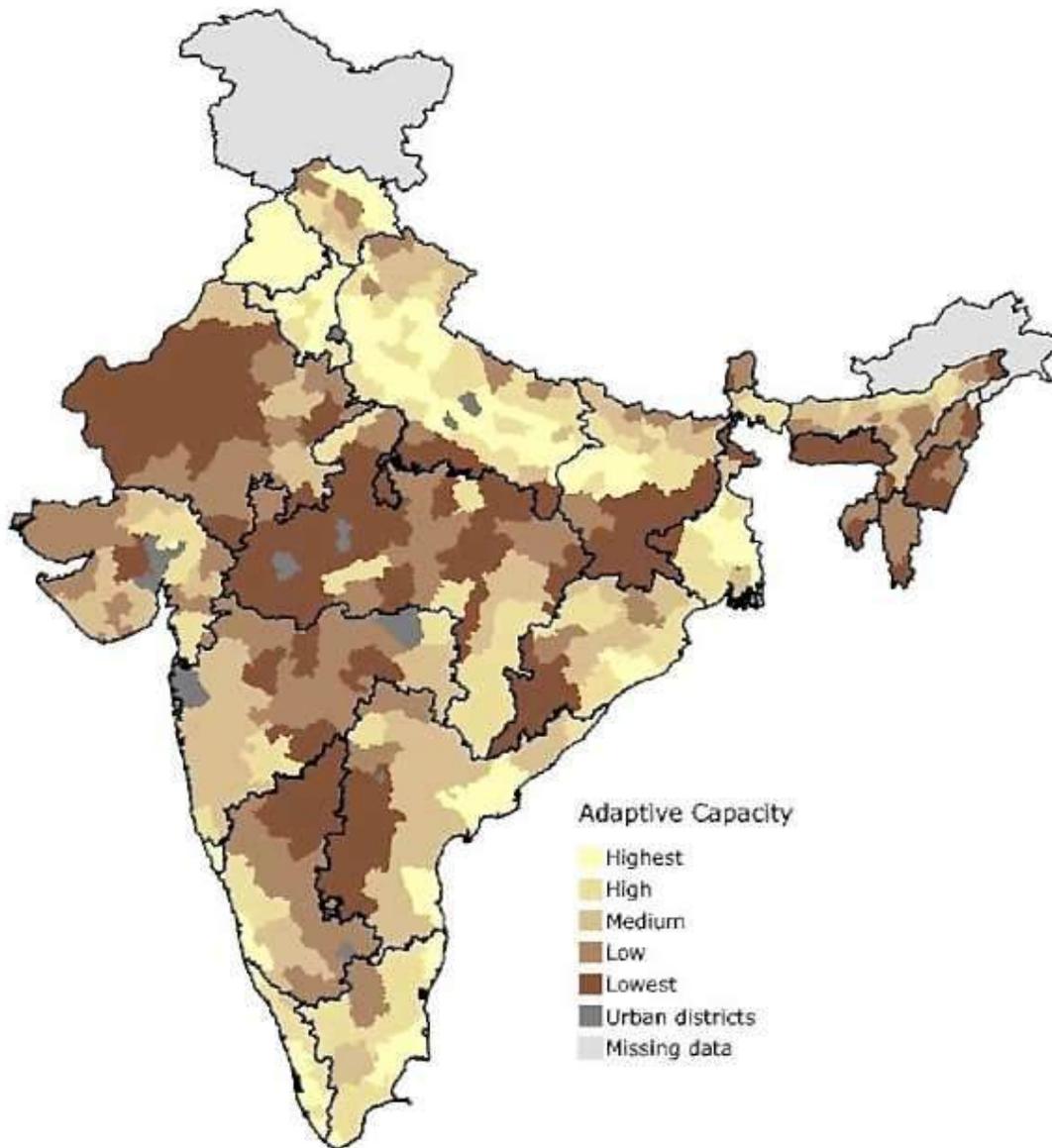
Figure 11: District-level mapping of climate change vulnerability, measured as a composite of adaptive capacity and climate sensitivity under exposure to climate change. Districts are ranked and presented as quintiles.

⁷Mapping vulnerability to multiple stressors: climate change and globalization in India; Karen O'Brien, et al, Global Environmental Change 14 (2004) 303–313



To measure adaptive capacity, the paper identified significant biophysical, socioeconomic, and technological factors that influence agricultural production. Biophysical indicators used in the profile consisted of soil conditions (quality and depth) and ground water availability; socioeconomic factors consisted of levels of human and social capital, and the presence or lack of alternative economic activities; and technological factors consisted of the availability of irrigation and quality of infrastructure. The results of the analyses are shown in figure 9 below, which show that the districts of southern Chhattisgarh have a higher adaptive capacity than the districts of northern Chhattisgarh.

Figure 12: District-level mapping of adaptive capacity in India. Adaptive capacity is measured here as a composite of biophysical, social, and technological indicators. Districts are ranked and presented as quintiles.



2.3 The Need for State Specific Vulnerability Analyses

While the above sub-sections give some indication of future climate conditions and impacts, there is a need for detailed climate modelling studies at the State level, covering possible impacts on each sector. As of now, no comprehensive vulnerability analyses have been carried out for Chhattisgarh for the various focus sectors under this CSAPCC. These will need to be carried out, as part of the detailed state level climate modelling exercises.

There are also currently no systematic documented community perceptions on climate change and its impacts across the state and across various sectors. While anecdotal references have been collated by various civil society groups/projects, but these are the exception rather than the rule.

Part B: Climate Change Strategy

3 Overarching State Framework

3.1 State Vision and Commitment

The State has articulated climate concerns in its Approach Paper for the 12th FYP, and as such, is committed to fostering an integrated approach to inclusive, sustainable, and climate resilient growth and development. This vision will be achieved through pursuing (a) mainstreaming of climate concerns into all aspects of development policy and implementation, and (b) ensuring complementarity with and contributing to the national agenda on climate change. Keeping in mind the overall motto of the CSAPCC – ‘Inclusive Growth for Improved Resilience’, these approaches will be supported by the strategies and actions outlined in this report, and by all other necessary actions by the State Government for the achievement of the Vision.

3.2 Overall Approach, Principles, and Strategies at State Level

The approach of the CSAPCC is to create and define a overarching climate response framework at the State Government level to reduce vulnerability; reduce hazards and exposure; pool, transfer, and share risks; prepare and respond effectively; and increase capacity to cope with unforeseen events, while articulating flexible sector specific response strategies and actions keeping in mind the overall Vision. The State recognises that it has several existing vulnerabilities (ecological, economic, social and cultural), and that climate change is likely exacerbate these further if not addressed adequately and holistically. Therefore the climate response strategy of Chhattisgarh has key elements such as accelerating inclusive economic growth, promoting sustainable development, securing and diversifying livelihoods, and safeguarding ecosystems. Further, the strategy is not to be viewed as a standalone action; instead it will be integrated into the regular developmental planning process, keeping with the convergence principles articulated in the State’s 12thFYP Approach Paper.

‘Adaptation’ will be the predominant philosophy and component of the climate response strategy of Chhattisgarh, while at the same time leveraging opportunities for mitigation co-benefits. The state lays equal emphasis on both ‘hard’ and ‘soft’ adaptation approaches – where ‘hard adaptation options’ include options that have physical attributes (e.g. infrastructure and engineering structures) and ‘soft adaptation options’ include the development of skills, processes, institutions, social systems, policies and programmes. Flexibility (within livelihoods, economic, social, cultural, ecological and institutional systems), diversification (involving multiple independent flows to livelihood and natural systems), learning and education (from events at both individual and institutional levels and knowledge base required to develop new systems when existing ones are disrupted), mobility (an attribute of flexibility), operational techniques (for risk reduction before and following disruptions), convertible asset and innovation (designing new systems and options) will be the key elements of the climate response strategy for Chhattisgarh.

Specific elements of the overarching climate response framework at the State Government level are articulated below (additional elements will be added as and when necessary). The state will develop action oriented operational plans and budgetary frameworks for these by end 2013. It has also been ensured that all actions to be undertaken as part of the CSAPCC have broad conformity to the NAPCC and the eight National Missions under it.

Scientific Knowledge, Evidence Base, and Understanding of Climate Change

The previous section has already outlined the fact that the currently available knowledge base vis-à-vis climate change vulnerability and its impacts on the State, its economy, and its various sectors and communities is limited or virtually non-existent. As such, the CSAPCC seeks to fulfil the following outcomes (which are linked to the overall knowledge management Strategy under the CSAPCC):

- Development of detailed climate vulnerability and risk analyses covering all districts, as well as specific analyses pertaining each of the sectors addressed in the CSAPCC;
- Improved scientific evidence base and coordination mechanisms between scientific research and academic institutions (including both national and state level agencies) for build scientific data and evidence base for the State; and collation of available scientific information and data on climate change pertaining to the State
- Review of the sectoral strategies under the CSAPCC based on the vulnerability and risk assessments; and
- Documentation (on an on-going basis) of people’s perceptions on community change and its impacts, and where appropriate, establish if these have scientific bases and validity.

To fulfil the above outcomes, the State will take all necessary steps including initiating (as one of the highest priority agendas) processes for carrying out detailed climate vulnerability analyses and developing a climate vulnerability atlas, which will be updated on an on-going basis. An appropriate state department/agency will be nominated to anchor this process. Dialogue between scientific research and academic institutions will also be fostered and coordinated on an on-going basis. The CSAPCC also recognises that scientific knowledge and evidence base is also limited and scattered -- while there are a large array of National and other scientific and research organisations, many of which

are involved in research programmes/studies on various aspects of climate change, there is no single clearing house mechanism in the State that aggregates the available evidence base and tracks all on-going and planned research programmes that may have relevance to the State. The State therefore will put into motion a process for doing this. These will then be used to foster processes for specific basic and applied research initiatives that may be required to support the implementation of this CSAPCC. The State will also foster dialogue and collaboration between scientific and academic research organisations in the State and elsewhere as part of the above processes.

Keeping in mind long-term requirements, the State also proposes to set up a State Centre for Climate Change, and to task it with the role of anchoring all climate change related research activity specific to the State, as well as acting as the State governance and Knowledge Hub on climate change. The Centre will also serve to build State capacities for understanding and tackling climate change through appropriate adaptation and mitigation actions.

Governance Mechanisms, Institutional Decision Making, and Convergence

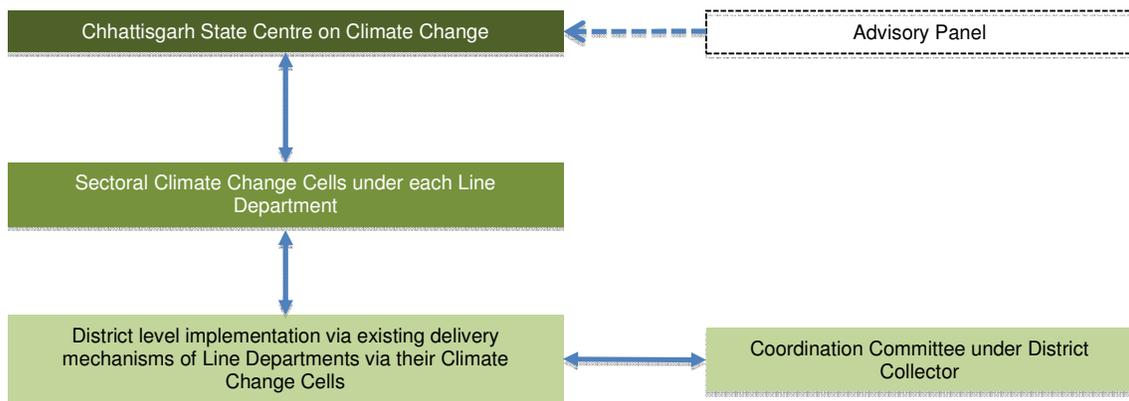
As indicated in an earlier section, Chhattisgarh is already implementing a range of steps/programmes that are climate-friendly/neutral. While continuing to foster such initiatives, the State will seek to fulfil a range of outcomes including:

- Developing and putting into place overarching institutional and governance mechanisms at the State level to oversee and implement the CSAPCC;
- Review of all state policies and revise these as necessary to articulate and integrate climate concerns;
- Articulation and integration of climate change considerations into development strategies, plans and programmes;
- Strengthening of institutional decision-making mechanisms and processes (including monitoring & evaluation) to ensure cross-sectoral coordination related to climate change;
- Development and adoption of appropriate management approaches including regulatory, incentive, and innovation based approaches to encourage appropriate adaptation and mitigation measures; and
- Development and strengthening of institutional capacity for climate related disaster risk reduction and management.

The (to be established) Chhattisgarh State Centre for Climate Change will act as the nodal body in the State for coordinating and overseeing all operational aspects of the CSAPCC implementation and coordination at the State level. It will be housed at the Forest Department, but will function independently. It will have a Board headed by the Chief Secretary at the decision making level and comprising other senior state officials, and for operational aspects, will have an Executive Committee with Principal Secretaries of all relevant line departments or their nominees. All sectoral line departments and other key agencies in the state will set up Climate Change Cells in their respective departments/agencies. These Cells will coordinate and oversee all aspects of CSAPCC implementation in their respective sectors, as well as liaise/coordinate with the State Centre for Climate Change and other line departments as required.

The overarching State level institutional architecture is given in Figure 10 below.

Figure 13: State level architecture for CSAPCC implementation



The State will also put together and co-opt an Advisory Panel comprising of five or six academic and practitioner experts to advise and work with the State SSC and the State Planning Board in carrying out their respective mandates. It is anticipated that the Advisory panel would co-opt new members as and when required or a case-by-case basis. At the District Level, implementation will be overseen by a Coordination Committee headed by the District Collector, and carried out by existing delivery mechanisms of the line department through their Climate

Change Cells. While this CSAPCC focuses on sectoral interventions across a selected set of government line departments/agencies, this will by no means exclude the role of other line departments/agencies, and these will be co-opted to support CSAPCC implementation processes from time to time.

Capacity Development, Education, and Awareness

The State recognises that overall awareness of climate change and its impacts in Chhattisgarh is limited. Therefore, the CSAPCC seeks the fulfilment of the following outcomes:

- Capacities of government line departments and agencies at all levels to analyse, plan, converge, implement and monitor programmes addressing climate change and its impacts; and
- Significantly improved awareness of climate change and its impacts in government at all levels as well as in communities, civil society, and the private sector in the State.

The State will initiate and foster a range of on-going awareness and capacity building measures aimed at targeting government departments and agencies at various levels, to improve overall awareness levels. The State will also put into motion a process of building awareness on climate change and its impacts among the population and communities in general and also develop and widely disseminate sets of actions that the citizens of the State can take to support the CSAPCC. In addition, the State will examine the possibility of incorporating climate change related modules into the educational curriculum across various levels, including the development of specific academic programmes on climate change at University levels. Appropriate external agencies will be co-opted as necessary to support the awareness and capacity building processes. The State will additionally seek to build and support a network of Climate Leaders – who can come from either government or elsewhere – to help foster and champion the climate agenda in the State.

Connecting Science, Policy, and Practice

As an extension of the overarching principles actions on improving scientific knowledge and evidence base articulated above, the State is committed to supporting processes that connect science to policy and practice. The following outcomes are envisaged towards this end:

- Data/research needs to support CSAPCC implementation and related policymaking identified (on an on-going basis, as needs evolve);
- Mechanisms to foster dialogue with and between scientific research and academic agencies; and
- Specific mechanisms to adopt and implement practical approaches and solutions based on basic and applied research to support CSAPCC implementation.

As such, under the CSAPCC, the State seeks to actively consult and dialogue with relevant scientific organisations and academia in the formulation of state policies, to develop a culture of evidence-based policymaking. It also similarly will support similar consultation and dialogue in the formulation of developmental and sectoral programmes by the various line departments and agencies, through their Climate Change Cells as has been proposed in the CSAPCC. On an immediate basis, specific emphasis will be given to practical approaches and solutions (technological and otherwise) that have already been developed by various research centres and academic institutions that have not yet found the dissemination, outreach, and exposure that are needed to make these widely available for deployment in the development contexts (both rural and urban). It is anticipated that the proposed Chhattisgarh State Centre for Climate Change will take a lead role in anchoring this initiative.

Integrating Poverty, Livelihoods, and Equity Issues

The State already places significant emphasis on inclusive growth and development, as has been articulated in its Approach Paper to the 12th FYP. The document identifies governance as a common thread running through all sectors as the biggest concern for National as well as state governments. Lack of good governance not only impedes growth, access to quality of life and human development; it aggravates poverty, vulnerability, inefficient use of resources, and ultimately leads to corruption and leakage. In a functioning democracy, responsive governance is about ensuring symmetry of power in the elected representative-functionary-community praxis, citizen-centric administration, accountability and transparency of process/ procedures, strong outcome orientation, and above all, delivering public goods and services in a manner that reduces inequality and vulnerabilities.

Deficit in governance and the consequent inequality manifests itself in the form of large-scale poverty. Chhattisgarh has a poverty headcount of 10.99 million and 49.4 percent of its population lives below the poverty line. This is an indicator of the inherent inequality and the fact that a significant population has not benefitted from the remarkable economic growth witnessed by the state in recent years. With nearly half the population grappling with poverty, overall governance, particularly the governance of programmes that target the most vulnerable needs to be far more inclusive. The State has been attempting to address this disparity by placing priority on development of sectors with high concentration of poverty like small-scale agriculture, forest based livelihoods and skill-development of those engaged in the unorganized sector. Efforts will now be required for providing them greater access to resources and benefits.

By extension, the State also recognises that since climate change can disproportionately impact the poor, women, children and the aged, and can also impact livelihoods, sectoral planning under the CSAPCC needs to explicitly integrate poverty, livelihoods and equity concerns. The State also recognizes the different roles that men and women play in society and because of the unequal power relations between them. While a large number of poor, rural women depend on climate-sensitive resources for survival and their livelihoods, they are also less likely to have the education, opportunities, authority, decision-making power and access to resources they need to adapt to climate change. Women's vulnerability to climate change differs from men and climate change interventions that are not gender-responsive often result in deepening the existing gender divide.

As such, the state will take the necessary steps towards fulfilling the following (but not be limited to) outcomes:

- (a) Reduced intra-state inequity between the various regions of Chhattisgarh as also reduced inter-district inequality, especially in infrastructure and service provision as these have a bearing on livelihoods and thus adaptive capacity as well;
- (b) Mainstreamed use of explicit gender-responsive language, data, and analysis in the detailed implementation plans to be developed under the CSAPCC and integration of gender and equity elements components in programming such as setting gender-specific indicators in programmes and schemes, carrying out gender-focused monitoring and evaluation, including gender-sensitive audits of adaptation programme and schemes, building capacities of women and men to implement participatory schemes at the village-level; building capacities on gender and adaptation within all governance institutions at all levels from PRIs to the State;
- (c) Partnerships and collaborative arrangements with relevant agencies (to be identified) to help build capacities within the Departments to work with gender and climate change adaptation; and
- (d) Partnerships and collaborative arrangements with the Panchayati Raj Department to help Gram Panchayats develop participatory and gender-just local action plans on adaptation (LAPAs) at the Panchayat level, in addition to their mandate of developing and implementing the Village-level Development Plans

It is expected that these actions will significantly enhance and contribute to equitable adaptive climate resilience in the State.

Approaches to Implementation in LWE Affected Areas

The State recognises that it will need to take special steps to implementation of the CSAPCC provisions in the LWE affected areas. As such, in addition to the actions set forth in this document, the State will also build in additional implementation approaches along the lines of the Integrated Action Programme (IAP) of the Government of India for such areas including, indicatively:

- Taking up steps to fill up critical infrastructure gaps in LWE affected areas including for example construction of school buildings/school furniture, anganwadi centres, drinking water facilities, rural roads, Panchayat Bhawans/Community Halls, godowns/PDS shops, construction of ANM (auxiliary nurse and midwife) Centres, development of play grounds etc.;
- Paying special attention to the coordination and effective implementation of various development schemes, flagship programmes such as the MNREGA and distribution of titles under the ST and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, in LWE affected States; and
- Coordinate and implement activities such as livelihood enhancement, skill development/vocational trainings, minor irrigation works, electric lighting, health centres/facilities, Ashram schools, construction of toilets, construction of multi-purpose chabutra, construction of passenger-waiting hall, special coaching classes for students.

Private Sector and Financial Institutions

The private sector already plays a role in contributing to the State's economy in the secondary and tertiary sectors, and a recently concluded (November 2012) Investor Summit has only affirmed this. A range of PPP initiatives and projects are already underway in the State in various sectors. Such PPP models can be useful for pooling resources and expertise and for up-scaling climate change adaptation (especially in terms of climate resilient infrastructure and low carbon goods and services) and mitigation initiatives by way of explicit incorporation of climate concerns into project frameworks. Private Sector has great potential and competency for bringing innovative solutions and scale to the various models for climate change adaptation shaped by the civil society and/or government institutions however their primary thrust thus far has been limited to clean development mechanism (CDM) and related projects.

Increasingly, there is a huge potential and need private sector to play critical roles sectoral initiatives in the primary sectors as well – brining in new management practices, technologies and technology transfer, innovation, capital and investments, capacity building, etc. In this direction, the CSAPCC will seek to fulfil the following outcomes:

- A roadmap for exploring the potential role of private sector across the various focus sectors of the CSAPCC especially in the primary sectors such as agriculture (with special emphasis on rain-fed mountain agriculture and extension), forestry, etc.;

- Review of existing initiatives by the private sector including corporate social responsibility (CSR) to examine possibility of incorporating climate agendas;
- Review of existing policy frameworks governing the private sector including the draft State PPP Policy with the objective of exploring the incorporation of climate change concerns into PPP projects in the state;
- Outlining of necessary enabling frameworks and regulatory mechanisms for involvement of the private sector.

As in the case of the private sector, increasingly, the financial sector and financial institutions will have critical roles to play in sectoral initiatives – bringing in new financial practices, products, and innovation, capital, investments, climate risk transfer mechanism, etc. As such, the CSAPCC envisages the following outcomes:

- Developing a roadmap for exploring the potential role of the financial sector and financial institutions across the various focus sectors identified in the CSAPCC (and in other sectors as appropriate/necessary); and
- Outlining the necessary enabling frameworks and regulatory mechanisms for involvement of the financial sector.

Role of Civil Society

Civil society and voluntary organizations have played critical roles in shaping the development landscape of not only Chhattisgarh, but also across the nation. These will continue to have vital roles in the context of climate change, and have the potential to deliver programmes and services to communities and to bridge the roles of not only the government and community but also bridge the roles of scientific research institutions and the private sector with government and the community.

As such, the CSAPCC envisages the following outcomes relating to the role of civil society:

- Developing a roadmap for exploring and articulating the potential role of civil society organisations (including NGOs and NGO Networks, community based organisations (CBOs) and CBO networks, etc.) in CSAPCC implementation including capacity building at various levels especially at district and sub-district levels, inputs to the CSAPCC on poverty, equity and livelihood concerns, outreach and extension and bridging roles, documentation of community perceptions and best practices, participatory research, knowledge networking, and contributing to expanding the available evidence base on climate change, etc. and
- Identifying appropriate civil society organisations and their networks at various levels who can partner CSAPCC implementation at various levels including state, district, block and at the grassroots.

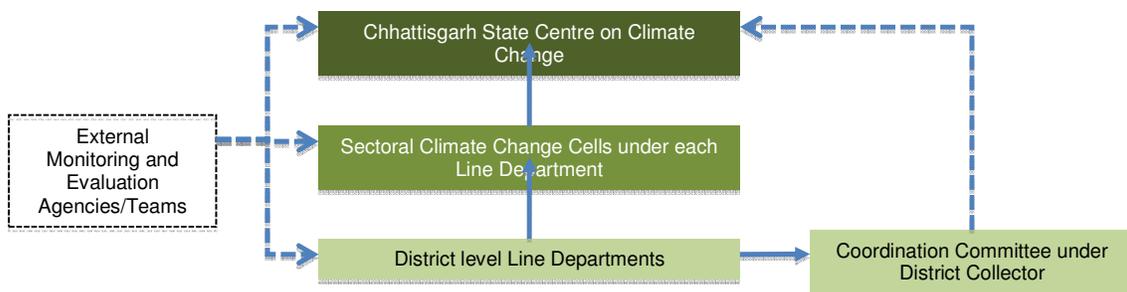
Role of International/External Support Agencies

Likewise, international/external agencies play significant roles in supporting developmental initiatives and bringing in technical assistance to the State. A range of international organisations, including multilateral, bilateral and other agencies have supported and continue to support significant development projects across government departments as well as civil society. As such, it is envisaged that international organisations will also play a significant role in supporting various aspects of CSAPCC implementation; the State will therefore proactively seek opportunities for collaborative partnerships with such organisations especially in the context of external support for financial support, technical assistance and advisory services, bringing in international best practices, knowledge management and networking, inter-state and regional dialogues on climate change, etc.

Monitoring Framework

A tentative and indicative outline of a monitoring and reporting framework is given in Figure 14 below.

Figure 14: Tentative and indicative monitoring framework for the CSAPCC



The state is committed to ensuring that CSAPCC implementation is complemented by a robust framework and mechanisms for monitoring and evaluation not only as a means of ensuring that the detailed operational plans that will be developed under the CSAPCC are implemented as planned, but more importantly, as a tool for systematic review and programme improvement as the needs of the State evolve with implementation. It is tentatively expected that reporting will take place on a quarterly basis at all levels, internal reviews of implementation progress and performance on a half-yearly basis. Likewise, considering that this CSAPCC broadly covers implementation plans over a five year period, implementation of the, an external third-party evaluation during mid-2014 to critically examine implementation and recommend course corrections, and another similar external evaluation will be carried out during end 2017. A detailed and robust monitoring framework will be developed including specific methodologies, protocols, and templates for monitoring and reporting as part of the process of developing detailed work plans under the CSAPCC.

Knowledge Management, Sharing, Learning, and Dialogue

The CSAPCC recognises that knowledge creation, management, and dissemination/ exchange will be critical and central to the successful implementation of the SAPCC. The CSAPCC also recognises that Chhattisgarh does not exist in an independent developmental vacuum; it exists in the developmental context of the central-north Indian region and also in the larger context of India. Therefore the CSAPCC will seek to fulfil the following outcomes in this regard:

- Develop protocols for new knowledge creation and documenting emerging best practice across sectors and at all levels, as well as documenting and sharing people's perceptions on climate change and its impacts on an on-going basis;
- Develop mechanisms and partnerships for sharing knowledge base and emerging experiences including best practice not only within the State at all levels but also with other states in the region and across India and elsewhere.

As such, it is envisaged that the CSAPCC outcomes knowledge management will be crosscutting and also closely connected to the envisaged outcomes on capacity building. Additional elements of Knowledge Management may be taken up from time to time during CSAPCC implementation as required.

Box 2: Linkages with the NAPCC and the National Mission on Strategic Knowledge for Climate Change

Linkages with the NAPCC and the National Mission on Strategic Knowledge for Climate Change

The above sub-sections, and in particular, those on -- Scientific Knowledge, Evidence Base, and Understanding of Climate Change; Capacity Development, Education, and Awareness; Connecting Science, Policy, and Practice; and Knowledge Management, Sharing, Learning, and Dialogue – are consistent with and complement imperatives outlined in the NAPCC in general and in particular, those under the National Mission on Strategic Knowledge for Climate Change.

3.3 Overall Common Sectoral Implementation Framework

It is envisaged the CSAPCC implementation under the various sectors of the State will be governed by a common implementation framework. The common elements will include:

- Sector policy reviews: Each sector will undergo a policy review, and where appropriate, explicit articulation of climate change concerns and sectoral responses will be articulated;
- Sector climate change impacts evidence base strengthening: Each sector will put into motion a process of building the evidence base on climate change and impacts to the sector;
- Locally specific adaptation plans: To increase resilience, locally specific adaptation plans will be made; enabling the exchange of case studies and good practices will facilitate the development of robust solutions;
- Leveraging Co-benefits: Each sector will proactively seek to identify and leverage opportunities for co-benefits arising out of CSAPCC implementation;
- Sector public/community perceptions documentation: Each sector will carry out periodic documentation of public/community perceptions on climate change and its impacts relevant to the sector;
- Periodic consultations with civil society and communities: Each sector will carry out periodic consultations with civil society and communities to gauge adaptive resilience needs;
- Incorporation of poverty, equity and livelihood concerns: Each sector will, where appropriate, incorporate and explicitly articulate poverty, equity and livelihood concerns in their policies, plans and budgetary processes;

- Monitoring and evaluation protocols: Each sector will, in line with the overarching State level framework, develop and deploy monitoring and evaluation processes and protocols to guide effective programme implementation; and
- Knowledge management (KM) activities: Each sector will, in line with the overarching State level framework, carry out KM activities, and contribute to the State level processes on an on-going basis. The State Centre for Climate Change will carry out the role of a knowledge aggregator, and become a clearinghouse of all data/information on existing and planned research projects and initiatives relating to climate change in the Chhattisgarh context. Towards this, the Centre organisation will provide the following inputs:
 - Hosting of geo-portal on climate change;
 - Host-hub for knowledge/information sharing related to climate change;
 - Knowledge repository;
 - Identification of potential research and development domains concerned with climate change issues in the state; and
 - Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change.

4 Agriculture and Allied Sectors

4.1 Overview, Characteristics and Status

Eighty percent of Chhattisgarh's population is dependent on agriculture for its livelihood. Of the 32.55 lakh farmer households in the state 76 percent fall under the small and marginal category. Currently approximately 28 percent of the area is irrigated from various sources – of this, the largest extent of irrigated land – 66 percent is fed by irrigation reservoirs/canals. Approximately 55 percent of the state's cultivable land has low capacity for water retention and hence it is not feasible to take a second crop without irrigation facilities. Agriculture in Chhattisgarh is characterized by low incomes, low productivity, and high dependence on rains, large number of small-marginal farmers, low investments, and mono cropping. Only a third of the State's geographical area is sown and just seven percent is under double crop.

Land Use Pattern

A table showing the land use pattern for the State is given below.

Table 7: Land use pattern, Chhattisgarh⁸

Details	Unit	Figures
2008-09 Geographical Area	Lakh Ha.	137.90
Forest Area	--"	63.49
Forest Department	--"	45.35
Revenue Department	--"	18.14
Land not available for cultivation	--"	9.63
Culturable Fallow Land	--"	3.47
Unculturable Land	--"	8.55
Fallow Land	--"	5.23
Current Fallow	--"	2.65
Old Fallow Land	--"	2.58
Net Area Sown	--"	47.1
Double Cropped Area	--"	9.73
Kharif Area	--"	46.41
Rabi Area	--"	16.33
Total Cropped Area	--"	62.74
Cropping Intensity	%	132
Net Irrigated Area	Lakh Ha.	13.34
Total Irrigated Area	Lakh Ha.	15.37
From Net Area	%	13.39
From Total Cropped Area	%	28

Soils of Chhattisgarh

The distribution of various soil types in the State and their suitability to various crops is mentioned in the following table:

Table 8: Soils of Chhattisgarh⁹

Types of Soil	Mother rocks	%	Districts/Region	Main crops
Red-yellow soil (or Matasi)	Gondwana	60-65	Surguja, Koriya, Jashpur, Raigarh, Korba, Bilaspur, Kawardha, Durg, Raipur, Dhamtari, & Mahasamund districts.	Paddy
Red-sandy soil	Archaean Granite	20-25	Bastar, Dantewada, Kanker, Durg, Rajnandgaon, & Dhamtari districts.	Kodo-Kutki, Jwar, Maize, Potato, grains, etc.
Red-domat soil	Archaean Granite	-	Dantewada and Konta tehsils.	Paddy
Laterite soil	Mixed	-	Bagicha, Samri, Sitapur, Ambikapur,	Pulses, Jawar, Kodo-

⁸ Source: Agriculture Department, Government of Chhattisgarh

⁹ Source: Chhattisgarh State Biodiversity Action Plan

Types of Soil	Mother rocks	%	Districts/Region	Main crops
			Kawardha, Chhui-Khadan, Saja, Bemetara and Jagdalpur tehsils.	Kutki, Oilseeds, Potato, Coarse grains, etc.
Black soil	Deccan Trap & Basalt	-	Mungeli, Pandariya, Raipur, Rajim, Mahasamund, Kurud and Kawardha tehsils	Paddy, Wheat, Cotton, Gram, Sugarcane, and Rabi Crops.

Cropping Pattern

As indicated in the table below the main crops are paddy, wheat, maize, groundnut, pulses, and oilseeds. Chhattisgarh is also called the "rice bowl of India." Chhattisgarh is home to more than 19,000 native varieties of rice. Nearly 4.0 million hectares, which is 83 percent of net sown area and 70 percent of total production, is under paddy cultivation.

Table 9: Crop Production (Kharif and Rabi) in '000 tonnes¹⁰

S no.	Crop	2009-10	2010-11	Growth %	2011-12 target	Crop	2009-10	2010-11	Growth %	2011-12 target
	Kharif					Rabi				
1	Paddy	4955.27	6159.21	24	6265.60	Wheat	232.34	215.91	-7	264.70
2	Maize	246.38	324.65	32	326.12	Maize	24.16	34.29	42	35.67
3	Red gram	85.17	85.74	1	97.50	Paddy	310.21	640.52	106	627.40
4	Green gram	11.99	9.67	-19	12.94	Chana	331.40	341.26	3	375.54
5	Black gram	74.41	73.51	-1	79.64	Peas	22.87	25.30	11	28.05
6	Ground nuts	67.59	79.09	17	85.99	Tivda/ratan	211.72	231.19	9	253.90
7	Soya bean	148.17	174.35	18	180.00	Mustard	84.00	81.96	-2	102.92
8	Ramtil/niger	24.07	28.09	17	29.00	Alsi/flax	33.01	33.35	1	43.52
	Grand total	5674.66	7003.11	23	7148.75	Grand total	1349.41	1729.45	28	1908.77

The increase in the growth rate in the area of Rabi crops is also due to the intensive efforts of the state government for increasing the double-cropped area. Increase in irrigation sources through different schemes of state Govt., played major role to increase the double-cropped area.

Though the productivity level of food grains in the state is lower than the national average, the total production of food grains in the state is higher than the state requirement except in oilseeds. Despite persistent efforts average food grain productivity in the state has now reached 1457 Kg/Ha against the national average of 1921 Kg/Ha (2010-11). However, the yield-gaps of other major crops are 65 percent of the national average. Between 2000-01 and 2010-11 total food grain production increased from 2891 to 7509 thousand metric tonnes.

Horticulture

Horticulture is growing popularity owing to the high value of produce as opposed to agriculture crops. Accurate (and current) statistical data on horticulture currently appear unavailable and fresh efforts are being made to generate and compile this. The major fruit crops grown in Chhattisgarh state are Mango, Guava, Lime, Litchi, Cashew nut, Chiku (Sapota), etc. Apart from these minor fruits like Sitafal, Bael, Ber, Anola etc., are also grown both as cultivated and wild crop. The total area of the fruit crops in the state is 1,30,098 Ha along with the production of 9,77,832 MT in the year 2008-09. Agro climatically Mango can be grown in the whole part of the state successfully while the northern hilly area of Sarguja and Jashpur district is suitable for production of Litchi. Cashew nut can be grown well in the plateau region of the Bastar and Raigarh district. Vegetables - Mostly all vegetable crops like Solanaceous crops, Cucurbits, Beans, Cabbage, Cauliflower etc., are grown very well in the state. The total area of vegetable crops in the state was recorded 2,93,764 Ha in the year 2008-09 with the production of 29,04,337 MT. Likewise, spices - Chilli, Ginger, Garlic, Turmeric, Coriander and Methi (Fenugreek) are the major spices grown in the state. The total area of spices recorded in year 2008-09 was 62,391 Ha with the production of 4,26,078 MT.

While the area under flower cultivation is negligible in the state, demand is increasing day-by-day. Major flowers like Marigold, Tuberose, Gladiolus, Roses, Gaillardia, Chrysanthemum, Orchids etc., can be grown very well without much care. The present area under floriculture in

¹⁰ Source: Chhattisgarh Economic Survey 2011-12

the state is 2390 Ha with the production of 6,945 MT approximately in the year 2008-09. The medicinal crops grown in the state are Ashwagandha, Serpagandha, Satawar, Butch, Aonla, Tikhur etc. Some aromatic crops like Lemongrass, Pamarosa, Jamarosa, Patchouli, E.citridora are promoted by the department for commercial cultivation among farmers. The present area of aromatic and medicinal crops in the state is 11,615 Ha with the production of 66,108 MT in the year 2008-09.

Animal Husbandry

The rural economy in the State is dominated by small farmers (<2ha) comprising over 75 percent of the total farm households. The average size of land holdings in the State is 1.4ha, and is likely to decline with increasing population pressure. Under such a scenario, crop production alone cannot provide an adequate livelihood to the majority rural population, and livestock could emerge as an important source of income and employment for the rural poor. They act as a buffer against income shocks of crop failure, which is a frequent phenomenon in Chhattisgarh. Livestock provide a continuous stream of outputs and thus income from livestock helps consumption smoothening. Species like poultry, goat, sheep, and pigs are of short-generation interval, have a high prolificacy rate and require less land, investment, and operational expenses and are better suited to the resource endowment of the poor. Cattle and buffalo are an important source of manure and draught power, which are vital to improving crop production and environment. Chhattisgarh is rich in livestock wealth. The state has about 144.18 lakhs animal population out of which 94.91 lakhs are cattle, 16.04 lakhs are buffaloes, and the remaining 33.23 lakhs are other animals, which include sheep, goat, horse, and other species. The State has about 142.45 lakhs total poultry population.

The Chhattisgarh State Livestock Department carries out various activities to support the sector including (1) veterinary health care service delivery; (2) improvement in breeding procedure in animals and birds; (3) extension and human resource development; and (4) rural development through promotion of livestock rearing. For covering these entire activities department has following infrastructure units -- veterinary Hospitals - 210; Veterinary Dispensaries - 755; Disease investigation Laboratory - 18; Motor Cycle unit - 20; Mobile Unit and Ambulatory Clinic 26; Rinderpest Eradication Unit - 05; Animal Check Post - 07; AVFO Training Centre - 02; Dairy Technology College - 01; College of Veterinary Science & Animal Husbandry - 01; Artificial Insemination (AI) Centre - 22; AI Sub Centre - 253; and Central Semen Centre - 05.

Fisheries

The fisheries sector has been recognised as a powerful income and employment generator and play an important role in rural economy and is a source of cheap and nutritious food. More than 2.50 lakh fisher folk in the state depend on fisheries and aquaculture for their livelihood. Fisheries sector occupies an important place in the socio-economic development of the state. It caters primarily to the need of socio-economically weaker and backward communities of fisher folk, SCs and STs. Which contributes the poorest section of the society. In addition to this fish is easily digestible and protein rich nutritive food commodity help to remove malnutrition.

The state possesses vast and varied natural water area available for fish culture in the form of river, reservoirs, ponds, and tanks. About 1.549 lakh hectare average water area is available for fish culture. Besides the state has two major river system viz Mahanadi and Godavari and their tributaries forming a network of 3573 km. Fishing in rivers is free for the member of scheduled tribes and scheduled castes. The fishing in these waters is on the decline due to unregulated and indiscriminate fishing. Available water resources for the development of fisheries are as under:

Table 10: Available water resources for fisheries¹¹

S.No.	Particulars	Available water area for fish culture		Under fish culture water area	
		No of tank/ reservoirs	Water area (ha)	No of tank/ reservoirs	Water area (ha)
1	2	3	4	5	6
1	Village ponds				
a	Gram panchayat	35964	51240	32215	44665
b	Janpad Panchayat	227	2394	141	1873
c	Others Private, municipal, const. of pond own land etc.)	17777	17213	11742	12227
	Total	53968	70847	44098	58765
2	Irrigation Reservoir				
a	Gram Panchayat	725	4239	647	3517
b	Janpad Panchayat	830	29126	759	27438
c	Zilla Panchayat	24	5713	24	5713
d	Fish Federation	05	4481	05	4481

¹¹ Source: Department of Fisheries, Chhattisgarh

e	Departmental	10	1154	10	1154
f	Departmental above 200 ha.	23	39401	22	38984
	Total	1617	84114	1467	81287
	Grand Total	55585	154961	45565	140052

Ownership wise percentage of water area is given below:

Table 11: Ownership wise percentage of water area¹²

S. No.	Particular	Available water area % (ha)	Under Fish Culture water area % (ha)
	Three tier Panchayat	60	87
	Fish federation	03	100
	Departmental	26	99
	Private	11	71
	Total	100	90

All the water bodies except water area beyond 2000 Ha have been leased out by the local Panchayat Administration since 1995. Village ponds and reservoirs upto 10 Ha are leased out by Gram Panchayat, 10-100 Ha water area is leased out by Janpad (Block) Panchayat and the water area 100-200 Ha is leased out by Zilla (District) Panchayat under new fish policy. More than 200 Ha average water area are to be auctioned by the fisheries department for a five years period at a time. Water bodies below one Ha are allotted to individual fisher folk and above one Ha, water bodies are leased out to fisher folk co-operative societies and groups for a period of five years. Department of fisheries has reserved a small reservoir in each district for the procurement of breeders. Fish seed is an important input in fish culture. Requirement of fish seed in terms of standard fry is 610 million annually. During the year 2005-06 target of production of 494 million standard fry was envisaged against which is 500 million. A well-organised fish seed trade also exist which assist in meeting above 19 percent of the total requirement outside the State. □

In the year 1979 the Madhya Pradesh Government established the MP Rajya Matsya Vikas Nigam to enhance the fish and seed production of the state. Later on 1st of August 1999, Matsya Vikas Nigam merged into the MP Matsya Mahasangh an apex Co-operative body that was already in existence since 1984. This was done by the government to strengthen the primary co-operative societies. On the eve of the state bifurcation of Madhya Pradesh state MP Matsya Mahasangh was also bifurcated and Chhattisgarh Rajya Matsya Mahasangh (CRMM) came into existence on 1st November 2000. Presently 450 primary societies are its members. The CRMM has six fish seed hatcheries with a total water area of 60 ha. These Centres are producing 30-35 corers spawn and 4.5 crores fry annually Two fish hatcheries Demar (25 ha.) and Salud (10 ha.) have been established with assistance of the World Bank. CRMM has been successful in its aim to provide quality fish seed for village ponds and CRMM's acquired reservoirs. The aim of CRMM is to generate maximum employment to fisher folk through raising fish production in reservoirs. The average fish production per hectare achieved is 21.54 kg.

4.2 Key Issues

Chhattisgarh faces a range of key issues in its agriculture; some of these are briefly summarised below:

- There is a continuous mismatch in the cropping system adopted by the farmers, which is leading to depletion of humus and other soil nutrients. Also, Low inputs in Agriculture due to unavailability of agri-inputs on time concerns the state. Since the terrains are inaccessible so non-availability of quality inputs hampers the production productivity;
- There is a limited area under irrigation. Due to difficult terrain and fragile ecosystems there has been inadequate infrastructure development in the area. This has direct bearing on the development of agriculture development;
- Lack of proper market linkages leads to increase number of intermediaries, which results in low value realization to the producer. Lack of supply of inputs at the right time and in right quantity coupled by inadequate extension work leave the farmers to practice less efficient agriculture;
- Continued vicious cycle of low production, low productivity, low input supply, non-awareness of new technologies and lack of extension support leaves the farmer practicing the inefficient farming operations. Apart from the scientific, technological and market barriers there are many socio-economic constraints;

¹² ibid

- There is a perceived need for region/state specific extension work, to take research/technologies/new inputs from the lab to the field. Lack of post-harvest technology as storage, grading, processing leads to lack of interest/initiative among farmers to grow high value crop, and thus restricting to subsistence farming;
- Though the state has geared up the production of horticulture by increased yield in the state through National Horticulture Mission (NHM) but there has been considerable post harvest loss of the produce due to lack of post harvest management practices. Thus the net production of crops reduces considerably and return to the farmers is also not as desired;
- Inputs for increased production of horticulture crops that promote area expansion like irrigation facilities and timely supply of quality planting materials are also lacking;
- There is virtually no facility available for proper collection and storage of surplus products at the farm gate level and above as well as presence of any organized market network from rural market to terminal market level;
- Lack of exposure of both the farmers and departmental staff towards modern horticulture practices as well as orientation to work under mission management mode also creates barrier to implement the program effectively; and
- Absence of forecasting facilities both in terms of weather, disease, and price of the products makes the position of the farmers vulnerable and increases the risk factor manifold. These intrinsic weaknesses coupled with excessive use of chemical fertilizers and pesticides in some pockets are harming the ecological balance and ultimately will reduce the productivity of the crops. □

4.3 Existing/On-going Initiatives and Priorities

New Draft Agriculture Policy

The State has developed a Draft Agriculture Policy in 2012 with a view to revitalising the agriculture sector. The Aim of policy is to stimulate the attitude and action, which should result in assessing agricultural progress in terms of improvement in income of farm families not only to meet their consumption requirement but also to enhance their capacity to invest in farm related activities. The policy emphasises five elements: (a) protection of the land health and enhancement; (b) conservation management and utilisation of natural resources with a focus on water and micro irrigation; (c) timely disbursement of agricultural loans; (d) post-harvest management integrated with the development of food processing; and (e) reducing the time lag/gulf in the transfer of knowledge from lab to the land/farm.

Priorities under the 12th Plan

Improved Extension and Outreach

As agriculture was traditionally subsistence, with low awareness and poor use of progressive agriculture practices, the State first began work on improved agriculture extension by filling-up vacancies and creating an outreach. Attention in the coming plan will be on improving quality of services and making them need-based- especially in remote tribal areas, where improved agriculture practices and diversification can significantly improve incomes. Closer involvement of producer groups in preparation of Extension Plans, farm demonstrations, soil testing and varietal selection will be encouraged for greater client-orientation and to promote convergence of schemes.

Box 3: Priorities for Agriculture under the 12th Plan

1. High investments in agriculture infrastructure to improve farm productivity and incomes
2. Particular attention to the needs of small and marginal farmers
3. Improve the quality of extension services
4. Bring average yields of major crops closer to national average while encouraging low input usage
5. Increase irrigation potential and expand coverage
6. Expand warehousing capacity and network in the state
7. Create incentives for non-farm livelihood diversification among agriculture labourer and the landless

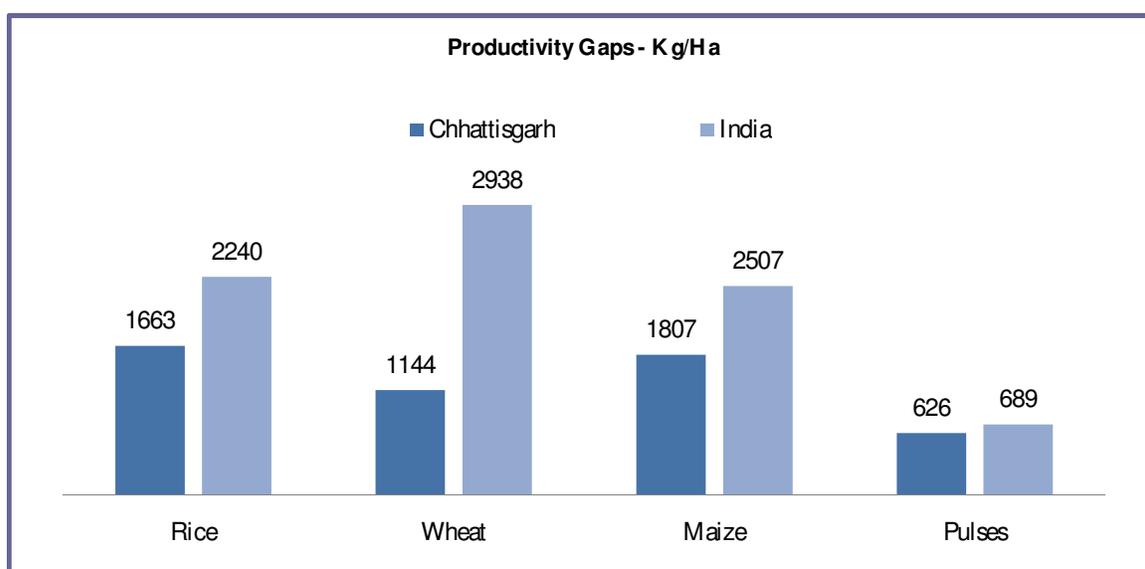
Use of Information Technology and mass media for generating awareness, better farm & post-harvest management, and monitoring the quality of extension services will be a priority. Knowledge and skills of Agriculture Extension Officers will be continuously upgraded through closer working with Indira Gandhi Agriculture University and Krishi Vigyan Kendras (KVKs) so that they are able to pass on this knowledge to producers. Bio-technology and farm mechanization has become a need of many rural areas facing shortage of agriculture labour due to migration and the state is supporting the establishment of Krishi Yantra Seva Kendras (KYSKs) for leasing farm equipment/machinery to

small-medium farmers; awareness about these schemes for linking progressive farmers with new technology will also be increased through the extension services.

The MGNREGA programme has contributed to better productivity for marginal farmers through its component on improving private farms and State will aim at improved targeting of this intervention. The flexibility to plan and prioritize locally provided by RKVY has helped improve agriculture and needs to be scaled-up in 12th Plan with revised norms. However, the untied component, which has been curtailed by almost 50 percent because of the new sub schemes, should be revised. Convergence of schemes for agriculture and allied sectors, as recommended by BK Chaturvedi Committee, will greatly help in achieving better outcomes.

There is still potential for improving productivity in rice and both productivity and acreage of other major crops, pulses, oilseeds, and wheat by improving practices and bringing additional area under irrigation. State targets to bring productivity of all its major crops at par with national average by the end of 12th Plan. However, despite a low average productivity of both rice and wheat- at 1663 kg and 1144 kg/ha respectively, Chhattisgarh is unable to avail adequate support under National Food Security Mission (NFSM) for both crops. Ten districts of the state has been covered under NFSM (Rice), while the NFSM district selection criteria for both rice and wheat need to be reviewed, the State will work on introducing newer varieties with higher yields and greater resilience and create incentives for increasing acreage.

Figure 15: Productivity gaps between Chhattisgarh and India



Seed Certification and Replacement

Availability of quality seeds is a precursor to good productivity. There has been a consistent increase in certified seed production and distribution with seed replacement in case of paddy increasing from 8.5 percent in 2006-07 to 34.3 in 2011-12. Nearly 50,000 ha of land are under seed production- yielding nearly 53,000 MT of certified seeds in 2010-11. The state will continue subsidy support for both seed production and replacement and make certified seeds available to farmers to replicate the success achieved in pulses, where seed replacement has increased four-fold in recent years.

Low Agriculture Intensity

Chhattisgarh still has the advantage of having relatively low agriculture intensity, though fertilizer consumption has grown two and half time in the period 2000 to 2011 from 0.245 million MT to 0.675 million MT (Kharif and Rabi); areas with no or low chemical input usage will be encouraged to create a niche in organic farming, while taking steps for retaining long-term soil fertility through promotion of bio-fertilizers and organic manures- both of which have seen increased consumption lately. Application of the System of Rice Intensification (SRI) on paddy for productivity improvement is becoming popular. Almost ¾ of area under rice is rain fed which is the main constraint in expansion area under SRI; hence State is promoting line sowing in rain fed area also where traditionally rice is sown by broadcasting method.

Promotion of Rice Research

While rice production increased at a consistent rate due to area expansion and productivity increase in the current plan period, it may plateau in coming years. Rice research will be promoted for gene-conservation and developing newer varieties suited to rain-fed agriculture through closer farm-lab collaboration in high productivity as well as tribal areas, with emphasis in tribal areas on promoting aromatic varieties that have huge national and international demand.

Oilseeds and Coarse Cereals

Area under oilseeds and pulses is rapidly increasing due to better productivity and returns. This is a happy development since Chhattisgarh is deficient in oilseeds, while surplus in cereals and pulses. Traditional staples like niger, kodokutki and maize are still produced and consumed by a significant population but not much research has gone into improving their cultivation and will need to be addressed in the 12th Plan.

Access to Timely Agriculture Inputs

Agriculture in Chhattisgarh is predominantly rain-fed and timely access to credit, information, and other inputs becomes decisive in the success or failure of a crop. Co-operatives and other entities providing these much-needed finances and inputs (certified seeds, pesticides, fertilizers, implements) will be further strengthened to provide timely and quality services. Steps would be taken for the financial inclusion of marginal farmers through widespread awareness and simplified access.

Expansion and Management of Irrigation

Increase in productivity is a function, among other factors, of water availability. The importance of judicious use of available water cannot be over-emphasized. The irrigation potential of the state has increased from 13.3 lakh hectare in 2000 to 18.4 lakh hectare by March 2012, but this is far short of providing water security to the small farmers. The eleventh plan target was to create an additional irrigation potential of 4.8 lakh hectare, but so far only one-fourth of this target has been achieved. As a result, food grain production during Rabi is barely 25 percent of State's Kharif production. To reduce overdependence on large dams and major projects for irrigation, which face problems in environmental and other clearances, the State will shift attention to developing and utilizing the potential of minor and medium irrigations projects and locally impounding water. Though there is high dependence on surface water for irrigation (76 percent), vast untapped potential still exists.

Scientific management of both ground and surface water will be promoted with priority to repair and maintenance of irrigation canals/ponds and incentives for micro-mini and lift irrigation systems to increase coverage and water use efficiency. Nearly 342 Water User Associations (WUAs) have been managing and maintaining the canal network and command area under them. These experiences will be used to increase the stake and participation of farmer groups in the management of irrigation projects, watersheds, water bodies, and small lift irrigation schemes in the 12th Plan to improve local water governance, cost recovery and viability of these schemes.

Irrigation is resource intensive and additional fund support is required to meet the expansion targets; review of current funding norms of Accelerated Irrigation Benefit Programme (AIBP) will help States like Chhattisgarh to increase the irrigation coverage. Increased irrigation potential is meaningless without regular power supply. Past efforts have tried to make requisite power available to farmers, especially during the cropping season; for further improving availability separation of electricity feeders for dedicated supply to agriculture users will be considered.

Agriculture Warehousing and Agro-processing

Increase in production needs to be complemented with warehousing and storage capacity to help farmers in holding their produce and for procurement agencies. For entrepreneurs willing to invest in warehousing and cold storages, smoother transactions between entrepreneurs and financial institutions will be facilitated. Special incentives will be created for entrepreneurs to set-up agro-processing industries with priority to women's collectives and women farmers.

Addressing Vulnerabilities in Agriculture

Small and marginal farmers cultivate 38 percent of the cropped area but constitute 75 percent of the State's cultivators. To empower the vulnerable and women farmers, forming their collectives is important for peer learning, diffusion of progressive farm-practices and pooling of marketable surplus for better bargaining. The State will encourage creation of more farmer organizations and producer companies to improve productivity, price realization and make agriculture services demand-driven. It will also continue improving access, especially of vulnerable farmers, to Rashtriya Krishi Bima Yojana (RKBY) and other safety nets.

In a sector largely dominated by men, women farmers face a lot of difficulty in accessing inputs, extension services, and subsidies for taking agriculture as a sustainable livelihood option. Easier access, information, and support to women in agriculture will be provided through their skill development in farm and non-farm activities. Gender sensitization of agriculture extension officers will be done so they can extend support to women farmers with gender friendly technologies. Tribals and women will be encouraged to take up agriculture extension targeting farmers of their own community for better acceptability and adaptation. Help of women farmers will also be sought to create awareness on the importance of homestead farming for catering to family's nutritional and health needs. With high investments in agriculture and fluctuating commodity prices, farm-level risk mitigation and management is vital, especially for smallholders. Greater use of Information Technology in agriculture will be promoted for better access to weather forecasts, closer producer-market linkages, and awareness on crop insurance.

Re-distribution to achieve food security for all has been initiated through a revamp of the Public Distribution System (PDS). The state undertook a series of reforms to plug the leakages and make PDS more accountable and transparent. This included transferring the management of Fair Price Shops to community institutions, improving operating margins, increasing awareness about the entitlements, eliminating errors of exclusion, and strengthening the monitoring system along the entire supply chain. In the 12th Plan the state would

complete the computerization of the entire value-chain of PDS, beginning from the procurement of food-grains to the delivery of entitlements from the Fair Price Shops.

Under veterinary health care the major activities for the year 2010-11, the department has carried out 25.27 lakhs treatments, 24.76 lakhs Medicine Supply and 3.30 lakhs Castration, 132.05 lakhs Vaccination and about 8,154 multipurpose veterinary camps in all over the state. Beside this Livestock Development Department solemnly dedicated to the weaker section of the Society are running various schemes. Distribution of Poultry Units and distribution of pigs and goat units on exchange basis are presently aimed to benefit those belonging to backward community of the state. Under its total plan outlay of 2450.32 lakh in year 2009-10 the department has distributed 9799 backyard poultry units, 83 male pigs & 73 pig trios on 10 percent subsidy basis & 168 male bucks in different plans. Presently in year 2010-11 plan outlay is increased to 2985.40 lakh and with more availability of funds due to change of some heads from plan to non plan, the department is planning to distribute 18000 backyard poultry units, 500 male pigs & 500 Pig trios and 6000 male bucks to different SC & ST beneficiaries. The state's availability of milk as 'per capita availability of milk' is 126gm/person in 2009-10, which increased to 128gm/person in 2010-11 as against Indian average of 300 gm/person. To meet out the deference newly formed state has got 5 Integrated Dairy Project under Central assistance in the tribal districts of the state (Raigarh, Ambikapur, Jashpur, Korea & Kabirdham).

Allied Agriculture

Eleventh plan emphasized diversification of farm portfolio, and horticulture saw an encouraging response with a jump in Mango, Litchi, and Cashew and Potato production. Area under fruits, vegetables, and medicinal plants will be increased beyond the existing five lakh hectares and incentives created to encourage post-harvest management and agro-processing.

Animal husbandry, dairying, fisheries, and sericulture have an important role in diversification and risk management. State has 14.4 million cattle and 14.2 million poultry birds and will promote better veterinary research and customized technical support for breed, feed and productivity improvement. Preference will be given to landless and marginal women farmers in the distribution of cattle and poultry units.

Fishery is vital for Chhattisgarh not only as an economic activity but also for its nutritional value, since much of it is consumed at the household. Ninety percent of State's water bodies have already been developed for fisheries and production grew at an impressive 10 percent between 2007-10. In the coming years distribution channels will be improved and fisheries cooperatives empowered to manage more water bodies.

In Sericulture, Chhattisgarh has comparative advantage in vanya (wild) silks- Tasar and Eri, which are abundant and employ large numbers in production and processing throughout the state. Chhattisgarh's Tasar has made a mark in the market. While interventions have been directed at skill upgradation for better handling worms and cocoons, there is potential for productivity improvement and process refinement on which WSHGs and farmer's groups will be trained. The state will adopt a value chain approach to allied agriculture through greater involvement and decision making of local communities/ producer groups at all levels collection-production-processing-marketing.

4.4 Perceived Climate Impacts

Currently, no comprehensive analyses of possible impacts of climate change to agriculture in Chhattisgarh are available, nor are systematically documented anecdotal references to impacts from farmers. At the same time, it is evident that a changing climate can pose serious threats to the existing crops and agricultural practices in Chhattisgarh. Any short-term or long-term fluctuations of climate can have dramatic effects on the agricultural productivity and impact food security. Recent years have seen increased climatic variability like frequent floods and drought affecting agricultural productivity. Adding to it, increased population pressure on the state and subsequently decreasing per capita availability of land is leading to unsustainable practices like monoculture. If global patterns of increase in temperatures and decrease in water availability apply to the State, productivity of most crops would decrease, with greater loss expected in Rabi as compared to Kharif.

4.5 Strategies

The State has already outlined its priorities for the agriculture and allied sectors such as horticulture, animal husbandry, and fisheries under its 12th Plan Approach Paper. The strategies therein are well positioned to build substantive climate resilience, and as such, will form the core of the strategies under the CSAPCC. Additionally, the State will undertake the several measures that will be complementary to the above (or place additional/special emphasis on) and are specifically designed to enhance resilience. These will indicatively include (but not be restricted to):

Short-Term (5 years)

1. Analysing the results of sectoral climate risk and vulnerability studies (as indicated in the overarching state strategy);
2. Building institutional linkages under the CSAPCC with and leveraging the National Initiative on Climate Resilient Agriculture (NICRA) of the Indian Council of Agricultural Research (ICAR) and its participating organisations including Central Research Institute for Dryland

Agriculture (CRIDA), Indian Agricultural Research Institute (IARI), Indian Institute of Horticultural Research (IIHR), Central Institute of Agricultural Engineering (CIAE), National Dairy Research Institute (NDRI), Central Marine Fisheries Research Institute (CMFRI), and other collaborating centres for technical advice, capacity building, and research support including State and sector specific vulnerability analyses, etc.:

3. Developing strategic plans at the agro-climatic zone level so that action plans are contextualized to regional scales in the areas of research and development, technology and practices, infrastructure and capacity building;
4. Collating, disseminating and follow best management practices including those for conserving resources and increase input use efficiency, bridging the yield gaps, and through customized interventions such as use of bio-technology to develop improved and diversified varieties of crops (including flood and drought tolerant varieties) and livestock, promoting efficient irrigation systems, demonstration of appropriate technology, capacity building and skill development;
5. Facilitating access to information and institutional support by expanding Automatic Weather Stations (AWS) networks to the Panchayat level and linking them to existing insurance mechanisms including Weather Based Crop Insurance Scheme (WBCIS) and National Agriculture Insurance Scheme (NAIS), scaling the returns at that level;
6. Implementing measures to minimize soil and water losses through resource conservation technologies such as agroforestry, integrated watershed management, and water harvesting through check dams, renovation of existing ponds, etc. and building new ones;
7. Improving irrigation efficiency including developing processes for adopting/promoting improved energy pricing and water pump efficiency;
8. Promoting adoption of solar and wind power systems for irrigation and other uses;
9. Strengthening weather services and early warning systems through enhanced agro-met systems;
10. Integrated nutrient and pest management and promotion of conservation agriculture; and
11. Capacity building of stakeholders by synergizing traditional knowledge, agricultural heritage and modern technology and research.

Specific and additional emphasis will also be placed on the role of women in agriculture and its allied sectors – which is high in the State and likely to be most adversely affected by the impacts of climate change. In these contexts, responsibility for adaptation is likely to fall on their shoulders – including finding alternative ways to feed their family. However, statutory and/or customary laws often restrict women's property and land rights and make it difficult for them to access credit and agricultural extension services, while also reducing their incentive to engage in environmentally sustainable farming practices and make long-term investments in land rehabilitation and soil quality. Despite these obstacles, recent evidence from elsewhere in India and outside of it demonstrates that women who are already experiencing the effects of weather-related hazards –such as erratic monsoon patterns, flooding and extended periods of drought – are developing effective coping strategies, which include adapting their farming practices. Therefore, efforts will be made to further recognize and support women's role in adaptation, including promoting women's involvement in decision-making processes and implementation. Also, given women's key role in agriculture, efforts will be especially made so that gender disaggregated data becomes available to enable gender specific planning and interventions.

Longer –Term (Beyond the 12th Plan Period)

Chhattisgarh would exploit its strengths as a predominantly agrarian economy and a State rich in bio-diversity to create more wealth for itself by developing value-added agro and forest-based industries. The focus would be on horticulture, food processing, oil-seeds, cotton, sugar, cereals, spices, and floriculture. The focus on the forest based industries would be the Sal, herb, olive, bran and aonla processing industries. The specific tasks that will be undertaken for developing this sector are mentioned below:

1. Mapping the potential of growth: The potential for the growth of agro and forest based industries would be identified in each district of the State. This would be done considering the climatic and the soil conditions. The bio-diversity of the forests would be mapped by the systematic classification of the rare flora and fauna.
2. Developing industry specific infrastructure: The industry specific infrastructure facility would include setting up sector specific industrial parks like an agro-industrial park or herbal villages. Developing other infrastructure facilities would include setting up of cold storage facilities at the district level, developing cold storage chains that would link warehouses to cold storage facilities for perishable horticulture and food products and forest produces, in the rural areas, facilities to sort, dry and pack the agro based products etc.

Strategies to achieve better agricultural production through sustainable agriculture practices would be undertaken including:

3. Diversification of agriculture: based on the varying set of climatic and soil conditions offer natural advantage for crop diversification seems to be very necessary. Crop diversification could prove to be an effective tool to cope up with threat of increasing climatic variability. This will take care of sustainability as well as economic viability. Promotion of cultivation and production of high value crops will fetch higher prices to the farmers and hence higher net returns even if the production is low. In regions where it is not feasible to

grow high yielding variety or it is not suitable for diversification of crops, value addition to the existing produce would be of immense use. For example, the hills form a natural habitat for growing crops like finger millets, barnyard millets, amaranthus, and buckwheat etc., crops that are rich in nutrients. A number of products can be prepared from these crops to provide nutritional security. This will also co-benefit in sustainable agriculture and on the other hand help in checking migration.

4. Strengthening the marketing base: Setting up an agricultural marketing board would strengthen the State's marketing mechanism. The market information system would be improved by the e-governance initiatives of the government to provide market-related information like price, demand, etc., to the farmer regarding the agro-based products across the mandis in the State.
5. To increase the availability of inputs: The availability of the agricultural inputs in the different regions of the state is being increased by providing considerable subsidy on the inputs. Krishi Mahotsaves are being arranged twice in year in the rabi and kharif season in which all the agricultural inputs are made available to the farmers.
6. Promoting/additional thrust to organic farming: Yield levels can be effectively raised in a stable and sustainable manner by adopting organic farming methods, since extensive use of chemical fertilizers may ultimately lead to soil deterioration. The key objective of orientation towards organic farming is to improve crop productivity, soil health, and the income of the farmers. Organic products have a parallel market, which, if captured in a strategic manner, can lead to the rapid development of these hill districts.
7. Adoption of new techniques: Introduction of new crop varieties to increase tolerance to water and heat stress is needed. Also advancement of planting dates of rabi crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seeding), frost management in horticulture through fumigation, community nurseries for delayed monsoon, custom hiring centres for timely planting, location specific intercropping systems with high sustainable yield index is also required.
8. Changing traditional technologies and crop diversification: Looking to the changing climate in some traditional technologies like biasi in rice will be discouraged and line sowing should be encouraged. Also, looking to the water scarcity long duration varieties should be avoided instead short or medium duration varieties should be adopted. Moreover, crop diversification should be encouraged to increase the net profitability of the farmers.
9. Nutrient Management: Appropriate and responsible use of fertilizers and sustainable nutrients can make a contribution to helping plants capture more carbon, fostering higher yields and slowing the decline of soil organic matter. The emissions originating from fertilizer use by farmers should be weighed against the net benefits of using fertilizers to increase agricultural productivity on the same amount of land, thus reducing the advent of land-use change and increasing the carbon content in soils.
10. Soil Conservation: Conservation agriculture techniques such as low or no-till agriculture, made possible through the use of herbicides and herbicide-tolerant biotech crops in appropriate and carefully managed cases, prevents wind and water erosion and loss of ground moisture, improves soil biodiversity, has the potential to increase soil fertility, and reduce carbon emissions. In addition, by limiting soil disturbance and promoting a permanent soil cover, conservation agriculture can contribute to limiting emissions from agriculture by increasing soil carbon content and preventing erosion.

4.6 Institutional Linkages and Stakeholders

A range of institutional linkages, convergence potential, and partnerships is envisaged under the CSAPCC¹³ and will indicatively include State institutions such as the National Food Security Mission, Chhattisgarh; State and central agriculture and allied sectors related research and training institutes, as well as public and private sector institutions; the various related departments such as Horticulture, Livestock, Fisheries (and their linked institutions); State Water resources Department; State Energy Department (and especially the State renewable energy development agency); State Forest Department; etc. in addition to various international development agencies, financial institutions, civil society, community based organisations, and agriculture and allied sector dependant communities in general, who are the primary stakeholders.

4.7 Linkages with the NAPCC

While the strategies outlined in the State Agricultural Roadmap and herein are consistent with the sectoral imperatives of the NAPCC and the National Mission For Sustainable Agriculture under it, the State will also take specific care to ensure that specific action plans developed under the CSAPCC are also consistent with the same.

The strategies under the agriculture and allied sectors under the CSAPCC also additionally have linkages with the National Mission on Water, National Mission for a Green India, National Mission for Enhanced Energy Efficiency, National Solar Mission, and the National Mission on Strategic Knowledge on Climate.

¹³ This is not meant to be an exhaustive list; rather, it gives some examples of possible linkages under the CSAPCC.

4.8 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

5 Forests and Biodiversity

5.1 Overview, Characteristics and Status¹⁴

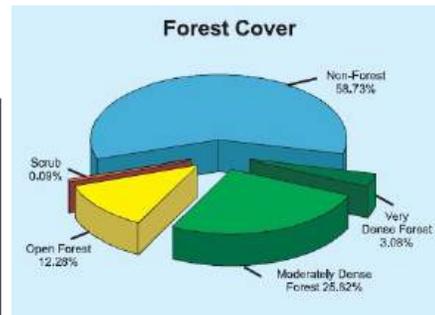
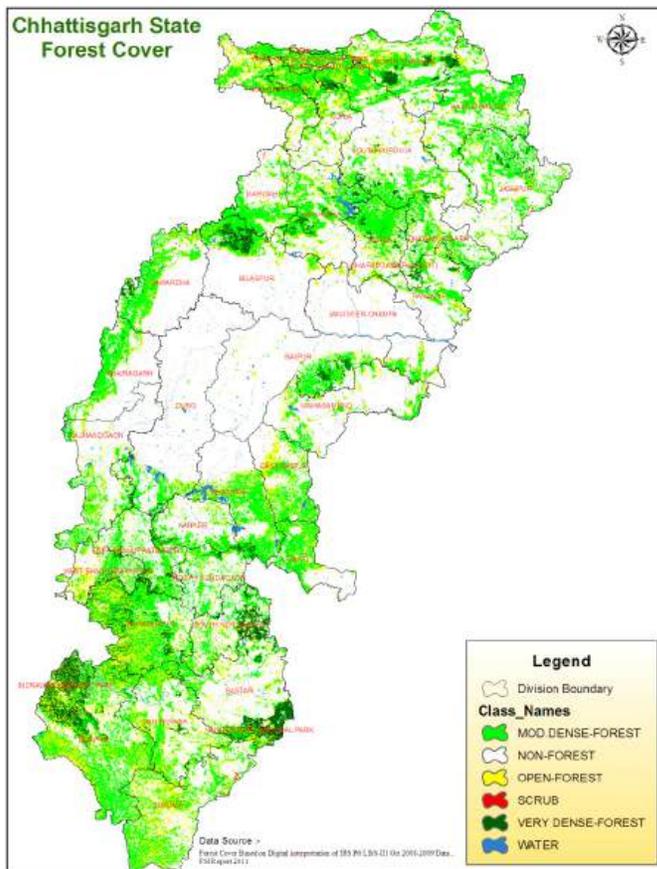
Chhattisgarh is gifted with the most pristine and abundant set of natural resources in the country. Mountain, Plateau, and Plains eco-systems constitute roughly a third each of its physiography. Dense, green, and untouched, its forests are also the source of major rivers like Mahanadi, Narmada, Indravati, and an exotic flora-fauna.

Recorded Forest Area, Protected Areas and Forest Cover

The recorded forest area in the state is 59,772 km², which is 44.21 percent of its geographical area. Reserved, Protected and Unclassed Forests constitute 43.13 percent, 40.21 percent, and 16.65 percent of the total forest area respectively. The state has three National Parks and eleven Wildlife Sanctuaries covering an area of 0.29 million ha and 0.36 million ha respectively. Thus, a total of 0.65 million ha area constituting 4.79 percent of the geographical area of the state is under protected area network. The forest cover in the state, based on interpretation of satellite data of October 2008-January 2009, is 55,674 km², which is 41.18 percent of the state's geographical area. In terms of forest canopy density classes, the state has 4,163 km² of very dense forests, 34,811 km² of moderately dense forests and 16,600 km² of open forests. The forest cover of the state is shown in the figure below.

Figure 16: Forest cover in Chhattisgarh

District-wise forest cover in different canopy density classes along



with the changes compared to 2009 assessment is given in the table below.

¹⁴ All statistical data in this section are sourced from the Forest Survey of India Report 2011.

Table 12: District-wise forest cover (in km²)

District	Geographical Area	2011 Assessment				Percent of GA	Change*	Scrub
		Very Dense Forest	Moderately Dense Forest	Open Forest	Total			
Bastar ^T	14,974	1,349	4,333	2,329	8,011	53.50	0	11
Bilaspur ^T	8,270	338	1,623	533	2,494	30.16	0	6
Dantewada ^T	17,634	1,082	6,167	4,079	11,328	64.24	0	22
Durg ^T	8,549	44	521	202	767	8.97	0	4
Janjgir-Champa	3,852	4	26	125	155	4.02	0	2
Jashpur ^T	5,838	111	1,485	568	2,164	37.07	0	11
Kanker ^T	6,506	215	2,044	835	3,094	47.56	0	2
Kawardha	4,223	70	1,126	389	1,585	37.53	0	4
Korba	6,599	203	2,306	840	3,349	50.75	0	6
Koriya	6,604	79	2,605	1,423	4,107	62.19	0	3
Mahasamund	4,789	4	534	422	960	20.05	-1	8
Raigarh ^T	7,086	126	1,697	723	2,546	35.93	-2	13
Raipur & Dhamtari	16,468	189	3,837	1,435	5,461	33.16	0	7
Rajnandgaon ^T	8,068	29	1,771	720	2,520	31.23	-1	4
Sarguja ^T	15,731	320	4,836	1,977	7,133	45.34	0	16
Grand Total	135,191	4,163	34,911	16,600	55,674	41.18	-4	119

* Change figure are based on comparison of 2011 assessment with that of 2009 after incorporating interpretational changes

Comparison of the current forest cover assessment with the previous assessment (satellitedata of Oct 08-Jan 09) shows a marginal loss of four km² of forest cover.

Forest Cover Change

Although there is an actual change of four km² as detected during 2011 assessment, there is a net decrease of 192 km² in the forest cover from the reported area in FSIR 2009. This has occurred due to refinement of interpretational methodology on the one hand and availability of satellite data of appropriate season with improved quality as compared to previous years. A quantitative account of the class-wise change is given in the forest cover change matrix below.

Table 13: Forest cover change

2009 Assessment	2011 Assessment					Total 2009
	VDF	MDF	OF	Scrub	NF	
Very Dense Forest	4163	0	0	0	0	4163
Moderately Dense Forest	0	34911	0	0	0	34911
Open Forest	0	0	16600	0	4	16604
Scrub	0	0	0	119	0	119
Non-Forest	0	0	0	0	79394	79394
Total 2011	4163	34911	16600	119	79398	135191
Change	0	0	-4	0	4	

The change matrix given in the table above reveals that there has been a decrease of four km² in open forest whereas no change in very dense forest and moderately dense forest has been observed.

Altitude Zone-Wise Forest Cover

Forest cover of the state in different altitude zones is given in the table below.

Table 14: Altitude zone-wise forest cover

Altitude Zone	VDF	MDF	OF	Total
0-500m	1,854	16,845	10,171	28,870

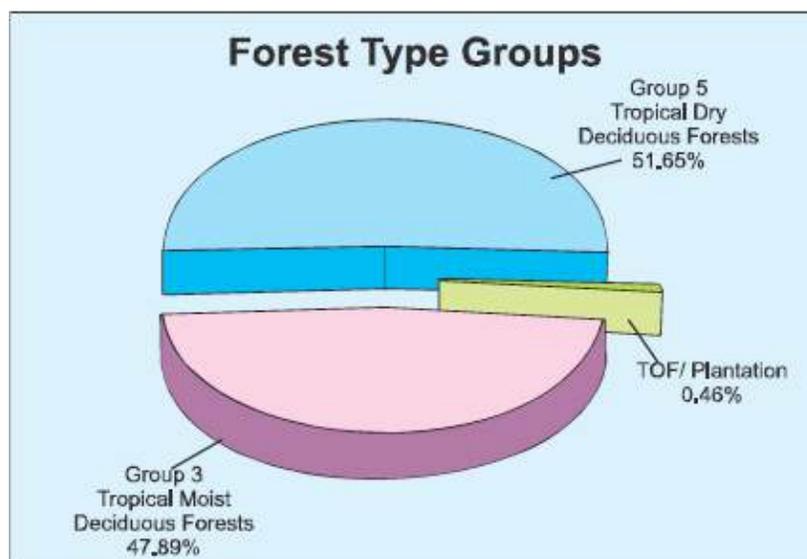
500-1000m	2,297	17,635	6,197	26,129
1000-2000m	12	431	232	675
Total	4,163	34,911	16,600	55,674

(Based on SRTM, Digital Elevation Model)

Forest Cover in Different Forest Types

As per Champion & Seth Classification, the state has ten forest types that belong to two forest type groups, viz. Tropical Moist Deciduous and Tropical Dry Deciduous. Forests distribution of forest cover in different forest type groups found in the state on the basis of forest cover assessment is given in the pie diagram.

Figure 17: Forest type groups



Tree Cover

Tree cover of the state has been estimated using trees outside (TOF) inventory data collected over a period of six years, i.e. 2004-10. The estimated tree cover in the state is 3,866 km², which is 2.86 percent of the geographical area of the state. Six districts of the state (Bilaspur, Durg, Jashpur, Kawardha, Kanker and Rajnandgaon) have been inventoried. The forest and tree cover of the state is presented in the Table below.

Table 15: Forest and tree cover (area in km²)

Category	Area	% Of Geographical Area
Tree Cover	3,866	2.86
Forest Cover	55,674	41.18
Forest & Tree Cover	59,540	44.04

Growing Stock

The growing stock in the recorded forest area has been estimated on the basis of the current forest cover map, forest type map and forest inventory data. This same has been estimated using TOF inventory data. The same has been presented in the table below.

Table 16: Growing stock

Forest	TOF	Total
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334.381	70.069	404.450
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Bamboo Resources

The extent of bamboo bearing area in the forests of the state is 11,368 km². Density-wise details, number of culms by soundness and equivalent green weight are given in the following tables:

Table 17: Bamboo bearing area by density in recorded forest area

Recorded Forest Area	Pure Bamboo	Dense bamboo	Scattered bamboo	Clumps hacked	Bamboo regeneration	No Bamboo
59,772	54	3,046	4,577	1,496	2,195	48,404

Table 18: Estimated number of culms and equivalent green weight

Number of culms (in millions)				Equivalent green weight (in '000 tons)		
458	123	20	601	1863	904	2767

Wetlands¹⁵

Area estimates of various wetland categories for Chhattisgarh have been carried out using GIS layers of wetland boundary, water-spread, aquatic vegetation, and turbidity. Total 7711 wetlands have been mapped at 1:50,000 scale in the state. In addition, 27823 wetlands (smaller than 2.25 ha) have also been identified and delineated as point feature. Total wetland area estimated is 337966 ha that is around 2.5 percent of the geographic area. The major wetland types are River/Stream accounting for about 53 percent of the wetlands (179088 ha), Reservoirs (90389 ha), and Tanks/Ponds (40226 ha). Graphical distribution of wetland type is shown in Figure 10. The small wetlands (< 2.25 ha) accounts for about 8.2 percent assuming that each is of one ha.

Analysis of wetland status in terms of open water shows that out of the total wetland area the extent of open water is 243814 ha in post-monsoon and 173678 ha in pre-monsoon. There is a significant reduction in the extent of open water from post-monsoon to pre-monsoon. It is reflected in all the wetland types (Table 4). Turbidity is observed to be dominantly moderate in post-monsoon (183025 ha) out of 243814 ha of open water followed by high (31804 ha) and low turbidity (28985 ha). Aquatic vegetation in Chhattisgarh accounts for about 0.6 and 5.8 percent of total wetland area in post-monsoon (2123 ha) and Pre-monsoon (19600 ha) respectively.

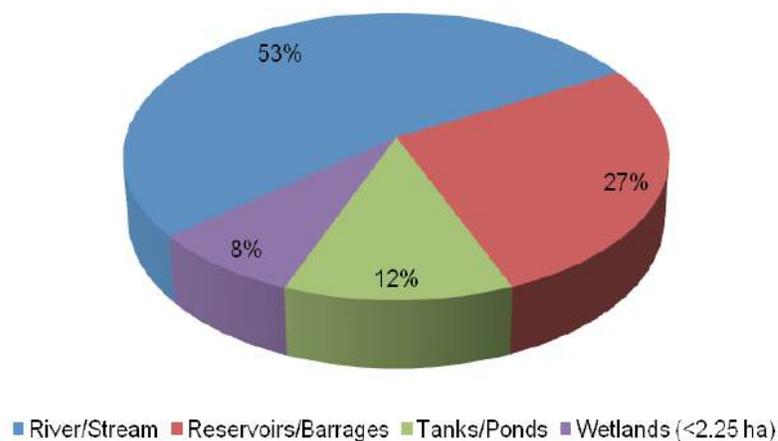
Table 19: Area estimates of wetlands in Chhattisgarh

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% Of wetland area	Open Water	
					Post- monsoon Area	Pre- monsoon Area
Inland Wetlands- Natural						
1	Lakes/Ponds	-	-	-	-	-
2	Ox-bow lakes/ Cut-off meanders	6	26	0.01	26	13
3	High altitude wetlands	-	-	-	-	-
4	Riverine wetlands	8	174	0.05	83	76
5	Waterlogged	-	-	-	-	-
6	River/Stream	156	179088	52.99	124712	93095
Inland Wetlands -Man-made						
7	Reservoirs/Barrages	604	90389	26.74	85148	54012
8	Tanks/Ponds	6906	40226	11.90	33671	26366
9	Waterlogged	31	240	0.07	174	116
10	Salt pans	-	-	-	-	-
	Sub-Total	7711	310143	91.77	243814	173678

¹⁵ Source of all data in this subsection is National Wetland Atlas: Chhattisgarh, Space Applications Centre, Indian Space Research Organisation, Ahmedabad, November 2010.

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% Of wetland area	Open Water	
					Post- monsoon Area	Pre- monsoon Area
	Wetlands (<2.25 ha), mainly Tanks	27823	27823	8.23	-	-
	Total	35534	337966	100.00	243814	173678

Figure 18: Type-wise wetland distribution in Chhattisgarh

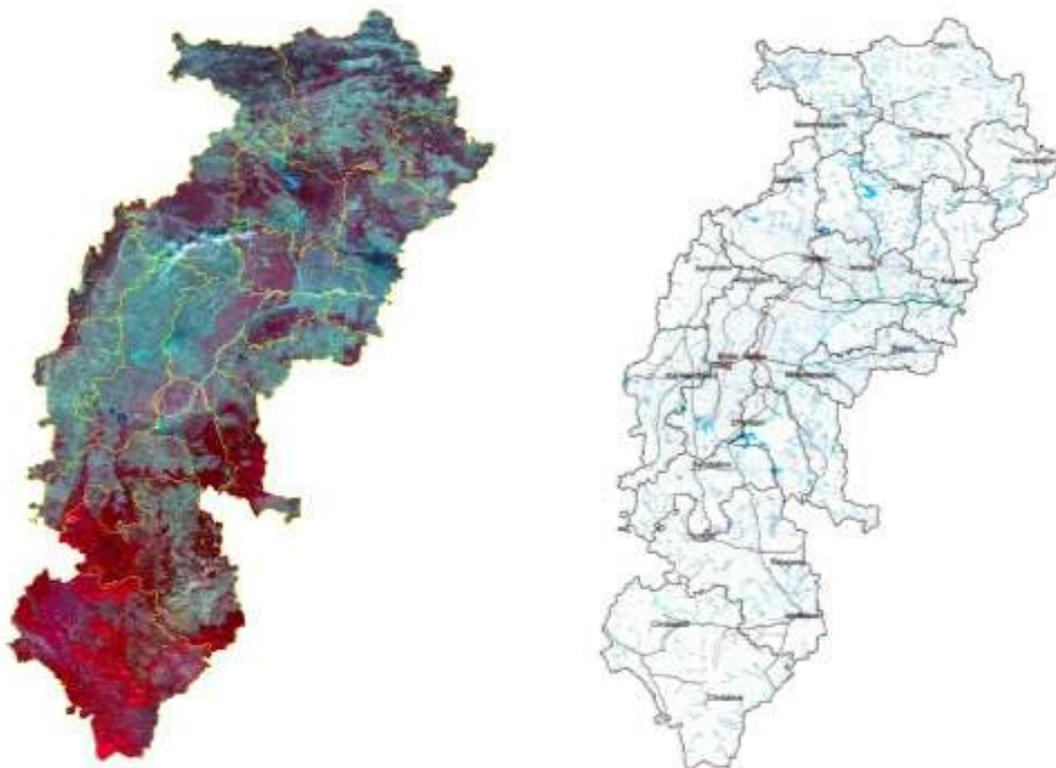


The state has sixteen districts and district-wise distribution of wetlands showed that Janjgir-Champa (6.78 percent) followed by Dhamtari (6.65 percent) and Durg (3.55 percent), Raipur (3.53 percent), and Mahasamund (3.52) have the highest extent of wetlands (Table 5). The least extents (less than 1.5 percent) of wetlands have been observed in Bastar (0.98 percent) Jashpur (1.3 percent) and Dantewada (1.45 percent) districts. The area statistics provided for each district has detailed tabular information on turbidity levels and aquatic vegetation status. Figure II shows graphical distribution of district-wise wetlands.

Table 20: District-wise wetland area

Sr. No.	District	Geographic Area (sq. km)	Wetland Area (ha)	% Of total wetland area	% Of district geographic area
1	Koriya	6604	14515	4.29	2.20
2	Surguja	15733	28794	8.52	1.83
3	Jashpur	5838	7585	2.24	1.30
4	Raigarh	7086	17719	5.24	2.50
5	Korba	9010	28624	8.47	3.18
6	Janjgir/Champa	3672	24886	7.36	6.78
7	Bilaspur	7215	19443	5.75	2.69
8	Kawardha	4223	6899	2.04	1.63
9	Rajnandgaon	6904	18149	5.37	2.63
10	Durg	8537	30291	8.96	3.55
11	Raipur	12507	44211	13.08	3.53
12	Mahasamund	4702	16557	4.90	3.52
13	Dhamtari	4049	26909	7.96	6.65
14	Kanker	6506	13219	3.91	2.03
15	Bastar	14974	14662	4.34	0.98
16	Dantewada	17634	25503	7.55	1.45
	Total	135194	337966	100.00	2.50

Figure 19: Wetlands of Chhattisgarh



5.2 Key Issues

Chhattisgarh's forests and wetlands face a number of key issues that have impacted them over the years and continue to do so – these involve both natural and manmade causes, and have in general resulted in the depletion or at least shrinking quantity/quality of the State's bio-resources.

One of the major causes for the loss of biological diversity in the wild lands has been the depletion of vegetative cover in order to expand agriculture. The collection of fuel wood, uncontrolled grazing for sustenance, food security, as well as income generation, and ever growing population has led to an increased rate of consumption of bio-resources. Most of the biodiversity rich forests of the State also have enormous mineral wealth potential. Exploiting this potential by opening new mines & mineral based industries in the recent past has led to destruction of rich habitats. Diversion of forest lands for non-forestry purpose like minor and major irrigation projects; hydroelectric power projects roads; industrial estates & other development projects. Release of toxic effluent both in water & air due to urbanization and industrialization has seriously affected the regeneration & growth of Biodiversity.

Spread of invasive weeds like Parthenium, Lantana, Eupatorium has posed serious hindrance in germination and growth of indigenous species. Deficiencies in institutional mechanisms for and traditional but destructive collection practices of NTFPs & medicinal plants and removal of roots /base of products such as collection of; tubers, roots of Palas, bark of Arjun, fruits and seeds of Char have also contributed to forest degradation. Loss of Soil cover due to degradation of forest cover in 40 percent of the State's managed forests and inadequate emphasis on watershed management, problems with natural regeneration of Sal forests, repeated man made fires, epidemics affecting forest strands and fauna are also key factors.

The lack of a comprehensive land use policy coupled with inadequate investments in the forestry sector have resulted in the loss of productivity, lowering of water table & change in drainage pattern in the forest areas. Districts such as Bastar, Dantewada, Kanker, Korba, Kawardha, Bilaspur, Jashpur, Raigarh, Surguja, and Manendragarh, while being rich repositories of biodiversity, are also rich in minerals. With the increasing demands on the mining sector, mining activities could pose a serious threat to biodiversity. Likewise, Manendragarh, Surguja, Jashpur, Korba, Bilaspur, and Raigarh districts of the State have witnessed installation of thermal power plants, and many more such plants are in the pipeline. The thermal emissions and fly ash would pose a serious threat to biodiversity. Similarly, the State's wetlands are equally

under stress from a range of factors are degrading rapidly or are diminishing altogether. Also, overemphasis on introducing high yielding varieties and improved farming practices poses a deep threat to the indigenous domestic biodiversity. Increased use of fertilizers and pesticides leading to decline in agro-biodiversity as well as adjoining wild biodiversity. Development of uniform cultivars, grown in uniform environments and the spread of these cultivars is leading to an erosion of primitive crop genetic variety and loss of agro-biodiversity.

5.3 Existing/On-going Initiatives

A range of initiatives is being undertaken by the State Forest Department. These include the preparation of working plans, and full digitisation and GIS mapping of all forest areas/divisions in the State, which is a major achievement. Some of the many on-going programmes and works of the Forest Department include, for example

Work under the Green India Mission: - multiple objectives including improved quality of forest cover, increased forest/ tree cover, improved ecosystem services, increased forest based livelihood income, and enhanced annual carbon sequestration, with bottom-up participatory approach with Gram Sabha/Joint Forest Management Committees (JFMCs) at the helm of planning, decision making and implementation, involvement of local educated youth. State has adopted a landscape based approach - 11 landscapes identified in Chhattisgarh in three agro-climatic zones; preparatory activities including awareness, outreach and communications, micro-plans, landscape survey, detailed mapping, nursery development, etc. are underway.

Sustainable livelihoods through JFM and NTFPs: Active and on-going programme, with 7887 Forest Management Committees covering over 33,190 Sq. Km and over 27.63 lakh members from forest/forest fringe dwelling communities; network of peoples' protected areas established for sustainable livelihoods including health cover. These initiatives have yielded excellent dividends including, for example:

- Decentralized decision-making process has set in due to establishment of three tier co-operative structure;
- Visible attitudinal change towards collaboration with people amongst all layers of forest administration;
- Exemplary institutional development - JFM societies, Primary coops, women self-help groups;
- Wide coverage of cooperatives; spread over 2 million NTFP gatherers;
- An effective legal framework for Nationalized NTFP trade;
- Appointment of the Minor Forest Produce Federation as a sole agent for trading and Development of nationalized NTFP; profit sharing mechanism well placed and being implemented in time. For example, State has taken a decision to distribute 100 percent profit from tendu leaves trade (amounting to nearly 150 crores annually) done by the MFP Federation as follows - 80 percent to collectors; 5 percent for temporary reimbursement of Losses of societies; and 5 percent for infrastructure development; and
- A huge network godowns for NTFP storage to the tune of 2.80 lakh metric tons storage capacity spread all Over the interior parts of the state

State Biodiversity Strategy & Action Plan: Developed under the National Biodiversity Strategy and Action Plan with holistic objectives and strategy including:

- To ensure food security by enhancing the productivity of the small and marginal agricultural lands by conserving the local agro-germplasm and propagating it by local innovative and available Biotechnology knowledge (With special emphasis on paddy);
- In-situ and Ex-situ conservation of Herbal Plants having medicinal value as one of the means to ensure livelihood security of the tribals of the State;
- Sustainable Utilisation & Conservation of the vast NTFP's potential, through participatory mechanisms;
- Improving the productivity of the State's 40 percent degraded forests through peoples' participation and harvesting its true potential in sustainable way for the development of tribals;
- Conservation and sustainable development of existing ground water resources in the State;
- To maintain an equilibrium between bio-diversity conservation & development of mining & mining based industries; through introduction of eco- friendly and green technologies; both for exploitation as well as reclamation;
- To promote a scientifically based approach to the planning, management, and development of Eco-tourism products and activities in the region;
- To check annual temporary migration of local populace, and to assure their dynamic contribution in the socio-economic development of the State; and
- To create a mechanism to conserve traditional and religious beliefs of tribals concordant to Biodiversity conservation and to float package of justified sustainable use of customary practices for their livelihood security.

Lac Development Programme: - to develop cultivation, processing and marketing of lac;

Construction of culverts on forest paths: - Construction of culverts on 30000 km of paths/trails running through forests to facilitate the movement of forest dwellers and transportation of forest produce;

Supply/distribution of seedlings: - In order to create an interest among people and encourage greening of/ afforestation in non-forest areas, saplings are supplied at concessional rates through this programme, which is operational in all the districts of the state;

HariyaliPrasar Yojana: - to encourage agro-forestry/ farm forestry the scheme targets scheduled castes and tribes and small farmers of other communities to raise plantations on their uncultivated lands of their preferred species;

River bank plantation programme: - riverbank plantations have been taken up to control soil erosion and associated problems;

Regeneration of degraded bamboo forests: - Clearing dead, damaged, and entangled bamboo shoots, doing the necessary ground clearance and soil culture and mounding the rhizomes. These operations help in the regeneration of the clumps and growth of strong shoots and increase the productivity of the bamboo forests.

Ground Water Conservation: - The programme has as its objective the increase in ground water levels, plantations on barren lands - for soil conservation and flood control; and

Plantation along highways, district, and rural roads: - to increase green cover.

Various other initiatives are also under way. Initiatives by other agencies but linked/complementary to the work of the Forest Department in the forestry sector include extensive plantations (for industrial use, etc.) and regeneration of degraded bamboo forests by the Chhattisgarh State Forest Development Corporation (CSFDC), activities taken up for medicinal plants cultivation by the National Medicinal Plants Board (NMPB), as well as the Chhattisgarh State Medicinal Plants Board (CSMPB) including the protection, promotion, sustainable extraction, processing, marketing of medicinal plants and co-ordination involved among the various departments/institutions, etc. The State has been also taking private sector participation (PSP) in the forestry sector to the forefront – during the recently concluded Chhattisgarh Global Investor's Meet 2012 (2nd and 3rd November 2012, at Naya Raipur), 18 MoUs were signed between investors and the Chhattisgarh Minor Forest Produce Federation (CGMFPF) covering a total value of 894.50 crores, with the potential to generate significant employment/livelihoods for forest dependant/fringe communities. The MoUs covered diverse projects such as bamboo flooring and fibre units, biogas, bio-briquettes, herbal extracts and processing, tamarind processing, dry flower products, etc.

5.4 Priorities

Protecting Forests and Restoring Forest Quality

Forests are an important natural resource for Chhattisgarh not only for its environmental importance but also because a significant population lives in close harmony with it. The preservation of this delicate forest-tribal interface is crucial for reasons far beyond ecological, social, cultural, and economic. Mainly tropical deciduous forests, 29 percent of the State's forest cover of 59,772 square kilometres (sq. km) is dense and very dense, while 12.5 percent is open forest and scrubs. While the overall forest cover has remained more or less stable in last one decade, its quality hasn't. Recent satellite images have shown a reduction in the dense and very dense forests by about 192 sq km and a proportionate increase in open and non-forests between 2004-09. Around 90 percent of the State forests fall outside the protected area network of its 3 national parks and 11 wildlife sanctuaries. As admitted by 12th Plan Approach Paper, states need additional resources to maintain and conserve these forests for their ecological importance and for sustaining their productivity. The State would take steps to improve forest governance and bring the remaining 42 percent of its forests under the management of JFMCs.

Apart from weak monitoring, mining in forest areas has also contributed to loss of forest cover and gradual degradation of surrounding flora and fauna. Nearly 28 percent of forests, spread over 16,700 sq km, are degraded, and require urgent revitalization. Emphasis will be on arresting further degradation and raising quality plantations on them through community participation. New plantations will be taken up considering the nistar (usufruct) needs of neighbouring populations to compensate for the loss due to land diversion and mining. Incentives will be created for agro-forestry, and funds from Carbon Trade employed for better maintenance of the forests.

Bio-Diversity Conservation

Bio-diversity is important for ecological security and the State is home to several endangered and vulnerable species. Capacities of PRIs, JFMCs and Biodiversity Management Committees (BMCs) will be improved on natural resource management, bio-diversity conservation and protection of the critical tiger-elephant corridors of the state. As such, effective implementation of the State Biodiversity Strategy and Action Plan will be a high priority agenda.

5.5 Perceived Climate Impacts

Currently, no comprehensive analyses of possible impacts of climate change to Forests and the forestry and related sectors in Chhattisgarh are available, nor are systematically documented anecdotal references to impacts from farmers. At the same time, it is evident that a changing climate can pose serious threats to the existing forests in Chhattisgarh. Any short-term or long-term fluctuations of climate can have dramatic effects on the forest productivity and impact forest dependent communities and their livelihoods. Increased climatic variability and prolonged droughts and higher temperatures can result in increased fire incidence and lead to forest degradation.

Other impacts could potentially include advancing/late unfolding, blossoming, and ripening in the leaves and fruit of wild plants; and of patterns of hibernation, migration, and breeding of wildlife in mountain regions and changes in synchronous relationships between predators and prey, as well as those between insects and plants, proliferation of existing weeds and evolution of new phenotypes, even the formation of novel species' associations and other ecological surprises.

5.6 Strategies

The overarching approach to the forests and biodiversity sector under the CSAPCC will be to foster an integrated approach that treats forests and non-forest public lands as well as private lands simultaneously, while identifying and leveraging opportunities for mitigation and adaptation measures that enhance ecosystem goods and services, particularly carbon stocks, water, and meet biodiversity conservation and livelihood security needs at the unit/landscape or sub-landscape/watershed or sub-watershed levels.

The CSAPCC will focus on restoration of native bio-diverse species mix while at the same time enhancing carbon sink in forests and other ecosystems, while being informed by sensitivity to the ecological nature and value of resources, for instance avoiding dense plantations in grasslands which have other values like fodder, watershed etc. Habitats of animals and plants will be preserved, especially the mosaic of different vegetation types that maximize niches for diverse life forms.

While undertaking greening, its scope of greening will not be limited to just trees and plantations; rather, emphasis will be placed on restoration of ecosystems and habitat diversity e.g. grassland and pastures, wetlands and other critical ecosystems. It will not only strive to restore degraded forests, but would also contribute in protection/enhancement of forests with relatively dense forest cover. Drivers of degradation, such as firewood needs and livestock grazing will be addressed using inter sectoral convergence (e.g. livestock, forest, agriculture, rural development, energy etc.).

The CSAPCC will ensure a key role for local communities in project governance and implementation. Gram Sabha and its various committees/groups including JFMCs, etc. will be strengthened as institutions of decentralized forest governance, and capacity building for adaptive forest management and livelihood support activities e.g. community based NTFP enterprises will be accorded high priority.

These will indicatively include (but not be restricted to):

Short-term (5 Years)

In the short term, focus will be on:

- Research studies to categorise vulnerability and potential as criteria for intervention, and intervention priorities and selection of project areas/sub-landscapes/sub-watersheds will be formed formulated based on the analyses from these studies;
- Climate change related sensitization, awareness generation and capacity building of Forest Department Staff and allied forestry institutions including CSFDC, CSMPB, JFMCs, etc. and others for adaptive forest management and livelihood support activities e.g. community based NTFP enterprises;
- Development and/or fine-tuning/strengthening of institutional arrangements and mechanisms for decentralized forest governance and maximizing resilience of forest dependent/fringe communities through micro-planning and landscape approach/management;
- Implementation of the State Biodiversity Strategy and Action Plan including documentation and dissemination of the State's biodiversity resources;
- Intensification of protection of the State's protected area network and improvement of facilities and management infrastructure. Key interventions in the protected areas will indicatively include (but not be limited to):
 - Improved protection through capacity building of relevant personnel, increased strength of frontline staff and improved/enhanced infrastructure including those for enhanced mobility, rapid response, and anti-poaching units;
 - Fencing of strategic areas to protect wildlife and control encroachments;
 - Appropriate zonation into multiple use categories including core, buffer, tourism zones, etc.;

- Development/improvement/augmentation of visitor facilities and nature/wildlife interpretation and promotion of protected areas as a favoured wildlife and eco-tourism destination;
- Control of invasive species including weeds;
- Treatment of catchment areas where required; and
- Exploring opportunities for transboundary conservation and cooperation with other neighbouring states where applicable.
- Development and initiation of a strategy to protect and preserve the State's wetlands based on prioritization of wetlands of high ecosystem value or those under high risk. Interventions in these would include (but not be limited to):
 - Protection measures on a priority basis including fencing, training/capacity building of relevant personnel, increased strength of frontline staff and improved/enhanced infrastructure;
 - Treatment of catchment areas, support to compatible land use practices, water quality monitoring, and other measures infrastructure and equipment needed to ensure sustained water balance, optimal wetland hydrology, and all-season water availability;
 - Extensive community education/awareness building on the importance of these wetland areas and the need to protect/conservate them and formation of community conserved zones around these wetlands for enhanced protection; and
 - Capacity building for, promotion of, and supporting infrastructure provision/ enhancements for enterprise linked community conservation efforts such as eco-tourism, birding, and bird photography, especially during migratory bird seasons.
- Reducing Emissions from Deforestation and Forest Degradation (REDD) is the global endeavour to create an incentive for developing countries to protect, better manage, and save their forest resources, thus contributing to the global fight against climate change. REDD+ goes beyond merely checking deforestation and forest degradation, and includes incentives for positive elements of conservation, sustainable management of forests and enhancement of forest carbon stocks. REDD+ conceptualizes flow of positive incentives for demonstrated reduction in deforestation or for enhancing quality and expanse of forest cover. It works on the basis of creating a financial value for the carbon stored and enhanced in biomass and soil of standing forests. Countries that reduce emissions and undertake sustainable management of forests will be entitled to receive funds and resources as incentives. REDD+ approach incorporates important benefits of livelihoods improvement, biodiversity conservation, and food security services.

India and its States potentially stand to gain a lot from a global REDD+ mechanism¹⁶. It has specifically opened the possibilities for the country to expect compensation for its pro-conservation approach and sustainable management of forests resulting in even further increase of forest cover and thereby its forest carbon stocks. Sustained efforts for conserving and expanding our forest and tree resources have the possibility of being rewarded for providing carbon service to the international community in addition to providing traditional goods and services to the local communities. The incentives so received from REDD+ would be passed to the local communities involved in protection and management of the forests. This will ensure sustained protection of our forests against deforestation. It is estimated that a REDD+ programme for India could provide capture of more than 1 billion tons of additional CO₂ over the next 3 decades and provide more than US\$ 3 billion as carbon service incentives under REDD+.As such, the Forest Department will proactively carry out a scoping study to examine the possibility of leveraging REDD+opportunities, as also CDM, etc., and
- Developing/refining the State's policies and initiatives for eco-tourism (especially in protected and other wilderness areas) and bio-cultural tourism through a critical re-examination/appraisal of existing plans, programmes, and activities.

Long-term (Beyond the 12th Plan Period)

Key Interventions in different forest classes will include the following.

Interventions in very dense forests: These have remarkable capacity to sequester and store carbon. As such, interventions will focus on enhancing storage and reducing emissions by ensuring full stocking, maintaining health, reducing losses due to tree mortality, natural

¹⁶The 18th Conference of the Parties of the UN Framework Convention on Climate Change took place in Doha in December 2012, with the aim of laying the roadmap for a global binding agreement on emissions reduction, due to be finalised in 2015. Negotiations on forests and climate change mitigation, dealt with under REDD+, took place in two tracks: The Ad Hoc Working Group on Long Term Cooperative Action (AWG-LCA), that mostly deals with the issues of REDD+ and results-based financing, and the Subsidiary Body on Scientific and Technological Advice (SBSTA) that deals with methodological aspects related to REDD+, most notably; providing guidance on key matters such as Safeguard Information Systems, Reference Emission Levels, Forest Monitoring Systems, and drivers of deforestation. Negotiations in Doha were expected to tackle the following topics: Rights-based safeguards in information systems, The valorisation of traditional knowledge, Support for indigenous monitoring systems for REDD+, Key threats to indigenous peoples' rights with reference to drivers of deforestation, the need to take into account non-carbon values of forests in REDD+ financing. However, no decisions on these topics were made during the talks. In fact, REDD+ negotiations met unexpected stumbling blocks in most areas, especially on issues related to verification and financing.

calamities, wildfires, insects and diseases, and stand density management by prudent tree removal. It is envisaged that this will provide a renewable source of products including timber, engineered composites, paper, and energy even as the stand continues to sequester carbon. These forests will continue to be protected rigorously against all threats.

Moderately dense forests: Moderately dense forests typically face a number of threats including recurring forest fire, invasive species, unregulated heavy grazing, local fuel wood cutting and head loading, etc. It is proposed to improve the condition of these forest areas through:

- Better protection by increased strength of frontline staff and improved/enhanced infrastructure;
- Improved/enhanced fire management through prevention, detection and control measures as well as improvement of infrastructure;
- Regulated grazing;
- Eradication of invasive species;
- Soil and moisture conservation through watershed management; and
- Gap plantation adopting indigenous species.

It is envisaged that sustainable management of these forests would lead to increase in stocking density, enhanced biomass and carbon sinks.

Open forests: These typically have immense potential for meeting the fodder, fuel wood, water, small timber, and many other minor forest produce but are degrading due to immense biotic pressure. The Forest Department proposes to improve these forests through:

- Large-scale gap plantation of indigenous species;
- Regeneration of rootstock;
- Soil, and moisture conservation, run off reduction, and integrated watershed management;
- Consultation with communities and plantation of multi-purpose and fast growing small timber yielding and other tree species to fulfil the requirement of local people such as fuel wood, fodder, NTFPs, agricultural implements, etc.;
- Constitution/re-vitalisation of forest protection committees/JFMCs and capacity building of these to develop community conserved areas and similar local protection regimes;
- Development and deployment of other innovative incentive based conservation measures involving local communities.

Scrub Forests: Typically these forests are highly degraded due to heavy grazing and biotic pressure. The Forest Department aims to improve the condition and productivity of these forests through:

- Planting small timber producing plants/trees;
- Fodder, fuel wood producing plants;
- Developing grass land and pasture land for local people within the carrying capacity of the scrub forest areas;
- Constitution/re-vitalisation of forest protection committees/JFMCs and capacity building of these to develop community conserved areas and similar local protection regimes to encourage re-generation of trees;
- Provision/promotion of efficient cook-stoves among local village households; and
- Development and deployment of other innovative incentive based conservation measures involving local communities.

Wetlands: Since Chhattisgarh is rich in wetlands and aquatic resources many of these areas are rich ecosystems with exceptionally high biodiversity, the Forest Department aims to intensify efforts to protect, maintain, and improve these wetland areas not covered under the short-term measures indicated above, as well as strengthening the measures in the key wetland areas. Community based conservation and management approaches will be adopted.

Wastelands: Available waste/fallow lands that can be treated and brought under plantation will be examined, and where possible, taken up for interventions.

Urban and peri-Urban areas (including institutional lands): Urban forests are an exciting opportunity to (a) mitigate climate change; (b) ameliorate air and dust pollution; (c) help in improving overall water regime; and (d) nurture bio-diversity in urban environments. As such, the Forest Department will leverage all opportunities for urban greening by various interventions categorizing urban forest in following broad categories:

- Recorded or notified forest patches: In urban areas where large or medium forest patches are available, it will be notified as protected forest and fenced;

- Open spaces/green spaces like parks/wood lots: Open Spaces/Green spaces such as parks/wood lots should be raised on municipal lands to enhance the vegetative cover;
- Avenue plantations: In urban areas road side avenue plantations will be raised at least in two rows on both sides of the road where land is available; and
- Plantation on institutional lands: In urban areas, many government institutions have large open campuses. Sufficient land is available in these -- where suitable species of trees/plants can be raised.

Agro-forestry and Social Forestry: Social forestry and agroforestry have immense potential in Chhattisgarh, which is pre-eminently an agricultural State. As such, the Forest Department, in coordination with the Agriculture Department and other appropriate agencies will plan and undertake agroforestry initiatives including development of large-scale nurseries of high quality tree/plant material; distribution of plants free of cost to farmers, making available extension and support services through research and other initiatives such as training for post plantation care, visits by forest department staff, agroforestry specialists/scientists from institutions such as the National Research Centre for Agroforestry (NRCAF) and other centres/universities; support for planting trees on non-agricultural rural lands such as homesteads, school yards, compounds of various offices, public spaces, roadsides, canal sides, private/public bunds etc.

Plantations along canals and river embankments: The State will examine the possibility of raising plantations on these embankments by using suitable species including bamboo, which is a strong soil binder. In addition to these river embankments, canal embankments can also be potentially brought under plantation.

A range of other interventions will also be undertaken. These will include

1. Extensive measures to be taken by using both traditional as well as modern inputs to contain forest fires -- with increase in temperature; forests are likely to be more prone to fires. Hence, wildfire management will be taken up at a priority basis to combat increased frequency and intensity of wildfires in future;
2. Activating the State Biodiversity Board and transforming it into a fully functional institution undertaking the full range of activities to survey, identify, catalogue, document, protect, and improve/enhance the status of biodiversity in the State including producing, in a time-bound manner, flagship publications on Chhattisgarh's biodiversity;
3. Developing and implementing a proactive and on-going programme of research and documenting studies relating to forestry and wildlife in the state including for example (but not limited to):
 - Studies on indigenous trees species to assess their vulnerability to climate change;
 - Assessing and documenting additional threats to biodiversity and wildlife.
 - Population dynamics and movement of wildlife;
 - Obtaining access to updated knowledge on climate change science and policy developments; and
 - Monitoring carbon stock and biodiversity at regular intervals etc.

Additionally, the Forest Department recognises that the private sector can play a role in many forestry related activity such as for example, incentivizing collection and value addition of NTFPs, growing of medicinal plants by people, promoting agro-forestry, and thus enhancing livelihood opportunities. As such, the Forest Department will actively examine the creation of enabling mechanisms for increased roles for the private sector in selected operations/activities.

5.7 Institutional Linkages and Stakeholders

A range of institutional linkages, convergence potential, and partnerships is envisaged with, indicatively, the State Agriculture Department, State Energy Department; Chhattisgarh Renewable Energy Development Agency (CREDA); Integrated Watershed Management Programme; State Water Resources Department, and other agencies as necessary for enhancing green cover or achieving the imperatives under the CSAPCC. Additional linkages will be built with National forestry research institutes/centres and universities; various international development agencies, private sector and financial institutions, civil society, community based organisations, and forestry and allied sector dependent communities in general.

5.8 Linkages with the NAPCC

The initiatives outlined above are consistent with the NAPCC and National Mission for A Green India. Additionally, the strategies and imperatives under the forestry and biodiversity section of the CSAPCC also have linkages with the National Mission on Sustainable Agriculture, National Water Mission, National Mission for Enhanced Energy Efficiency, National Solar Mission, and the National Mission on Strategic Knowledge on Climate, and the National Mission on Sustainable Habitat.

5.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

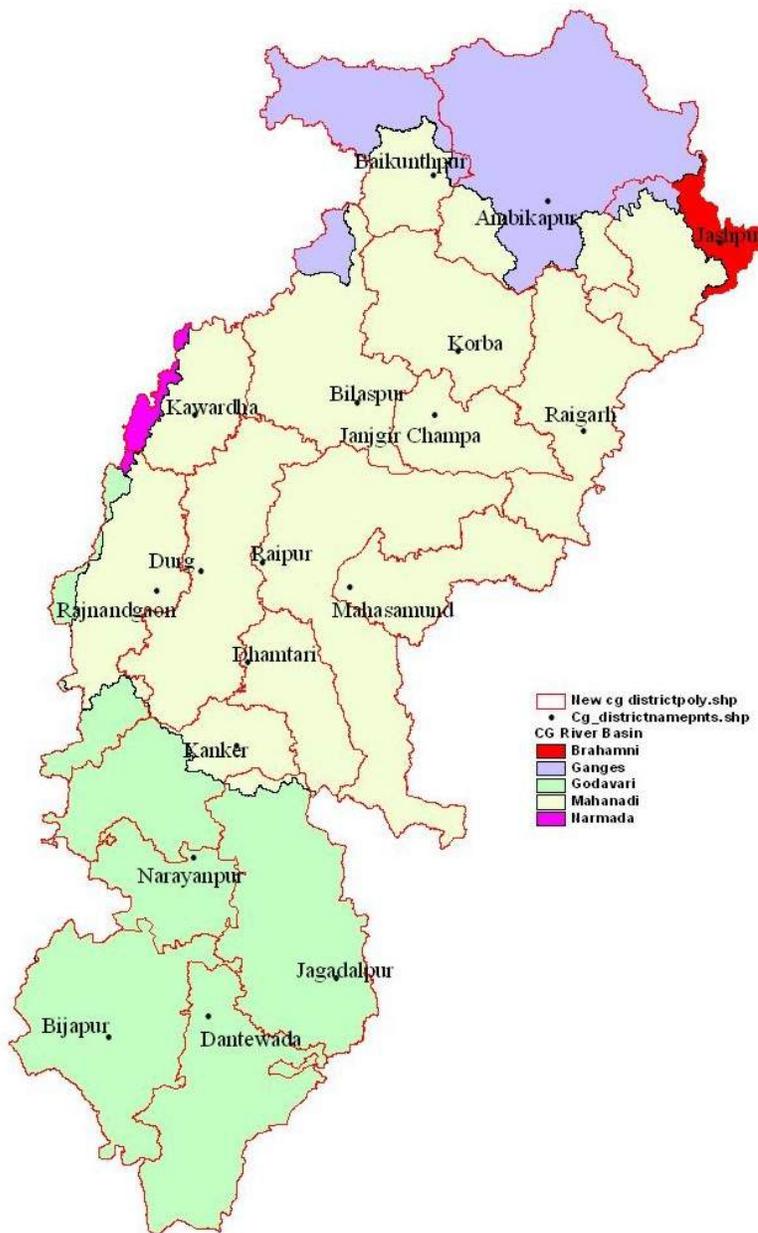
6 Water Resources

6.1 Overview, Characteristics and Status

River Basins and Rivers

The State of Chhattisgarh is divided into five river basins -- The Mahanadi Basin drains out 77,302 Sq km, Godavari Basin drains out 38,361 Sq km, Ganga Basin drains out 18,865 Sq km, Brahmani Basin drains out 1,316 Sq km and Narmada Basin drains out 2113 Sq km of catchment area in the state. A map depicting the river basins is given below.

Figure 20: River basins covering Chhattisgarh¹⁷



¹⁷ Source: Hydrology Project Chhattisgarh, Water Resources Department

Three of these are further divided into sub-basins as given below:

1. Mahanadi Basin -- Seonathsub basin, Hasdeosub basin, Mandsub basin, lbsub basin, Pairi sub basin, Jonk sub basin, Kelosub basin, and Tel sub basin;
2. Godavari Basin -- Indravati sub basin, Sabarisub basin, Pranhita sub basin, Lower Godavari sub basin, and Wainganga sub basin;
3. Ganga Basin -- Son sub basin, Banas sub basin, Gopad sub basin, Rihand sub basin, and Kanhar sub basin.

River Mahanadi, draining the vast central region of Chhattisgarh state, forms the most important and biggest water body of the state. This river system collects almost all the rainwater of the basin and carries it to the Bay of Bengal. The volume of water varies considerably between the rainy and the dry season. The Mahanadi, after collecting a number of streams in the Kanker tehsil, flows towards the north traversing Raipur district in a northeast direction for about 204 Kms, until it is met from the west by its biggest tributary, the Seonath. The portion of Mahanadi Basin located in Chhattisgarh is divided further into a few more basins. The Chhattisgarh Basin lies in the central districts, in the north are the Raigarh basin, Hasdo- Rampur basin, and the Korba, and in the south is the Kanker basin. The Chhattisgarh Basin formed by the Mahanadi and its main tributary Seonath, drains the central districts of Rajnandgaon, Durg, Raipur, and southern Bilaspur, and is the most extensive and agriculturally rich region in the state. It is referred to as the 'rice bowl' of the country and supports a large chunk of the population of the state. Paradoxically, this is also the area of greatest drought related distress.

Most of the tributaries of Mahanadi join in from the western and northern side. The major ones among these are Maini, Kelo, Mand, Baroi and Hasdo, a powerful river and the second most important tributary of Mahanadi after Seonath. The plains to the northwest of Seonath are entirely dissected by a large number of streams emptying into the main river. With all its tributaries, the Seonath also is an important river system that drains large parts of Rajnandgaon, Kawardha, and Durg. Its main tributaries are Arpa, Kurung reservoir and river, Miniari reservoir and river, Sakri-Hanp, Kartha and Surhi, two important tributaries that heavily drain Kawardha, Rajnandgaon and Durg, and Kharkhara and Tandula tributaries in Durg district. Tandula is not only an important tributary, but also forms a big reservoir in the district, from which a canal carries water towards the northeast of Durg. Kharum and Jamunia are two other important tributaries near Raipur. Though the contribution of the tributaries from the eastern side of the Mahanadi is lesser, both in number and in volume, three important rivers deserve a mention here. A small river, Silari, is important as it links a big reservoir, Maramsilli, in the southwest of Raipur district to Mahanadi. River Pairi, running down from Raipur uplands, drains a significant portion of the entire undivided Raipur district. Jonk and Lath are the other two rivers.

The Rihand is another major river-body in the state, rising in the south of Surguja and flowing northwards, draining the Surguja Basin. In fact it is a tributary of Son, which in turn merges with the Ganga. Before meeting Son, it is joined by three main tributaries during its course northwards in Surguja district. These are Gungata, Mahan, and Moran. In the eastern part of Surguja is the KanharRiver, which flows for only for a few kilometres in this district, before joining the Son River in the state of Uttar Pradesh.

The third river system draining the state is that of the Indravati. The river and its tributaries are located in the Bastar area. Like the Rihand, Indravati too is a tributary of Godavari. Originating from Orissa it divides the area into two halves. Its major tributaries are Narangi, Baordhig, Nibra, Kotri, and a stream, the Chintavagu. Besides the Indravati and its tributaries, there are three important streams in the Bastar area, all direct tributaries of Godavari. These are Talperu, Chinta, and Sabari. In the Dandakaranya region lying to the south of Indravati most of the rivers are perennial, though with highly fluctuating regime. Due to rapid run-off and evaporation, the land dries up very quickly after the monsoons. A very negligible amount of their water is used for agriculture.

Thus, we find that there are many basins and sub-basins in the region, especially in the southern and eastern parts of the state. The rivers draining these basins usually carry huge volumes in the rains, but are usually flowing in deep gorges in hilly areas. These offer a rich potential for rainwater harvesting and surface irrigation projects that protect kharif. The Mahanadi Basin extends over an area of 1,43, 441 Sq Km and major part of the Mahanadi Basin falls in Chhattisgarh. Out of the total basin area of 312,813 Sq km, the major part of the Godavari Basin falls in Maharashtra, and only about 38,361 Sq Km (12.26 percent of the basin area) falls in Chhattisgarh. Likewise, the Brahmani Basin lies in the districts of Raigarh and Sarguja in Chhattisgarh, Ranchi and Singhbhum in Jharkhand and Sundergarh, Deogarh, Sambalpur, Angul, Dhenkanal, Keonjhar, Jajpur and Kendrapara in Orissa. The basin is situated between Mahanadi Basin (on the right) and Baitarani Basin (on the left). Chhotanagpur Plateau in the East and South bound the basin, in the north a ridge separates it from Mahanadi basin, and to the east of the basin lie the Bay of Bengal and the Baitarani basin. Out of the total basin area of 39,269 Sq km, the major parts of the basin falls in Orissa state and only about 1316 Sq km which is 3.43 percent of the basin area falls in the Chhattisgarh state. The Narmada River, rises in the Amarkantak Plateau of Maikal range in the Shahdol district of Madhya Pradesh at an elevation of 1057 meters above mean sea level at a latitude 22° 40' north and a longitude of 81° 45' east. The river travels a distance of 1,312 km before it falls into Gulf of Cambay (Khambhat) in the Arabian Sea near Bharuch in Gujarat. The Narmada basin extends over an area of 98,796 Sq km and out of the total basin area, only about 2113 Sq km, which is 2.14 percent, falls in the Chhattisgarh state.

Estimated surface water flowing through rivers is 48,296 Million Cum. and due to various geographical and interstate constraints the usable surface water in the state is 41,720 Million Cum. Surface water being used at present is only about 18,249 Million Cum.

Hydrogeology and Groundwater

Chhattisgarh is endowed with high rainfall. Areas of chronic shortfall are few and localized. The rainfall is typically late in coming, very heavy when it comes, concentrated in a few days and bouts, and early in termination. This rainfall pattern combines with high gradients, hard rock sub-surface characteristic, and low percolation to result in massive and rapid run-off of rainwater. The main water bearing formations are the sandstones of the Gondwana formation. The alluvium formations of the river basins of Mahanadi, Shivnath, Arpa, Indravati etc. are also potential. The cavities and weathered portions of limestone and dolomitic formation are also very good for ground water storage in the Chhattisgarh region.

The ground water potential of the State as per latest assessment is 13.68 billion cubic metres (BCM), out of which 60 percent i.e. 10.67 BCM is safe and usable. The ground water development in our State is restricted to the shallow aquifer zone, within 50 m depth and mostly through both in public and private sector. The shallow ground water structures include dug wells and bore wells in hard rock areas and dug wells, shallow tube wells and filter point tube wells in alluvial terrain. The medium tube wells are also constructed in alluvial areas down to an average depth 40-50m. The present level of ground water exploration in the state is 20 percent and there is a further scope for future expansion.

The Govt. Ministry of Finance plan finance – I Division, New Delhi, vide letter No. 41 (3) PF-1/2011-799 dated 20.11.2011 has released ` 34.68 crores as a 1st instalment during the year 2011-12 for repair, renovation and restoration of water bodies with domestic support sanctioned for ` 122.91 crores of 123 nos. of minor schemes of this department and a total amount of ` 19.81 crores has been utilised up to 9/2012 under RRR.

Table 21: Categorisation of blocks by groundwater characteristics¹⁸

Total No of blocks	Safe		Semi-Critical		Critical		Over-exploited		Others	
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
146	138	94	8	6	0	0	0	0	0	0

Name of Semi critical Blocks- Gurur, Balod, SajaDhamdha, Patan, Durg, Dhamtari, and Bilha

Irrigation

At the time of formation of the State sources the irrigation potential of 13.28 lakh hectares, which was 23 percent of the total sown area. Estimates show that 43 lakh hectares can be brought under irrigation, 33.8 lakh by surface sources, and 9.2 lakhs from ground water sources. After the formation of the state, priority was given by the government to raise the average to 48.9 percent. In the year 2008-09 the development of water resources and enhancement of irrigation potential was accorded highest priority. In 2011-12 the irrigation potential was increased to cover an additional 0.35 lakh hectares. Till March 2012 a further 5.16 lakh hectares were added taking the total irrigated potential to 18.44 lakh which comprises 33.15 percent of the total sown area. As of March 2012, the construction of 8 major, 33 medium and 2347 minor projects had been completed in the state and 3 major, 6 medium and 412 minor irrigation projects were under construction. Likewise, up to the year 2011-12, through 26 departmental/governmental tube well projects, comprising of 1134 tube wells, an irrigation potential of 25500 ha were created, and through private tube wells under beneficiary oriented schemes, 598 successful wells helped create an irrigation potential of 2990 ha for the year 2011-12.

6.2 Key Issues

As is the case with many other states, Chhattisgarh too faces a range of issues related to its water resources and their management. Rapid growth of population and industries, over-abstraction of water resources, unplanned urban development, and pollution are some of such issues. There are number of challenges related to the development of new infrastructure, maintenance and operation of existing infrastructure and increasing threats to the resource base from pollution, and unplanned development that exacerbate existing climatic risks such as droughts and floods. Water logging, salinization, and increased levels of toxic elements in the water are serious concerns. It has also been noted that significant water resources, especially groundwater is being drawn by industries, and that groundwater tables in the state have been declining. As such, it

6.3 Existing/On-going Initiatives

A comprehensive master plan for the state, for optimum use of water resources is under preparation. The state is moving ahead towards a more integrated and sustainable approach to water resources management. The State has also developed a new Draft State Water Resources Development Policy in 2012 with the main objectives as follows:

¹⁸ Source: Water Resources Department, Government of Chhattisgarh

- 1 Development of water resources is to be done in such a planned way, which is sustainable to the environment;
- 2 Technically feasible every possible effort for the development of water resources in the drought affected and rain shadow areas;
- 3 To make available water for drinking, agriculture and industries at feasible rates so that at least maintenance expenditures can be met;
- 4 In view of necessity of huge investment in water resources development, private sector investment is to be encouraged;
- 5 Participation of leaders of water users in water resources development and maintenance be ensured;
- 6 To ensure water security to the entire population by ensuring appropriate institutional and legal frame work in the water sector for supply of water to the various uses/users;
- 7 To Improve Water Management efficiency by:
 - Integrated and co-ordinated efforts by all concerned institutions/organisations in developing a policy framework for planning water resources augmenting them and putting them to productive use;
 - Effective participation of users in development and management of the states water resources;
 - Increasing the productivity of water by fixing the standards of infrastructure services and utilisation efficiency; and
 - Reducing the climatic risks and improvement of rain fed agriculture productivity;
- 8 To improve availability and efficiency of Irrigation water by:
 - Realising optimum irrigation potential under Major, Medium and Minor Irrigation Projects; and
 - Improving the performance of Irrigation projects by narrowing the gap between potential created and utilisation;
- 9 To maintain and sustain ecological balance by:
 - Conserving and protecting the water bodies and wetlands through regulation and enforcement of standards for water infrastructure, uses and waste disposals.
 - Regulating the uses of lands around water bodies; and
 - Enforcing the recycling of industrial effluents and water disposal.

Key elements of the Draft 2012 State Policy of Water Resources Development include (a) water resources planning; (b) water resources development; (c) water resources management; (d) rationalization of water rates; and (e) water conservation.

In the 11th FYP there is a target bringing 3.5 lakh hectares from surface water and 0.5 lakh hectares of under shallow tube wells. In 2011-12, 91 new projects, including Anicut (cost 456.04 crore) whose designed irrigation capacity is 17125 hectares were taken up. In 2010-11, the large, medium and small projects a target for irrigating 12.95 lakh hectares of kharif crop were set, against which water was supplied for irrigating 10.95 lakh hectares and 2958.63 mcm to industry, 315.708 mcm for drinking water purposes to several towns.

With an assistance of ` 163.437 crore from the Asian Development Bank (ADB), repairs and expansion are being carried out in 24 medium and 123 small irrigation projects, which would enhance the irrigation potential by 1.76 lakh hectares. In the budget of 2011-12 allocation of ` 30.17 crore has been made. Keeping in view the increasing shortage of water the construction of anicuts and stop dams has been proposed. These soil water conservation works will help increase availability of water for drinking, irrigation, meet requirement for industries, water for cattle as well as augment the ground water levels. The Action plan for the construction of 595 Anicuts at an estimated cost of ` 2570.95 crores has been approved. Of this, the work related to 160 anicuts has been completed at a cost of ` 383.49 crores. Work on 128 anicuts is in progress, the costs for which are ` 1001.24 crores. In the Budget for 2012-13 there is a provision of ` 389 crores for the construction of anicuts.

In 2011-12 an amount of ` 4300 lakh was approved for the construction of field channels. Of this 2110.17 lakhs have been expended till October 2012. Against a physical target of 30,876 hectares, 13,029 ha have been covered during the said period.

Participatory Irrigation Management: in the past year 2000-01 a new programme involving Mahanadi in ayacut farmers has been started with the objective of equitable distribution of water. The farmers committees formed have been provided with grants for the running of these committees.

6.4 Priorities

The Draft 2012 State Policy of Water Resources Development articulates the key priorities for the State in terms of water resources development as indicated above. In addition, the State's Draft Approach Paper to the 12th FYP also articulates the following priorities:

Management of Water Resources

River basins of Mahanadi, Godavari, Ganga, and Narmada cover a large part of Chhattisgarh. While the large forests help in ground water recharge, pockets with a high concentration of population and industry now face water shortage. Lessons need to be learnt from other parts of the country facing water shortages and response strategies planned in advance.

The main sources of water for the State are rivers, tanks, and ground water. However, surface water sources have not been able to keep pace with the shooting demand and increasing use of the ground water is being made in many areas. Even though greater use of surface water is being made for irrigation, the trend will reverse when agricultural intensifies.

In line with the State Water Policy of integrated development of water resources, in 11th Plan the State persistently worked to increase net availability by improving both ground and surface water; irrigation projects were taken up to increase both the potential and the storage capacity. The state will aim to make substantial progress on 4 major projects (Bango, MRP, Arpa-Bhaisajhar and Paury), completion of Kelo Project, lining and repair of canals of major projects, completion of 9 medium projects that are at various stages of development and construct anicuts throughout the state to increase irrigation potential by at least 3 lakh hectares and provide irrigation to all regions. The hydrogeology of the State does not support quick recharge due to large presence of hard upper crust and very few regions with water yielding mediums. Therefore, any plan for ground water conservation and recharge has to be long-term and well planned.

The state has drawn a 25-year Master Plan covering all five major river basins to increase the irrigation potential to 64 percent of the sown area. In the 12th Plan it will work on an integrated river basin management plan beginning with aquifer-mapping for watershed development and improved water use efficiency, and also integrate ground water recharge plans with water usage. The transition from flood irrigation to precision farming has already begun. A State-level Water Resource Regulatory Authority will be created to develop a ground water draft policy, ensure retention of ground water quality, and promote conjunctive use of surface and ground water.

Water-Security and Quality

Dysfunctional piped water supply schemes have led many rural habitations to 'slip back' to unsafe drinking water sources, as noted by the Planning Commission. Experiences elsewhere have shown that greater community involvement in the management of piped water schemes improves the probability of their success. Systems for tracking and monitoring household water security throughout the year will be established to prevent such slippages. Complementing this, the role and capacities of Water User Associations and Village Water Sanitation Committee will be enhanced for ensuring better provisioning, repair/maintenance, and quality of irrigation and drinking water.

Quality of water is important for improving health and sanitation and for reducing disease and mortality. Water quality monitoring modules and mitigation mechanisms will be set-up through better coordination among departments to tackle fluoride and iron contamination of ground water sources and arrest water salinity in some parts of the state.

The target will be to connect at least 70 percent of all habitations and 55 percent households with piped water supply by the end of 12th Plan and involve community/PRLs in the management of all drinking water sources.

6.5 Perceived Climate Impacts

No in-depth climate vulnerability and risk analyses currently exist for the State. Nevertheless, a range of studies has examined various aspects of vulnerability of water resources to climate change and its impacts elsewhere in similar contexts. Climate change can affect the hydrological regime changing water flows, precipitation levels, and evaporation. These changes would in turn impact the communities adversely as the pressure on natural resources and environment would compound; water availability in the rivers will be affected; crop yields could decrease, therefore jeopardizing food security; and leading to health concerns due to occurrence of extreme events such as floods and droughts. While some regions would receive excess precipitation, there might be reduction in other regions (adversely affecting arid and semi-arid areas); increased evaporation; changes in runoff and available surface flow also causing changes in the groundwater recharge. Patterns of seasonal distribution of rainfall can shift, and these can cause significant problems, especially for agriculture.

Extreme precipitation events could have geomorphological significance to the State. The response of hydrological systems, erosion processes and sedimentation in this region could alter significantly due to climate change. Increase in rainfall is likely to cause fresh floods land slides and damages to the landmass. This has a very severe implication for the existing infrastructure such as dams, bridges, roads, etc., for the areas and shall require appropriate adaptation measures to be taken up.

6.6 Strategies

Short-term (Five Years)

The CSAPCC recognises that scientific knowledge and evidence base on impacts of climate change to the water sector is limited. As such, a comprehensive climate vulnerability analysis will be taken up. As a complementary activity, a comprehensive water data base in public

domain and assessment of the impact of climate change on water resource through the various agencies responsible for different aspects of water resources management in the State will be developed, and updated and analysed on an on-going basis. Strategies towards this will include:

- Review of network of hydrological observation stations;
- Review of the network of automatic weather stations and automated rain gauge stations;
- Collection of necessary additional hydro-meteorological and hydrological data for proper assessment of impact of climate change in the state including other improvements required in hydrometric networks to appropriately address the issues related to the climate change. Such data will include hydrological and hydro-meteorological data in low rainfall areas;
- Improved network for collection of evaporation and rain gauge data using automated sensors;
- Establishment/strengthening of ground water monitoring and geohydrology networks;
- Collection of data about river morphology for monitoring erosion and carrying capacity; and
- Surface and ground water quality data collection, etc.

Other initiatives will include adoption/development of modern technology for measurement of flow in rivers areas, developing inventory of wetlands, development of water resources information system, and reassessment of basin wise water situation, apart from projection of water resources availability as a result of impact of climate change which would inter-alia include the likely changes in the characteristics of water availability in time and space. Other necessary studies to improve understanding of climate impacts to the sector will also be carried out from time to time, and robust data mechanisms will be established.

Capacity development, education, and awareness are high priority agendas for the sector, and as such, initiatives for this will be taken up including (but not limited to):

- Interactive sessions with policy makers for sensitization;
- Development and deployment of capacity building for professionals from various departments/organizations associated with water resources development and management including Panchayati Raj functionaries;
- Promotion of do-it-yourself action by citizens through intensive social communication; and
- Mass awareness programme including through school/college/university curriculum development and deployment.

In line with the priorities outlined in the State's Approach Paper to the 12thFYP, expeditious implementation of water resources projects particularly the multipurpose projects with carry over storages will be taken up. Significant emphasis and priority will be given to revival and repair of traditional systems of water storage, conservation, and micro-irrigation, and development of new systems will be promoted. Also, conservation and preservation of wetlands and maintenance of optimal wetland hydrology will be taken up on a priority basis in convergence with the Forest Department.

Specific emphasis will be given to empowerment and involvement of Panchayati Raj Institutions, urban water bodies and primary stakeholders in management of water facilities, and practices of participatory irrigation management will be revitalised/promoted. Systematic approaches to community level coping mechanisms and adaptation responses for coping with floods will also be developed.

Long-term (Beyond the 12th FYP Period)

Physical sustainability of groundwater resources will be accorded high importance, and intensive programmes for ground water recharge in over-exploited areas will be taken up. The State will also take other necessary steps for increasing water use efficiency, including incentivising water harvesting and encouraging non-agricultural type developments of the type where not much water is required, incentivising or encouraging leakage control programmes, developing regulations/frameworks for in-house water withdrawals of industries, through royalties and licenses, extending subsidies and incentives for recycling and recovery, revision of water tariff based on cost recovery principle, promotion of water efficient fixtures, incentivisation for recycling waste water, etc. Options for taking up/enhancing water conservation measures under the NREGA will also be examined.

The State will take up steps for addressing the quality aspects of drinking water especially in rural areas, while also seeking to improve water efficiencies in urban water supply systems through promotion of water efficient techniques, technologies, and management, including effective and timely operation and maintenance of water resources projects and infrastructure assets across all water sub-sectors in the State. All necessary efforts to adhere to national standards for water quality in water bodies and rivers will be undertaken.

Steps will also be taken to foster integrated water resources development and management planning, and seeking convergence among the various water resources programmes and organisations such as integrated watershed management programme, Agriculture Department, Forest Department, Industries Department, Urban Development Department, etc.

In view of above, appropriate measures for mitigation of the impact of climate change on water resources, as also the adaptive measures are to be undertaken by various state departments and agencies. A water resources and climate change "Cell" will be set up for the necessary coordination and monitoring mechanisms.

Documenting sectoral responses, learning what worked and what did not, dialogue and sharing of data and information, etc. will be carried out as essential functions either by the individual agencies involved or collectively by a nominated agency. Such lessons can be valuable to other States, as will be learning from similar experiences in other States. As such, such learning-sharing mechanisms will be developed and put into place.

The gender dimensions of water use and management are fairly well documented. It has long been noted in the gender and environment literature, for example, that women and girls generally assume primary responsibility for collecting water for drinking, cooking, washing, hygiene and raising small livestock, while men use water for irrigation or livestock farming and for industries. These distinct roles mean that women and men often have different needs and priorities in terms of water use. Climate change may also lead to increasing frequency and intensity of floods and deteriorating water quality. This is likely to have a particularly harsh effect on women and girls because of their distinct roles in relation to water use and their specific vulnerabilities in the context of disasters.

In the context of climate change, the imperative will be to ensure that that policies and programmes draw on the existing body of knowledge on gender and water to inform interventions – and scale these up. To support the integration of gender knowledge into policy and planning, it is proposed to train planners and raise their awareness of gender issues. Toolkits available from women's or gender networks will be used as a starting point, and gender networking between experts will be strengthened. Coping with water scarcity as an important issue will be taken into account in adaptation planning, and the equal participation of women and men will be made advocated for in planning. Additionally, gender experts will be consulted during the detailed planning process.

The private sector has considerable experience, expertise, technologies, and innovation capabilities as has been demonstrated in many other States in terms of increasing private sector involvement in water sector, especially by way of PPPs and other projects. As such, it is expected that the role of the private sector will be actively examined in the Chhattisgarh water resources context, and where appropriate, co-opted to bring in incremental gains for the sector.

6.7 Institutional Linkages and Stakeholders

A range of institutional linkages, convergence potential, and partnerships is envisaged with, indicatively, the State Agriculture Department, State Energy Department; CREDA; Integrated Watershed Management Programme; and other agencies as necessary for enhancing green cover or achieving the imperatives under the CSAPCC. Additional linkages will be built with National water research institutes/centres and universities; various international development agencies, private sector and financial institutions, civil society, community based organisations, and forestry and allied sector dependant communities in general.

6.8 Linkages with the NAPCC

The initiatives outlined above are consistent with the NAPCC and National Water Mission. Additionally, the strategies and imperatives under the forestry and biodiversity section of the CSAPCC also have linkages with the National Mission on Sustainable Agriculture, National Mission for A Green India, National Mission for Enhanced Energy Efficiency, and the National Mission on Strategic Knowledge on Climate; and the National Mission on Sustainable Habitat.

6.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

7 Urban Development

7.1 Overview, Characteristics and Status

Chhattisgarh is the ninth lowest urbanized state with an urban population percentage of 23.24. It is also the ninth lowest in terms of percentage decadal growth of urban population. Census 2011 data also shows that the percentage growth of urban male population stood at 40.09 as opposed to 30.06 for India, and for urban female population, at 43.69 against a figure of 33.73 for India. The data also shows that as against a total percentage decadal growth of 22.59 between 2001-2011 for the State as a whole, the corresponding figure for urban population in the State was significantly higher at 41.83, showing a dramatic growth in urbanisation.

Table 22: Decadal growth of population in Chhattisgarh (compared to India)¹⁹

India/State/	Percentage Decadal Growth (Persons) 2001-2011			Percentage Decadal Growth (Males) 2001-2011			Percentage Decadal Growth (Females) 2001-2011			Percentage Share of Urban Population	
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	2001	2011
India	17.64	12.18	31.80	17.19	12.12	30.06	18.12	12.25	33.73	27.81	31.16
Chhattisgarh	22.59	17.75	41.83	22.47	17.88	40.09	22.71	17.63	43.69	20.09	23.24

Urban Agglomerations and Population Growth

Urban Agglomerations in Chhattisgarh with a population above 100,000 as per 2011 census are shown in the table below. In 2011, the State has 182 towns (as opposed to 97 in 2001), 168 statutory towns (as opposed to 75 in 2001), and 14 Census towns (as opposed to 22 in 2001). The State has 10 Municipal Corporations, 32 Municipal Councils, and 126 Nagar Panchayats, with a total urban population of 59,36,538 (2011 Census data). Top seven urban centres in the State are Raipur, Durg, Bilaspur, Korba, Rajnandgaon, and Raigarh.

Table 23: Urban agglomerations with population above 100,000 in Chhattisgarh²⁰

Rank	Name	District	Population 2011	Male	Female	Population below 5 yrs	Literacy Rate
1	Raipur	Raipur district	1,122,555	578,339	544,216	142,826	86.45
2	Durg-Bhilainagar	Durg district	1,064,077	545,683	518,394	116,977	87.02
3	Bilaspur	Bilaspur district	425,821	232,995	219,856	52,550	87.29
4	Korba	Korba district	365,073	189,466	175,607	45,529	84.36
5	Rajnandgaon	Rajnandgaon district	163,122	81,873	81,249	18,677	87.95
6	Raigarh	Raigarh district	149,991	76,898	73,093	18,344	87.27
7	Jagdalpur	Bastar district	125,345	63,910	61,435	13,804	85.44
8	Ambikapur	Surgeja district	123,173	64,130	59,043	14,172	87.74
9	Dhamtari	Dhamtari district	101,645	50,769	50,876	11,283	85.94

Urban Infrastructure and Services

Provision of urban services and maintenance of public assets is mainly the responsibility of Urban Local Bodies (ULBs) consisting of Municipal Corporations, Municipalities, and Nagar Panchayats. Service level benchmarking (SLB) carried out by the Ministry of Urban Development, Government of India) data for 43 cities and towns in the State shows significant deficits in terms of service levels for water supply, sewerage, solid waste management, and storm water drainage. For example, the typical hours of water supply delivery range from 2 to 4 hours.

The SLB data is indicative of the fact urban agglomerations in Chhattisgarh too face the typical problems that plague ULBs elsewhere in India as well -- inadequate operation and maintenance (O&M) budgets to run water treatment plants, lack of staff both at managerial and technical level to manage the water supply system and staff need training in modern water utility management and operational techniques. Insufficient revenue is generated from water sales to assist with O&M costs. There is a lack of water meters so it is difficult to charge commercial and

¹⁹ Source: Census of India 2011

²⁰ Ibid

high users of water, and also no incentive to stop people wasting water. High levels of non-revenue water (NRW) are also a major issue. An improvement in accounting practises in ULBs is required so that water consumers can be identified, and the introduction of billing to ensure that revenue is obtained for the water service delivered.

The issues affecting sewerage are similar to those affecting water supply- but the sewerage system issues are more serious than water supply issues. The issues are lack of Town Sewerage Master Plan, inadequate water supply, lack of investment in sewerage infrastructure, inadequate capital & O&M budget for sewerage systems, lack of specially trained sewerage management and O&M staff, need for training in of sewerage utility management, inadequate revenue, lack of understanding of wastewater treatment chemistry and lack of wastewater laboratory facilities. Likewise, the typical issues affecting solid waste management are lack of solid waste master plans, no landfill site identified, lack of investment in solid waste management, inadequate capital and O&M budget for garbage disposal, garbage which is collected is disposed of indiscriminately at the side of the road or at town boundaries, the effect on the environment and public health effects of indiscriminate garbage disposal and lack of trained staff.

The issues affecting drainage are lack of drainage master plans, limited capacity of city storm water drainage channels, periodic and serious town flooding due to monsoon, use of open drains for disposal of sewage and toilet wastes, lack of storm water pump stations to clear flooding from monsoon rains, lack of investment in drainage infrastructure, inadequate capital & O&M budget for drainage management, effect on the environment and public health effects of flooding and use of drains and ditches for sanitation and lack of trained staff.

At the same time, the State is putting in significant efforts to overcome these issues; some of these initiatives are described in subsection 7.3 and 7.4 below.

7.2 Key Issues

As indicated in the subsection above, the State's urban development sector faces a number of key challenges. With growing urban populations across all the cities and towns, the existing infrastructure and services deficit is only likely to widen further increasing the risks to these agglomerations unless urgent steps are taken. The institutions responsible for providing the civic amenities are themselves starved of resources; while reform measures are underway, the financial health of urban local bodies in the state is a cause of concern. Further, urban roads congestion and traffic management are major problems in most cities and towns. The large numbers of urban poor (as per 2007-08 poverty census, nearly 5.45 lakh below poverty line (BPL) families live in urban areas and about 2.5 lakh families live in slums), and increased the number and vulnerability of people coming to urban areas in search of employment and working in the unorganized sector typically live in unhygienic and unsafe slums, which further aggravates their vulnerability.

The biggest challenge to urban development is the acute shortage of resources and capacities. Funds available under various schemes for smaller towns and cities are meagre at Rs. 498 per capita as against Rs. 4,030 per capita available for rural areas. While Raipur and Naya Raipur get covered under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM); Bilaspur, Raigarh and Kondagaon are supported through the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT); and 17 towns partially supported for housing under Integrated Housing and Slum Development Programme (IHSDP), most towns and cities are largely dependent on own/State resources and grants from Finance Commission. Additional resources and technical support is required to improve the living conditions and infrastructure of these medium and small towns and ensure balanced regional development.

Grants for ULBs are likely to shrink in future and resources need to be mobilized internally to develop and manage the urban infrastructure. The State will work to strengthen the capacities of ULBs in raising and managing funds. A significant portion of Central funds in the coming plan period will be linked to urban sector reforms and performance of ULBs on service-delivery, infrastructure development-maintenance, resource generation and efficiency of their expenditure, so that they gradually become self-sustained and self-reliant.

As recommended by Thirteenth Finance Commission, Second Administrative Reforms Commission (ARC), and the Planning Commission Approach Paper, States need to devolve clear functions and finances to ULBs so that they can manage responsibilities under their jurisdiction. Initial support will be required by them for planning and raising resource through tolls, taxes and levies.

7.3 Existing/On-going Initiatives

Various schemes for improving the urban infrastructure of the state are under implementation including Central Government schemes. Some of the key initiatives are highlighted below.

Naya Raipur

The State is developing Naya Raipur, a new greenfield city as the 4th new planned capital city in the country after Chandigarh, Gandhinagar and Bhubaneswar, with a total area of 8000 ha. The city is being constructed in three phases, and is planned over 21 sectors, with planned density of 250 person/hectare and anticipated average population of 16,000 per sector. The city is expected to have total planned water supply, sewer network, planned road networks, telecom infrastructure including a fibre optic network, excellent power supply, as well as strong social infrastructure including designated areas for hospitals, educational institutes, and recreation. The city will also have large city parks, water

bodies, jungle safari, and botanical garden. A Bus Rapid Transit System (BRTS) is under implementation under World Bank Support as a demonstration city for World Bank's Sustainable Urban Transport Project. A Light Rail Transit System (LRTS) also proposed. Other plans for Naya Raipur include a pedestrian corridor, golf course, luxury hotels and convention centres, shopping malls and multiplexes, a cricket stadium, and demarcated areas for Special Economic Zones (SEZs), townships, and etc.

Integrated Municipal Solid Waste Management

A Pilot project for integrated municipal solid waste management is close to being implemented in Raipur. The project involves door-to-door collection of garbage, covered transportation and re-segregation and disposal after due treatment; minimum 80 percent recycling of the collection and use for engineered land fill not more than 20 percent. The project will become operational in Raipur from January 2013-14.

Rapid Mass Transport Solutions: Metro Rail

Greater Raipur (Raipur, Naya Raipur, Durg and Bhilai) is fast emerging as a metropolitan city. This gives urgency to appropriate mass rapid transport solutions. Metro Rail is one option that is being explored. The track length between Rajnandgaon and Raipur is estimated at around 93 Kms. The State has engaged Delhi Metro Rail Corporation (DMRC) to conduct a pre-feasibility study of the Metro Rail project in the State. The State is forming an Urban Metropolitan Transport Authority (UMTA) to facilitate and support efforts to realize mass rapid transport solutions for Greater Raipur.

Urban Water Supply on 24 x 7 Basis

Water supply is on the special focus list of four municipal services in the State. The ideal is to migrate to 24 x 7 water supply in the right measure (135 lpd per capita) and right quality. A pilot on EPC mode is poised for launch in outer Raipur under the Water Augmentation Scheme. The supply volume is 150 mld.

Under Ground Urban Sewerage System

Drainage/Sewerage is on the special focus list of four municipal services in the State. The State has drafted Waste Water Recycling and Re-use Rules. An underground sewerage scheme (UGS) pilot project is under implementation in Bilaspur under UIDSSMT scheme of Government of India. The estimated investment is 280 Cr. The project involves EPC for developing infrastructure facilities for collection of sewerage from sources and draining them to a trunk underground sewerage system to be duly treated and effluent disposed off after treatment. Recycling of re-usable water back to the city has been put in the scope of the Bilaspur Municipal Corporation.

Other Initiatives

The SarovarDharohar Yojana programme has been introduced for renovation, revitalization, deepening, and beautification of ponds and water bodies located in urban areas with a view of environmental improvement. In the fiscal year 2011-12 the task on 50 ponds has been undertaken. Renovation of schools in urban areas of the state and the construction of additional rooms is done through the Gyanansthali Yojana programme. Of the total sanctioned for 986 school buildings, the construction of 846 school buildings was completed. UnmuktKhelMaidan Yojna -- the programme for the protection of existing playgrounds and creation of new ones is also being undertaken. The total approval so far is for 164 projects; 112 projects have already been completed. A range of programmes such as the Mukhyamantri Swavalamban Yojana, Mahila Samridhhi Bazar Yojana, etc. are being implemented to alleviate urban poverty and provide employment.

The Transport Nagar Yojana formulated to simplify and streamline the transport system in the state has been started in eight urban bodies. Two projects have been completed and work is in progress in the rest. The Bhagirathi Nal- Jal Yojna, a new programme to provide improved water supply service levels through piped water to nearly 2.5 lakh poor families live in slums situated in various urban centres free of cost has been started. These are only examples of a range of other such initiatives being undertaken in the State.

The State has also decided to adopt a well-defined urban development policy to meet the challenges of urbanisation. The objectives of this urban development policy are to ensure:

- Improvement in the quality of urban living;
- More accountability of Urban Local bodies towards urban citizens;
- Planned urban development;
- Better quality, access and efficiency of service;
- Alleviation of urban poverty and equal access of services to the urban poor;
- Financial sustainability of local institutions; and

- People's participation in local governance

These objectives would be met through the following strategies:

Strategy 1 - Capacity building and institutional development: The Government emphasises capacity building of local institutions, especially the ULBs. This would be including building organisational as well as financial capabilities of ULBs to meet the challenges of urban development. The existing role of ULBs would be strengthened in light of the 74th Constitutional Amendment;

Strategy 2 – Stress on operational efficiency: Delivery of municipal services like water supply, sewerage and sanitation, street lighting, transportation and housing would be strengthened. Emphasis would be laid on adoption of appropriate technology along with sustainable management of urban environment. Needs of the urban poor would receive special attention and service delivery to urban poor would be strengthened;

Strategy 3 – Strengthening Urban Planning: Urban planning would be reflective of the economic development in the region. The ULBs would play a pivotal role in urban planning.

Strategy 4 – Enabling Public Private Partnerships: Public private partnership includes involvement of private sector, NGOs, community representatives, citizen groups, etc., in various aspects of urban management. Private sector participation would not only supplement scarce Government resources, it would also help in improving the quality of service.

7.4 Priorities

The State recognises that long-term strategy and City Development Plans (CDPs) need to be developed for its urban agglomerates in terms of connectivity, urban infrastructure (water, housing, sewerage and street lighting), transportation, and other amenities (health and education). An Urban Development Strategy and Response Plan with a 20-30 year horizon will therefore be prepared taking account of the probable scale and character of future urban growth. Priority will be to work closely with ULBs to create basic infrastructure -housing, water, transportation, and sanitation in all urban locations in the 12th Plan. Since local bodies may neither have the capacities nor resources to do these alone, PPP-based models for public transportation, waste disposal and infrastructure development will be explored for large and medium towns.

ULBs have a huge mandate to fulfil, but are constrained by the capacities of their elected representatives and functionaries. For the municipalities and municipal corporations this mandate translates into a massive and long-drawn exercise for better planning, training, introducing new technologies, business processes, and extensive handholding. Some of this work has been initiated in Eleventh Plan period and will be rolled out in all municipal bodies in the next plan period. State will support their capacity development for pro-poor, accountable, transparent, and efficient urban governance. For Nagar Panchayats, which have seen the sharpest increase in numbers, it will mean improving capacities for planning, resource mobilization and enhancing their knowledge about schemes for urban/peri-urban areas.

Apart from Swarna Jayanti Shahri Rozgar Yojana (SJSRY) under which 18,000 beneficiaries have been trained on skills and nearly 1000 linked to banks for credit, the State has also launched its own schemes for urban self-employment and skill-development of youth and women and this will be scaled-up in the 12th Plan.

Integrated slum development will be undertaken for the urban poor by pooling state resources with the Rajiv Awas Yojana for developing low cost housing on existing slums and provisioning them with clean drinking water, sanitation and other basic civic amenities. For inclusive growth, the State also will assure access to the basic entitlements for vulnerable populations living in urban areas.

The Rajiv Awas Yojana has also been taken up as a major initiative, and is due for launch in four towns – Raipur, Bilaspur, Bhilai, and Korba in the first phase.

7.5 Perceived Climate Impacts

No in-depth climate related vulnerability and risk analyses currently exist for the State. However, it is known from available evidence from across the world that climate change causes vulnerability of human settlements, which is related to extreme weather events, and such gradual changes in the climate exceed the adaptive capacity of human systems. Climate change adds to the existing stress on the sustainability of human settlements and society. Non-climate sources of change like rapid urbanisation are often the main source of stress.

The concentration of urban population in a few large cities has led to tremendous pressure on civic infrastructure systems like water supply, sewerage and drainage, solid waste management, parks and open spaces, transport, etc. It has also led to deterioration in the quality of city environment. In several cities, the problems of traffic congestion, pollution, poverty, slums, crime and social unrest are assuming alarming proportions. Climate change is likely to exacerbate the existing stresses that these settlements already face. It may also impact measures that are being undertaken for sustainable development of these areas. Human settlements are accustomed to variability in environmental conditions and are resilient to normal variations. Vulnerabilities arise out of experiences that are beyond the normal experience and due to limited adaptive capacity. Climate change is likely to affect infrastructure related to water, sanitation, energy, transportation, health-care, fire services, and other forms of emergency measures. Climate change could affect water supply systems in any number of ways. It can affect the water demand for drinking and cooling systems. Where climate change leads to failure of small local water sources such as wells, it could lead

to greater demand for regional water supplies. Changes in precipitation patterns could lead to reduction in water availability and fall in water tables.

A change in water availability and supply also affects sewerage and drainage systems. When water supplies reduce, sewerage systems also become vulnerable. Further, sewage treatment plants are vulnerable to floods, as these are often located near rivers or water bodies. Storm water drainage systems could become frequently overloaded and cause flooding if heavy storms become more frequent due to climate change. The impact of inadequate drainage systems in cities like Mumbai is already being felt leading to flooding and huge economic losses. More frequent floods could also present a significant threat if these lead to contamination of floodwaters with faecal material. Climate change may impact upon transport and other infrastructure due to extreme local climatic experiences, leading to significant economic losses. The urban-heat island effects could get exacerbated due to increase in baseline temperatures, affecting climatic comfort of the urban populations and may consequently lead to additional costs in climate control.

The vulnerability of human populations varies with economic, social, and institutional conditions. The poor and the marginalized have little capacity to adapt to changes in climate by adopting such mechanisms as air-conditioning or heating. The traditional coping mechanisms of these vulnerable communities may be over stretched due to additional stresses related to climate change. Climate change threatens the homes, livelihoods, and health of the urban poor. When disasters strike, their homes may be damaged or destroyed and they may be unable to travel to work causing them to lose money for food and other basic needs. Poor people often live in informal settlements on land, which is susceptible to climate change – flood plains, lowlands, or unstable hillsides. Drains and culverts are frequently blocked with rubbish. Slum dwellers often lack secure tenure, proper shelter, water, sanitation, electricity and other services. Most have no insurance. Climate change may add to their problems.

7.6 Strategies

The State recognises that while cities are exposed to considerable challenges and risks from climate change and its impacts, cities have the potential to build resilience by a range of measures aimed at addressing multiple stressors and risks. As such, the Urban Development Department is committed to taking all necessary steps towards this under the GSAPCC. It would, adopt a set of broad guiding principles the objectives that are articulated in the National Mission for Sustainable Habitat:

- To exploit the potential for mitigating climate change through reduction in demand for energy in the residential and commercial sectors by adopting various energy efficiency and conservation measures. With respect to adaptation, the aim would be to promote greater use of renewable sources and to reduce dependence on a single source. In formulating climate change strategies, mitigation efforts need to be balanced with those aimed at adaptation;
- To adopt a comprehensive approach in the management of water, municipal solid waste (including segregated collection, and disposal of non-bio-degradable wastes in scientific landfills or alternative scientific disposal) and waste water with a view to realize their full potential for energy generation, recycling and reuse, and composting; also, all efforts will be made to ensure proper separation of wastewater streams and ensuring that grey water and black water do not enter storm water drains and also to ensure that untreated wastewater streams do not enter water bodies or rivers
- To address the issue of mitigating climate change by taking appropriate action with respect to the transport sector such as evolving integrated land use and transportation plans, achieving a modal shift from private to public mode of transportation, encouraging the use of non-motorised transport, improving fuel efficiency, and encouraging use of alternate fuels, etc. To evolve strategies for adaptation in terms of realignment and relocation, design standards and planning for roads, rail and other infrastructure to cope with warming and climate change;
- To reorient urban planning with a view to address climate change with respect to mitigation as well as adaptation and improve the responsiveness to disasters by strengthening community based disaster management and to provide better warning systems for extreme weather events;
- To facilitate adoption of technologies and research and development which lead to energy efficiency and reduction in emissions;
- To promote patterns of urban growth and sustainable urban development that help secure the fullest possible use of sustainable transport for moving freight, public transport, and encourage cycling and walking; thereby reducing the need to travel, especially by car;
- To promote measures that improve resilience of infrastructure and human systems to cope with vulnerability consistent with social cohesion and inclusion;
- To conserve the natural resources that are the key to sustainability of human habitats like water, clean air, flora and fauna, recognising the integrated nature of human and other systems;
- To reflect the development needs and interests of communities that are especially vulnerable to climate change;
- To encourage competitiveness and technological innovation in mitigating and adapting to climate change;

- To develop a transparent, flexible, predictable, efficient, and effective planning system that will produce the quality development needed to deliver sustainable development and secure sustainable communities. National policies and regional and local development plans provide the framework for planning for sustainable development and for that development to be managed effectively;
- To encourage community involvement in ensuring more sustainable patterns of development;
- To bring together key stakeholders at the central, state, district and local levels for a co-ordinated and comprehensive response to vulnerabilities arising out of climate change; and
- To promote and strengthen efforts aimed at generating awareness related to climate change.

Towards these goals, the State will adopt the following measures:

Short-term (Five Years)

Towards improving scientific knowledge and evidence base and understanding of climate change and its impacts, the Department will take necessary steps towards collating available data/information of impacts of climate change on cities, their systems, infrastructure, and people. It will begin the process of developing the necessary systems, databases, and protocols for collecting and collating the necessary evidence base on an on-going basis.

Towards improving governance mechanisms, institutional decision-making, and convergence, a Climate Cell will be formed within the Department, which will also notify climate resilience focal points in all ULBs. Likewise, explicit incorporation of climate concerns into all aspects of urban infrastructure planning and implementation in Chhattisgarh will be made a norm. Coordination/convergence opportunities with other sectoral line departments will be analysed, and leveraged as required.

The Department will develop and deploy a range of awareness and capacity building programmes for municipal officials for promoting appropriate measures towards climate resilience in their respective ULBs, as also similar programmes for building awareness on climate change and its impacts for the urban populations. The Department will also seek to converge such efforts with other sectoral initiatives such as health, education, housing, water, etc. and foster inter and intra departmental coordination.

Towards building adaptive resilience and contribute to reduction in green house gas emissions, in addition to strengthening urban infrastructure systems under the various projects of the JNNURM and UIDSSMT, the Department will proactively seek to develop plans for developing interventions aimed at improving traffic conditions, reducing journey times, and improving safety of all users and particularly the most vulnerable (pedestrians, cyclists, and motorcyclists) through a combination of investments. These will generally focus on major roads and include (i) road widening and strengthening to create greater road capacity, thus relieving congestion and easing traffic flows; (ii) car parking restrictions and provision of multi-storey car parks, and bus and truck terminals, where possible, through PSP to improve passenger convenience and increase road space; (iii) providing of pedestrian subways and footpaths to improve pedestrian movement and safety; (iv) improving traffic management improvement; and (v) street lighting for improved traffic and pedestrian safety and security. These initiatives towards 'green transportation' will be encouraged with the help of Transport Department both in the government as well as in private sector.

The concept of 'Green Buildings' will be promoted in both the public and private sectors to save energy, water, and reduce/recycle waste. Instructions will be given to the ULBs to enforce water and energy savings in housing sector. 'Rain water harvesting' will be promoted especially in housing sector. The Urban Development Department also plans to promote energy efficiency and appropriate use of solar energy is going to be promoted in street lighting. Adequate use of compact fluorescent lamps (CFLs)/light emitting diodes (LEDs) will be encouraged to save energy. Solar water heating will be encouraged through CREDA.

It is also proposed to end the regime of common drains for sewer and storm water by building dedicated storm water drains. These will be linked to the project for strengthening of urban water bodies by using storm water drains as feeders for the water bodies.

While many other measures are currently underway, and since these are expected to continue beyond the 12th Plan period as well, these are mentioned in the sub-section below, on Long-Term strategies/plans.

Long-term (beyond the 12th Plan Period)

As part of longer-term measures, emphasis will be given to 'greening' the towns, and plans will be developed and implemented for increasing the available green cover in the cities and towns in the State. Cooperation of the Forest Department will be sought in the 'greening' campaign. Appropriate awareness campaigns will be launched for 'clean environment'.

Provision of rainwater harvesting tanks in all ULB buildings and new constructions in municipal limits will be taken up. Cleaning/conservation/beautification of water bodies' situated within the ULB limits, retrofit of municipally owned and controlled buildings and facilities with energy efficiency and renewable energy measures that significantly reduce energy use, create jobs, and serve as local demonstration projects; establishment of official or informal energy building codes that reflect the "state of the art" in energy efficiency; investments in district heating and cooling systems where higher densities that provide or facilitate the provision of a full range of energy efficiency measures to the local community will be other programmes to be developed under the CSAPCC.

Under JNNURM sub mission namely Basic Services for the Urban Poor and Rajiv Awas Yojana Programme; climate resilient housing models would be advocated for and adopted. Additionally, climate concerns will also be planned and integrated into urban poverty alleviation programmes, such as those under the SJSRY.

The ever-increasing urban population has put tremendous pressure on the budgetary resources of States/ULBs underscoring the necessity of private sector participation in urban development. The unbundling of services and technological innovations has opened up areas to private sector participation. As such, the Department will proactively explore private sector participation options in various fronts including (but not limited to) especially for the following and in smaller towns and cities:

- Energy efficient housing;
- Water supply augmentation and efficiency improvements;
- Door-to-door collection of municipal and household solid waste, secondary storage, development of transfer station & transportation, treatment and processing; and disposal, including development of sanitary landfill; integrated municipal solid waste management systems (with combination of above);
- Wastewater collection, handling, treatment, and disposal including storm water drainage, sewerage systems including treatment plants, decentralised wastewater treatment units, sewage gas based power generation, etc.;
- Beautification of parks and other green areas and developing new green lungs;
- Communications and advocacy including awareness campaigns for clean city concepts;
- Hoarding policy (including energy efficient installations, operation and maintenance of street lights); and
- Partnerships for green transportation.

7.7 Institutional Linkages and Stakeholders

A range of institutional linkages and partnerships is envisaged, including with the Water Resources Department, the Energy Department, CREDA, Disaster Management agencies, related infrastructure and urban development agencies, the Transport Department, ULBs, as well as apart from linkages with academia, civil society, international development agencies, private sector and financial institutions, and urban communities in general.

7.8 Linkages with the NAPCC

The strategies and actions proposed in the CSAPCC under the Urban Development section are consistent with the NAPCC and the National Mission for Sustainable Habitat. In addition, it has also linkages with the national Mission for a Green India, national Water Mission, National Mission for Energy Efficiency, and the National Solar Mission.

7.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

8 Transport

8.1 Overview, Characteristics and Status

Sector Status and Growth

The status of physical transportation infrastructure has already been outlined in Subsection 1.4 of this report. As a consequence of the inadequate rail transport facilities in Chhattisgarh, road transport occupies an important place for the transport of goods and people within the state. Till the end of March 2010 the total number of registered vehicles in the state of Chhattisgarh, which was 2.4 million subsequently has increased substantially registering a total growth of 13.59 percent. Category wise growth includes 20.82 percent for cars and light vehicles, the highest for any vehicular segment. In 2010-11, revenue collections from duty and taxes on motor vehicles, etc., was 426.74 crore and 351.85 crore in 2009-10, an approximate growth of 21.28 percent. For 2011-12 till September 2011, the revenue collections were Rs. 220.57 crore and in for the same period in the previous year 184.90 crores.

In undivided Madhya Pradesh, till 31.12.2002 only means of public transportation available was the Madhya Pradesh State Road Transport Corporation (MPSRTC) under the Department of Transportation. After the formation of Chhattisgarh, the corporation was dissolved and the transport sector has been privatized. This resulted in an increase in the state and inter-state transport, and new reciprocal agreements were entered into with neighbouring states.

8.2 Key Issues

Some of the key issues in the sector include:

- Increasing congestion, especially in urban agglomerations; increasing air pollution from vehicular emissions;
- Very little public transport facilities especially in urban areas; what exists is largely out-dated vehicle fleets;
- High forest cover prevents improving road connectivity; and
- LWE and security issues lead to escalated development and maintenance costs that go well beyond the funds allotted by national programmes; also, maintenance of highways and roads in LWE affected areas are an issue; many of these are in poor repair.

8.3 Existing/On-going Initiatives

As indicated in the earlier section on Urban Development, a BRTS is under implementation in Naya Raipur under World Bank Support as a demonstration city for World Bank's Sustainable Urban Transport Project. A LRTS also proposed. Likewise, the State has engaged DMRC to conduct a pre-feasibility study of the Metro Rail project in the State. The State is forming an UMTA to facilitate and support efforts to realize mass rapid transport solutions for Greater Raipur.

The State Transport Department is undertaking a various measures in the sector. For example, the process for issuing smart cards for vehicle registration and driver licensing is in the final stage. The plan for implementing the Central Government initiative/ directive for high security plates for all vehicles is nearly finalised. There is a proposal to establish check posts and computerised weighbridges at the state borders – in Patkohera, Kamharpali and Dhanwar. The task of checking vehicles by the various departments -- the Transportation, Commerce, Forests, etc. would be done at the same location, and this convergence would facilitate smoother inter-state transport/vehicle movement.

Substantial resources, including loans, have been galvanized to bridge this infrastructure gap, take road connectivity to all habitations, and compensate for the poor rail network. Priority was placed on first reaching the hitherto unconnected habitations. Between 2001 and early 2011 rural roads measuring 17,668 km and 20,870 bridges/culverts have been constructed. To facilitate smoother inter-State and internal traffic State highways and district roads have also been upgraded. The Public Works Department has paid special attention to the improvement of roads and construction of bridges. In 2010-11 2138 km of roads were constructed and repaired, which included metaling, black top, widening, strengthening, renovation. In addition construction of 54 large bridges, 28 medium sized bridges, has been completed and 117 large and 7 are in progress. In 2011-12, till September 2011, construction and repair of 671 km roads, 19 large and 10 medium bridges as been completed while 188 large bridges are in progress. Also, the Chhattisgarh State Roads Development Project is being implemented with assistance from the ADB. Under the project, 1249 km of state high ways and district roads are being upgraded/repared. The estimated project cost is 1225 crores. Under the scheme, 18 of the 19 routes have been completed and one is under way. A proposal for a second loan from ADB, of 2500 crores for the work on 1500 km of other important roads is being prepared. Additionally, in 2010-11 three bypass roads -- (1) Ghargoda bypass measuring 6 40 km, (2) Champa by pass measuring 5 km, and (3) ZoraSaddu Dhaneli measuring 17.03 km have been completed and 3 roads measuring 34.4 km are under progress last year and this year. Likewise, several railway over bridges have been completed and others are in progress. Also, work on one interstate road of economic significance is in progress.

8.4 Priorities

The State's key priorities are in the development of national and state highways. Industrial investments will come only if good quality infrastructure and connectivity is ensured. Difficult topography of many areas and the heavy industrial traffic put a constraint on construction as well as maintenance. In road projects where viability gap is of more than 40 percent, mechanisms will be devised for gap funding from internal resources, rather than going for a Built-Operate-Transfer BOT model. With Chhattisgarh's commitment to accelerate the pace of development, 12th Plan will be the time to rollout a coordinated strategy to improve the quality of road infrastructure. A specialized agency will be created to provide end-to-end solutions for improving roads right from their conceptualization, clearances, financing, execution, and maintenance. Thrust will also be on linking industrial areas with nearest railhead and national highways through state roads of quality standards.

8.5 Perceived Climate Impacts

While there have been no State specific detailed studies on climate change and its relationship to transportation and vice versa, available trends from across the world, show that:

- Overall demand for transport activity (for both passenger and freight) is growing rapidly;
- Transport activity is increasingly motorised (private cars for passenger transport and lorries for freight, almost all of which are propelled by internal combustion engines); and
- Technological improvements such as fuel-efficient vehicles and alternative power sources have not been rapid enough to offset the impacts of this growth.
- These trends translate directly into various costs for the environment, society, and economy.

The transport sector's consumption of fossil fuels translates into energy-related carbon dioxide (CO₂) emissions, which is projected to increase as transportation needs grow, with a direct impact on climate. Additionally, transport-related pollution, noise, and vibration can pose serious threats to human health and wellbeing. Local air pollution is caused by exhaust emissions produced by traffic, mostly in the form of Sulphur Oxides (SO_x), Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Hydro Carbon (HC), Volatile Organic Compounds (VOC), toxic metals, Lead Particles and Particulate Matter (PM) – including Black Carbon. These emissions represent a large proportion of pollutants, especially in developing cities. Such air pollutants are a cause of cardiovascular/pulmonary and respiratory disease. For example, exposure to lead can cause increased blood pressure, liver and kidney damage, impaired fertility, comas, convulsions, and even death. Children are particularly vulnerable; they can suffer from reductions in IQ and attention span, learning disabilities, hyperactivity, impaired growth and hearing loss.

Road accidents remain a serious public health issue, and many victims tend to be pedestrians, cyclists and motorcyclists, for whom infrastructure provision is often neglected. Climate change is only likely to exacerbate this by impacting available infrastructure assets. Likewise, congestion is caused when the volume of traffic reaches the capacity of infrastructure. It is particularly common in urban areas, where it can severely limit the positive effects of agglomeration. Travel times for public-transport users, as well as pedestrians and cyclists, frequently increase if dedicated infrastructure is not provided. Congestion also increases fuel consumption and the level of pollution, as fuel is still consumed whilst cars are stationary. Again, climate change can exacerbate these impacts, leading to traffic-filled roads that can become physical and psychological barriers that can sever communities and divide entire cities.

Roads, railways, and other transport infrastructure can also have a severe impact on the natural environment, from the removal of vegetation during construction or the subsequent fragmentation of habitats and disturbance of animals; such fragmentation, without proper ecological infrastructure planning can severely disturb wildlife and reduce biodiversity.

8.6 Strategies

The State recognises that a phased approach will be need to address the issues related to transport and climate change – and this would involve a complete overall revamping of the existing transportation scenario.

Short-term (5 Years)

As such, in the short to medium term, the State, through appropriate departments/agencies will seek to:

- Improve access to quality public transportation with a focus on bus services and service quality;
- Put into place mechanisms for proper planning and provisioning of infrastructure facilities;
- Improve route and traffic planning, and regulate issue of permits through surveys and scientific data;
- Provide/improve passenger information systems, and remove institutional and regulatory hurdles;

- Undertake capacity building of personnel in the Transport Department and other agencies as required;
- Promote initiatives such as vehicle pooling, etc., especially in cities and towns;
- Rigorously implement measures for vehicular pollution control;
- Promote the use of ensure availability of cleaner fuels such as CNG and bio-fuels; and
- Systematise and ensure uniformity in institutional arrangements for providing public transport services.

Long-term (Beyond the 12th Plan Period)

In the long term, the Department will undertake necessary feasibility studies for and implement a three-pronged investment strategy to transform the transport sector. This will involve key strategies and steps to (indicatively, but not limited to):

- Promote access instead of mobility; shift to less harmful modes of transportation; and improve vehicles towards lower carbon intensity and pollution. A fundamental shift in investment patterns will be sought, based on the principles of avoiding or reducing trips through integrating land-use and transport planning and enabling more localised production and consumption.
- Shift to more environmentally efficient modes such as public and non-motorised transport;
- Invest in public transport and infrastructure that promotes walking and cycling generates jobs, improves wellbeing and add considerable value to the state economy, as well as reduce greenhouse gas emissions;
- Improve vehicles, vehicle maintenance, and fuels as a priority to reduce urban air pollution and greenhouse gas emissions as also ensuring that vehicles that have passed their useful life do not come out on roads; ensuring that stricter controls are followed on transport vehicle over-loading so that improved fuel efficiency and reduced road wear result;
- Adopt green transport policies will also reduce road accidents and alleviate poverty by improving access to markets and other essential facilities;
- Develop green-belts and avenue plantation for in-situ urban pollution dispersal;
- Coordination with the Food and Civil Supplies Department to check and eliminate fuel adulteration and enforce strict controls for fuel mixtures;
- In coordination with the Public Works Department and other appropriate agencies, strive to ensure fully paved roads for reducing dust pollution levels;

The Transport Department/other appropriate agencies will undertake to develop a comprehensive Sector Roadmap including strategies for the short, medium, and long-term, with explicit incorporation of climate concerns.

8.7 Institutional Linkages and Stakeholders

Institutional linkages are envisaged with Transport and related authorities/private sector agencies involved in transportation, the Urban Development Department, state infrastructure related agencies/corporations, Tourism Department, Indian Railways, other relevant state departments, as well as linkages with academia, civil society, international development agencies, private sector and financial institutions, and communities in general.

8.8 Linkages with the NAPCC

The outlined strategies herein are consistent with the NAPCC in general; they also have linkages with the National Mission on Sustainable Habitat and the National Mission on Energy Efficiency.

8.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

9 Energy

9.1 Overview, Characteristics and Status

Power Situation in Chhattisgarh

Chhattisgarh has excellent power infrastructure, and is a power surplus state. With a potential to produce 50,000 MW of power, Chhattisgarh has the prospect to become the power hub of India. As of March 2011, the total installed power generation capacity for Chhattisgarh was 4,882.4 MW, which comprised of 2,199.0 MW under the state utilities, 1,831.9 under private utilities, and 851.5 MW under the Centre.

Table 24: Installed Power Capacity (MW) in Chhattisgarh as on November 2011²¹



Few noteworthy on-going Thermal power projects in the State include the Korba West Extension thermal power plant (TPP) (1 x 500 = 500 MW) at Korba, and the Marwa TPP (2 x 500 = 1000 MW) at Janjgir- Champa. In addition, Non conventional energy sources have been accorded very high priority. A special agency -- CREDA has been set up. Micro-Hydel power potential is also being tapped in a big way, and several projects have been identified for viable private investment. The HasdeoBango reservoir offers a relatively cheaper source of power generation

As on March 2012, average uninterrupted energy demand of the State is 2,732 MW and average supply has been around 2,740 MW. The current consumption pattern is 24.52 percent domestic, 4.58 percent non-domestic, 55.84 percent industrial and 14.14 agriculture (against 10 percent in 2001). Keeping its promise to reach the unreached, BPL connection holders (1.3 million connections) get 13.63 percent and beneficiaries of irrigation pump schemes (small and marginal farmers) get 14.3 percent of the power generated. For the domestic and agriculture sector, priority has been given to electrification of BPL households, schools-hospitals, and energisation/line extension for irrigation pumps.

State Electricity Board and Reforms

Power Sector reforms were initiated in early years of its formation. The Chhattisgarh State Electricity Board (CSEB - formed in November 2000) was re-organised into following five companies in accordance with the provisions of Electricity Act 2003 in December 2008:

1. The Chhattisgarh State Power Holding Company Limited
2. The Chhattisgarh State Power Generation Company Limited
3. The Chhattisgarh State Power Transmission Company Limited
4. The Chhattisgarh State Power Distribution Company Limited
5. The Chhattisgarh State Power Trading Company Limited
6. The Chhattisgarh State Power Generation Company Limited became functional w.e.f. 01.01.2009.

²¹ Source: India Brand Equity Foundation (IBEF) report on Chhattisgarh, November 2011

The reforms also encouraged private players to use Chhattisgarh's locational advantage for setting up Captive power plants. It allowed and facilitated third party sales to buyers outside the State. In addition to the Chhattisgarh State Power Generation Company Limited (CSPGCL), the power in the State is generated by Independent Power Producers (IPP), which includes LANCO and Jindal Power. Over 87 percent of private sector power capacity and over 93 percent of state - owned power capacity are from coal-based power plants.

Chhattisgarh Renewable Energy Development Agency

The State has placed significant emphasis on renewable energy development. CREDA is the State Nodal Agency of Ministry of New & Renewable Energy (MNRE), Government of India responsible for Development, Deployment, and Promotion of Renewable Energy (RE) in the state. RE based power plants currently generate about 279 MW, and contribute over 5 percent to the total power generation in the State.

The State Electricity Regulatory Commission (SERC) has mandated renewable purchase obligations to promote RE. Obligated entities are required to procure RE Power up to 20 percent (by 2020) of their power consumption. RE Power generation has been declared as priority sector under state industrial policy. In order to further promote RE power, the State has announced state policies for promotion of solar, wind, hydro, and biomass power projects.

Achievements of CREDA in the rural sector include electrification of 1439 remote un-electrified villages and hamlets through solar photovoltaic (SPV) of total capacity 3500KW benefiting 58000 families and 9,500 street light points. The remaining un-electrified villages are also being taken up for electrification through RE power. Other rural initiatives include electrification of 1137 tribal hostels, 306 health centres, 209 remote police stations/camps, installation of 265 SPV Pumps for drinking water supply in remote villages, and installation of 232 SPV Pumps for irrigation in far flung locations from grid. Likewise urban RE power achievements include roof top SPV Power Plant of total 13.6 MW capacity in 1089 locations, solar water heating systems of total 12 lakh LPD capacities in 2500 locations. Raipur and Bilaspur have been selected as Solar City Projects of MNRE, with a target is to reduce energy consumption up to 10 percent (from base year 2011) in next 10 years through energy efficiency and renewable energy installations. CREDA will also be the nodal agency for promotion of the Wind Energy Policy of the State.

Chhattisgarh Biofuel Development Authority" (CBDA)

Based on the state's excellent potential for production of tree borne oilseeds (TBOs) such as Pongamia, Pinnata (Karanja) and Jatropha (Ratanjot) it was felt that there is a need for effective and coordinated management and monitoring of the activities connected with promotion of plantation, collection of seeds, extraction of bio-fuel and marketing of bio-fuel from tree borne oil seeds. As such, the State set up the CBDA for promotion of bio-fuel in January 2005. The major aims and objectives of the CBDA are:

- Promote research and development facility for undertaking need based research, developing appropriate technology and extension packages;
- Increasing rural income and women empowerment;
- Generating rural employment;
- Promoting renewable energy through harnessing the bio-fuel energy;
- Growing TBOs and extracting biofuel through identification of areas conducive for TBOs;
- Reducing the import bill of oil for the country/State;
- Reduction of toxic emission during combustion of Bio-fuel, which is practically free of sulphurous compound;
- Reduction of green house gas emissions through substitution of fossil fuels with plant oils based fuels;
- Self-reliance and fuel security; and
- Earning carbon credits.

CBDA's activities will be executed through coordinated efforts of the concerned departments of the State Government. Since the ultimate use of Bio-fuel is an application of alternate energy hence CREDA is the Nodal Agency and Energy Department the Nodal Department for this Authority. Besides finalizing various plans under Biofuel Development Programme, sensitization of farmers, investors and other stakeholders are the basic aims of the CBDA. For this, various types of pamphlets/booklets have been published. Also, rural based programmes, farmers trainings etc. have been organized. Private investors desirous of setting up biodiesel plants along with undertaking captive plantation are being provided with information under the programme. CBDA also coordinates with various State departments/agencies for efficient execution of the biofuel development programme.

Chhattisgarh Environment Conservation Board (CECB)

The CECB has also been playing a key recommendatory and regulatory role in the power sector. It has taken steps to ensure that the State adopts super-critical technology for all new large power plants to improving fuel burning efficiency by 1-3 percent, and making the use of high

concentration slurry based disposal systems for fly ash disposal to minimise pollution and dispersal/fugitive emissions of fly ash for all new thermal power plants from 2010 onwards. The CECB also recommends the use of 'beneficiated' or washed coal in thermal power plants in the state for energy output maximisation and efficiency, as well as recommending plantation and advocating the use of alternative fuels.

9.2 Key Issues

While state-sector power generation capacity has increased mainly through renovation and modernization of existing plants and installation of additional capacity and improved energy infrastructure like very high-tension transformers and 100 percent increase in line extensions. However, in terms of efficiency the progress has been mixed. On the production side the Plant Utilisation Factor (PUF) of thermal power plants is up from 65.75 to 88.99 percent -- one of the best in the country. However, on the distribution side, losses are still unacceptably high, at around 30 percent.

9.3 Existing/On-going Initiatives

In addition to the initiatives already outlined above, the State has an overarching Energy Policy aimed at accelerating the pace of development of the State and make at par with other developed states. Key focus areas under the Energy Policy include:

- Rural electrification - to bring per capita electricity consumption at par with national level, State Government accords highest priority to providing electricity to all the villages and Majra/Tolas (Hamlets). Transmission & Distribution network shall be accordingly strengthened. Looking to the problems in electrification due to dense forest coverage, villages will be electrified through non-conventional energy resources wherever feasible;
- Energy for agriculture -- keeping in view the important role of agriculture in the State's economic development and low irrigation percentage, priority shall be accorded to energisation of agriculture pump sets. Recognising the importance of agriculture sector in the economic development of State, electricity shall be made available on priority to Lift Irrigation Schemes (LIS) also;
- Energy for industries: for giving impetus to industrial investment in the State. Specific policy segments encourage and incentivise captive power plants for industries;
- Generation -- including setting up of new power plants as well as renovation and modernisation of CSEB owned thermal power plants to improve plant load factor (PLF) and enhance generation; significant emphasis on RE power through enabling policies and incentives;
- Power sector reforms for financial viability and technical efficiency improvements;
- Development of non-conventional energy;
- Energy conservation and demand side management (DSM); and
- Consumer satisfaction;

Future and up-coming/planned power projects include:

Table 25: Future/upcoming power projects under CSPGCL

Projects	District	Commissioning Schedule
Korba South TPP (2X500= 1000 MW)	Korba	Unit 1- June 2014; Unit 2- Oct 2014
Bunji Bundeli TPP (2X250= 500 MW)	Korea	Tender issued for DPR
Bhaiyathan TPP, CSPGCL-India Bulls [JV] (2X660= 1320 MW)	Sarguja	2012-13
IFFCO-CSPGCL TPP, [JV] Prem Nagar (2X660= 1320 MW)	Sarguja	2013
Bodhghat HPP (4X125= 500 MW)	Dantewada	2017
Matnar HPP (3X20= 60 MW)	Bastar	2016
Kanhar HPP (2X25= 50 MW)	Sarguja	2016
Rehar HPP (3X32= 96 MW)	Sarguja	2016

In a move announced on 6 December 2012, the GoCD has also decided to set up a geothermal power plant at Tatapani, in the newly constituted Balrampur-Ramanujan district; a MoU with the National Thermal Power Corporation (NTPC) is expected to be signed soon.

9.4 Priorities

The overall State priorities of the energy sector have already been outlined in the State Energy Policy, in subsection 9.3 above. For the domestic and agriculture sector, priority has been given to electrification of BPL households, schools, hospitals, and energisation/line extension for irrigation pumps.

Several new small and large power projects of nearly 35,000 MW are in the pipeline. With State's policy of encouraging private players and joint ventures three large power plants with a combined capacity of 5,280 MW are in various stages of completion. Additional investments of 22,000 crore to generate 5,000 MW is expected to come in the 12th Plan period, subject to allocation of coal blocks and clearance of coal supplies.

In the national interest Chhattisgarh has been canvassing for establishment of pithead thermal power plants. This will not only keep cost of power generation low but also free the freight carrying capacity of railways. This has also been recommended by the Thirteenth Finance Commission and needs to be considered seriously for the energy security of the country. To compensate for the negative externalities that the host State bears, in terms of degradation of its land and water resources, it needs to be either allocated ten percent free power or allowed to impose a four percent duty on the power generated. This will enable it to plough back these resources for rehabilitating the surrounding population and natural resources.

Since power generation in Chhattisgarh is predominantly thermal –and with significant addition to thermal power generation capacity in the coming years, this distribution will get further skewed. High dependence on coal-based power generation, looking at the nationally projected shortfalls in domestic coal production, is an issue and the State is seeking to spread its risks. With attention shifting to cleaner production sources, coal-bed methane has become a vital source of energy and State will promote exploration and extraction of natural gas from its coal-beds.

As per targets, the State was to electrify all its villages and habitations in the 11th Plan. By March 2012, 548 villages and 10,906 habitations were still unconnected and the target seems difficult to achieve. Progress has been slow due to problems of initiating work in forest areas, adverse population norms of Rajiv Gandhi Gram Vidyutikaran Yojana (RGGVY) and lack of feasibility in many inaccessible areas, as well as LWE related security issues. The challenge in the 12th Plan will be to provide uninterrupted and metered power supply to all the villages and habitation, either through line extension or off-grid solutions.

Chhattisgarh has so far electrified nearly 1378 off-grid villages and promoted use of non-conventional energy. Despite abundant availability of biomass, schemes for community-managed biomass gasifiers and biogas-based plants have had limited success and need to be reviewed. The State will pursue CDM projects in energy efficiency and renewable energy, and use the resources generated to cover habitations ineligible for RGGVY.

Energy saved is energy generated. With high transmission and distribution (T&D) losses (transmission losses-3.7 percent and distribution losses - 30 percent) and presence of a large number of energy intensive industries and MSMEs there is vast scope for improving energy efficiency. In the 12th Plan industrial units and MSMEs engaged in energy intensive activities and agriculture sector would be encouraged to cut down waste. The target will be to cut energy wastage across sectors by ten percent and bring T&D losses at par with the national average by system strengthening and establishing new/efficient sub-stations to check losses.

Strengths of the private sector will be deployed in power distribution to improve efficiency and cost recovery to make distribution utilities viable so that they are in a position to continue providing cheap and affordable power to all. With a bullish growth expected in the power sector through the entry of private players, energy regulatory environment needs to be further strengthened to ensure access for all while taking care of environment.

9.5 Perceived Climate Impacts

While there have been no Chhattisgarh specific detailed studies on climate change available evidence shows several pointers on the impact the energy sector has on climate, as also the impact climate change is likely to have on the energy sector.

Energy services are a necessary input for development and growth. At the same time, fossil energy conversion, and end use, is recognized as a major contributor to global warming. Today 70 percent of greenhouse gas emissions come from fossil fuel combustion for electricity generation, in industry, buildings, and transport – and these emissions are projected to rise. By 2050, the global population will grow to 9 billion, with growth mostly concentrated in developing countries with improved living standards. If we continue as we are today, delivering energy services and sustaining economic growth will result in a tripling of annual greenhouse gas (GHG) emissions.

Efforts are under way, in developed and developing countries, to arrest and reverse the growth in GHG emissions and lower the carbon footprint of development. The energy sector is a primary target of these efforts. Consequently, capacity is being built to integrate lower carbon development objectives into long-term (20 to 30 year) energy planning processes. Experience and knowledge of new technologies and measures to lessen carbon footprints are being exchanged. There is significant focus on the major scale-up of renewable energy sources, efficiency measures (supply and demand side), loss reduction, and cleaner fossil fuel combustion technologies.

Energy services and resources will be increasingly affected by climate change—changing trends, increasing variability, greater extremes, and large inter-annual variations in climate parameters in some regions. Though potential climate impacts have been recognized strongly within the energy sector, the focus has mainly been on the responsibility for greenhouse gas mitigation rather than on the management of energy services. Climate impacts cross the entire energy supply chain. Impacts on energy supply and demand are the most intuitive but there are also direct effects on energy resource endowment, infrastructure, and transportation, and indirect effects through other economic sectors (e.g., water, agriculture). This exposure is driven in part by the current state of the sector (e.g., inefficiencies in energy and water use mean energy services are vulnerable and have less capacity to deal with change).

Increasing temperatures are almost certain to reduce heating demands but increase cooling demands overall, but inter-annual variability will remain and cold periods will not disappear. Seasonal demand profiles will alter responding to user needs for energy for heating and cooling in buildings, for industrial processes, and for agriculture (e.g., irrigation). Flooding and droughts will continue, with likely impacts on infrastructure (including silting of reservoirs), and on demand. Climate change may impact the generation cycle efficiency and cooling water operations of fossil fuel fired, nuclear, and biomass fired power plants.

The generation potential of renewables may change but is impossible to assess without additional locally specific study:

- Hydro-generation may benefit or suffer, or both at different times, from changes in rainfall;
- Solar generation may not be affected in a substantial manner, although some regions may see future decreased generation;
- Wind generation may be impacted either positively or negatively by local adjustments to the wind regime; and
- Biomass/biofuel generation could be affected by changes in cultivation regimes.

Energy transportation infrastructure (for power, oil, and gas) are also variously exposed to wind gusts, storms, storm-related landslides and rock falls, land movements, siltation and erosion processes, as well as changes in water basins. The table below summarizes potential impacts on the energy sector.

Table 26: Potential energy sector vulnerability to climate change

Item	Relevant Climate Impacts			Impacts on the Energy Sector
	General	Specific	Additional	
Climate Change Impacts on Resource Endowment				
Hydropower	Runoff	Quantity (+/-) Seasonal flows high & low flows, Extreme events	Erosion Siltation	Reduced firm energy Increased variability Increased uncertainty
Wind power	Wind field characteristics, changes in wind resource	Changes in density, wind speed increased wind variability	Changes in vegetation (might change roughness and available wind)	Increased uncertainty
Biofuels	Crop response to climate change	Crop yield Agro-ecological zones shift	Pests Water demand Drought, frost, fires, storms	Increased uncertainty Increased frequency of extreme events
Solar power	Atmospheric transmissivity	Water content Cloudiness Cloud characteristics		Positive or negative impacts
Climate Change Impacts on Energy Supply				
Hydropower	Water availability and seasonality	Water resource variability Increased uncertainty of expected energy output	Impact on the grid Wasting excessive generation Extreme events	Increased uncertainty Revision of system reliability Revision of transmission needs
Wind power	Alteration in wind speed frequency distribution	Increased uncertainty of Energy output.	Short life span reduces risk associated with Climate change Extreme events	Increased uncertainty on energy output
Biofuels	Reduced transformation efficiency	High temperatures reduce thermal generation efficiency	Extreme events	Reduced energy generated Increased uncertainty

Item	Relevant Climate Impacts			Impacts on the Energy Sector
	General	Specific	Additional	
Solar power	Reduced solar cell efficiency	Solar cell efficiency reduced by higher temperatures	Extreme events	Reduced energy generated Increased uncertainty
Thermal power plants	Generation cycle efficiency Cooling water availability	Reduced efficiency Increased water needs, e.g., during heat waves	Extreme events	Reduced energy generated Increased uncertainty
Oil and gas	Vulnerable to extreme events	Floods, erosion and siltation (coastal areas, on land)	Extreme events	Reduced energy generated Increased uncertainty
Impacts on Transmission, Distribution, and Transfers				
Transmission, distribution, and transfers	Increased frequency of extreme events	Landslides and flooding	Erosion and siltation Weather conditions that prevent transport	Increased vulnerability of existing assets
Impacts on Design and Operations				
Siting infrastructure	Increased extreme events	Flooding from sea level rising, coastal erosion Increased frequency of extreme events	Water availability Geomorphodynamic equilibrium	Increased vulnerability of existing assets Increased demand for new good siting locations
Downtime and system bottlenecks	Extreme weather events	Impacts on isolated infrastructure Compound impacts on multiple assets in the energy system	Energy system not fully operational when community requires it the most	Increased vulnerability Reduced reliability Increased social pressure for better performance
Energy trade	Increased vulnerability to extreme events	Cold spells and heat waves	Increased stress on transmission, distribution, and transfer infrastructure	Increased uncertainty Increased peak demand on energy system
Impacts on Energy Demand				
Energy use	Increased demand for indoor cooling	Reduced growth in demand for heating Increased energy use for indoor cooling	Associated efficiency reduction with increased temperature	Increased demand and peak demand, taxing transmission and distribution systems
Other impacts				
Cross-sector impacts	Competition for water resources Competition for adequate siting locations	Conflicts in water allocation during stressed weather conditions Competition for good siting locations	Potential competition between energy and non-energy crops for land and water resources	Increased vulnerability and uncertainty Increased costs

9.6 Strategies

The energy sector vision will be to strive for improved energy security in Chhattisgarh through multiple strategies including improving generation, transmission, distribution, scaling up use of renewables, promoting energy efficiency across all sectors, as well as fostering mechanisms for demand side management. A range of initiatives is already underway in the State as described above and also new initiatives are planned under the 12th FYP Approach Paper; additionally, the State has now developed policies for the RE power subsectors. The State recognises that while energy systems already take account of some climate risks in their operation and planning, adaptation measures can further reduce their vulnerability to environmental change, by building capacity and improving information for decision making, and integrating

climate risks into management and operational decisions, and as such, is committed to taking all necessary measures to build in climate concerns into energy sector policy, planning, and implementation.

The State has already planned a set of measures in the context of climate change, and these are given below:

Generation

Since coal based thermal power plants are the highest contributors in CO₂ emissions, the following actions will be taken to improve the overall efficiency of such thermal power stations:

- Renovation and modernisation of existing units to restore original efficiency along with reduced auxiliary power consumption and reduced chimney emissions;
- Adoption of super critical technology for all upcoming coal based power stations to have better efficiency and reduced emissions;
- Fly ash utilisation is part of each plant's environment plan. While some quantity of fly ash is used in land development, expressions of interest will be sought from cement manufacturers for use of fly ash for their current needs and future expansion projects;
- Sufficient green lands will be identified around future projects; and
- Feasibility of gas based and other alternative source power plants will be being explored.

Transmission

The following measures will be taken up to reduce transmission losses:

- Expansion of high voltage transmission network with latest and state of the art technologies and adequate coverage network to prevent loading beyond limits;
- Use of sufficient reactors and capacitors in the network;
- Replacement of old and jointed conductors;
- Better load management, efficient scheduling and use of information systems to achieve optimum network utilisation; and
- Proper upkeep of GSS transformers.

Distribution

The following measures will be taken to reduce AT&C losses:

- Replacement of old and jointed conductors;
- Procurement of start rated distribution transformers and load balancing of existing ones;
- Tariff structure to be such as to levy lower tariff for lesser energy consumption and ToD tariff, etc. to promote lower energy withdrawal and promote conservation;
- Underground cabling in green areas;
- Addition of adequate capacitors and upkeep of PSS transformers and distribution transformers;
- Expansion of network with high HT/LT ratio;
- Adoption of HVDS systems where feasible and putting into place effective anti-power theft measures; and
- To facilitate power supply for metro-rail schemes envisaged for cities as part of improving public transportation systems, which will also be expected to considerably reduce emissions.

Demand Side Management

The following demand side management measures will be taken up:

- Promoting the use of energy efficient pumps and motors in the State;
- Implementing promotion of CFLs under in identified pilot areas and expanding the scheme to other parts of the state in a phased manner; and
- Investing in building consumer awareness about energy efficient equipment and energy conservation measures.

Renewable Energy Projects

RE generation has a significant role to play in Chhattisgarh, and the State is taking significant measures to promote this subsector through CREDA. The State will explore the provision of banking and wheeling facilities for all grid connected renewable energy electricity generation projects up to 25 MW. Entry tax will be waived on capital costs for equipment for decentralised distributed generation (DDG) based renewable energy plants of less than five MW. The State will also encourage project developers to install or adopt mechanisms such as CDM for leveraging funds for renewable energy based projects.

Other Initiatives

In addition to the above, a range of other strategies/actions will be taken up:

Research, Climate Impacts Needs Assessment: Necessary research will be undertaken to develop comprehensive Chhattisgarh specific energy sector vulnerability analyses, and options for developing in-house skills for data analyses, modelling, and forecasting will be considered;

Awareness and knowledge exchange: Specific efforts will be made to document and disseminate experience and learn from the increasing data and knowledge of climate impacts on the energy sector, and their management;

Development of project screening tools: Templates to screen individual energy projects for climate vulnerability and risks, either retrospectively or during project planning and implementation will be developed;

Development of adaptation standards for the energy sector: Based on climate vulnerability assessments, adaptation standards for the energy sector will be defined, codified and adopted into standard operating procedures in all aspects of energy sector planning and implementation;

Retrofitting existing infrastructure: where required, based on climate vulnerability analyses, retrofitting of existing energy infrastructure will be taken up;

Promotion of energy efficiency: A range of initiatives to promote energy efficiency across all sectors of the economy and the public will be designed, and launched, to supplement/complement the initiatives already being undertaken or planned. These will indicatively include initiatives for taking up actions under Market Transformation for Energy Efficiency as prescribed in the National Mission for Energy Efficiency and will include measures for CDM, demand side management across all sectors, standards and labelling, public procurement, technology upgradation and replacement of inefficient equipment/appliances etc., energy conservation building codes, energy audits, etc.;

Capacity building: Steps will be taken up to increase the capacity of key stakeholders including energy sector policy makers, regulators, operators, and consumers for climate risk management.

Addressing poverty and equity concerns: Several studies clearly show gender differences in energy production, energy use, and access to energy and the participation of women in energy-related planning and decision-making. Especially in rural areas of developing countries, a lack of energy services is evident. Lack of access to energy mainly affects women in their role as household managers because they are usually responsible for providing energy for the household. Without access to convenient, affordable fuels for cooking and heating as well as efficient cooking devices, women have to spend large amounts of time and physical energy obtaining traditional fuels (such as wood, charcoal, dung and agricultural waste) to heat water and cook meals. Furthermore, energy is often a precondition for income-generating activities.

Energy poverty is also a growing problem affecting poor households in particular. The share of female-headed (single mothers or elderly) poor households is notably high. Indoor air pollution, a result of extensive use of fuel wood and other biomass burning or household energy, is a major problem affecting the health of women. The participation of women in energy planning and decision-making is extremely low. Therefore, the State will develop a separate equity focussed strategy to address rural energy security including substitution efforts for reducing fuel wood consumption in association/coordination with the Forest Department. Such a strategy should involve incorporating gender analysis at each step of policy, programme, and project planning and implementation will help to identify gender-related impacts, develop the right questions for further research and data collection, and make gender a standard consideration for planners and decision-makers. The power sector in its turn can support the strategy by livelihood enhancement by up-gradation of traditional watermills, poverty reduction, and livelihood enhancement by providing electricity facility through micro-hydro Projects and other such initiatives.

9.7 Institutional Linkages and Stakeholders

Institutional linkages are envisaged with virtually all State Government departments and other institutions, since efforts will be required across sectors, especially in the promotion of energy efficiency measures. Linkages are also envisaged with academia, civil society, international development agencies, private sector and financial institutions, and communities in general.

9.8 Linkages with the NAPCC

The outlined strategies herein are consistent with the NAPCC in general and with the national Mission on Energy Efficiency as well as the national Solar Mission. Additionally, they also have linkages with the all the other National Missions under the NAPCC.

9.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

10 Industries and Mining

10.1 Overview, Characteristics and Status

Chhattisgarh is among the richest Indian states in terms of mineral wealth, with 28 varieties of major minerals, including diamonds and ranks second in the country in mineral production. The state holds a major share of coal deposits in India, which has led to the State also being a major power producer and being power surplus. It is the only state in India to have tin ore reserves. About one-fifth of the iron-ore in the country is mined in the state and one of the best-quality, iron-ore deposits in the world is found at the Bailadila mines in the South of Chhattisgarh from where it is exported to Japan and other countries. Rich deposits of bauxite, limestone, dolomite, and corundum are also found in the state, making it the ideal location for low-cost of production of end products such as cement and aluminium. During 2009-10, the state had contributed 14.09 per cent in the national revenue from minerals.

Table 27: Production of key minerals²²

Mineral	Production – 2008-09 (Million Tons)
Coal	97.0
Iron-ore	32.9
Limestone	15.6
Dolomite	1.2
Bauxite	1.6
Tin (Concentrate)	57500*

*In kilogram

Chhattisgarh is making significant investments in industrial infrastructure. The Chhattisgarh Industrial Development Corporation has set up four Industrial Growth Centres, five Industrial Parks and 12 Integrated Infrastructure Development Centres (IIDC). The state has three notified SEZs. With excellent natural resource base, good rail and road connectivity to major ports and cities, direct air connectivity to all major metros, comprehensive natural gas pipe line network with a capacity of 30 MMSCDM across the State, excellent power supply and energy infrastructure, favourable policy initiatives such as the Industrial Policy 2009-14, SEZ Policy, and other such policies, investor friendly governance and support provided by the Chhattisgarh State Industrial Development Corporation (CSIDC) and the State Investment Promotion Board (SIPB), as well as a rich labour pool, the State is fast becoming an industrial powerhouse and an attractive investment destination for industries. Key industries in the State include mining, iron and steel, cement, power, IT and ITeS, biotechnology and pharmaceuticals, food processing, gems and jewellery, etc. Other industrial growth sectors include apparel, aluminium and metals, MFP and processing-value addition of MFP, handicrafts, automotive and engineering, etc.

The state is the iron and steel hub of the country. The Bhilai Steel Plant of Steel Authority of India Ltd (SAIL) produces more than 3 million tons of iron and steel per annum. In addition, substantial capacities have been set up by the private sector.

- Chhattisgarh contributes 28 per cent of India's sponge iron production; it has 91 plants in the sector;
- The state ranks third among all the iron-ore producing states in India; and
- In 2008-09, the state produced around 32.9 million tons of iron-ore.

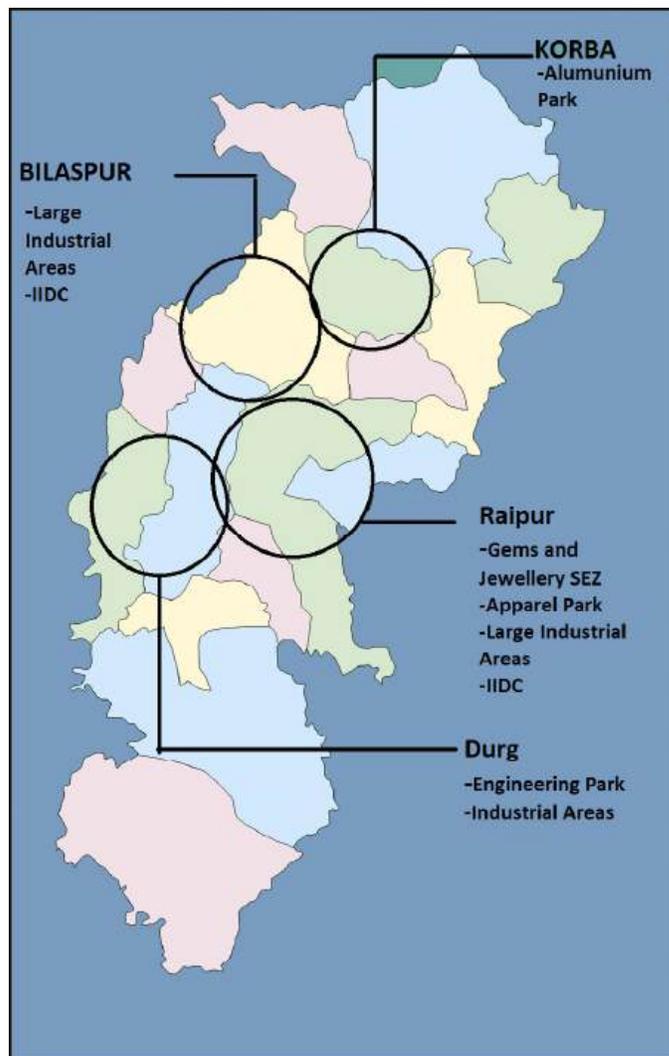
The state has widely occurring limestone reserves that support a strong cement sector.

- Chhattisgarh accounts for around 5 per cent of the total limestone reserves in India;
- In 2008-09, the state produced 15.6 million tons of limestone;
- The state has nine major and 12 minor cement units; a majority of the cement production units are concentrated in the Raipur area; and
- In 2009-10, total cement production in the state was 8.7 million tons.

²² Source: Mineral Resources Department, Government of Chhattisgarh

Not surprisingly, the State has consistently ranked amongst top three investment destinations in India from 2006. A comparison of state-wise share of investment intentions from January 2007 - May 2011 for all Indian states shows a 14 percent for Chhattisgarh, the second highest in the country (second only to Orissa, at 17 percent). A map showing key industrial clusters is given below.

Figure 21: Key industrial clusters in Chhattisgarh



The State also has a well-established MSME sector, with a large and diversified base. As of FY2011-12, 15,153 such units were registered in the state as of with a cumulative fixed capital investment of 1254 Crores and providing employment to over 81000 individuals.

10.2 Key Issues

(To be completed in discussion with the relevant State department/agencies)

10.3 Existing/On-going Initiatives

The above subsections have outlined the status of mining and industries in Chhattisgarh. The State is continually putting in efforts to maintain a favourable investment climate and enabling environment through a range of initiatives. Some of these are outlined below.

The State Labour Commissionerate has been created to formulate an industry- friendly policy, which can simplify the complexities of various labour laws. As a part of this policy, it has been aimed to reduce the quantum of inspection that is complaint based under various labour laws.

Simplified and consolidated annual return for various labour laws is also under active consideration. The State Unorganized Workers Social Security Act has been made in 2010 and in January 2011 Social Security Board has been formed for unorganized workers.

While the State already has a strong workforce base, this is being further enhanced by MoUs initiating the setting up of (a) International Institute of Information Technology (IIIT) at Chhattisgarh, and (b) setting up of ITI at Baloda, in the Champa-Janjgir District. The proposed IIIT shall be committed to the development of human talent and the availability of IT work force with special domains. The focus of the activities of the institute may be in the areas of bioinformatics, information and communication technology, Very Large Scale Integration (VLSI) and Embedded Systems, Computer Aided structural engineering etc. IIIT Chhattisgarh shall offer a range of degree programmes as well as Diploma with certificates. In order to increase employability and ensure availability of Technical Manpower, NTPC in association with Technical Education Department, Government of Chhattisgarh has proposed to set-up a new ITI at Village Baloda, district Champa-Janjgir under PPP mode. The proposed ITI will have all necessary infrastructure provision for providing quality technical and vocational training.

The State has a number of proactive and favourable policies in place to encourage growth of business. For example, the State Industrial Policy 2009-2014 aims at the following:

- To encourage development of allied sectors parallel to core sector.
- To generate self-employment as well as additional employment opportunities in industries to the local residents of the State.
- To promote private sector participation for the development of basic and industrial infrastructure.

Few of the salient features of the policy include:

Basic Infrastructure: PPP model of Common Rail Corridor will be established to provide connectivity to state's proposed industrial projects from mineral areas. For balanced industrial development, industrial areas will be developed for micro and small industries in different districts as per requirement. In large industrial area 20 percent reservation will be made for micro and small enterprises out of allocable land;

Administrative and Legal reforms: Continuous monitoring of action taken by various departments on common applications submitted in State Investment Promotion Board by Industries/investors shall be done at high level in order to immediately address of matter related to clearance of mega industrial projects. An information centre will be established in Raipur where workshops, seminar, training programme etc. will be arranged to educate the entrepreneurs on export promotion related activities. Raipur Inland Container Depot will be made well equipped so as to enable direct export from the state. Efforts will be made towards strengthening the "Foreign Trade Office";

Entrepreneurship and human resource development: With the help and co-ordination with the financial institutions, Entrepreneur Development Cell will be established in SIPB, Raipur for maximum and optimum utilisation of available human resources, creating interest towards industries amongst the youngsters and training related to self-employment plans. Technical information relating to establishment of Industries and Government schemes will be made available to Entrepreneurs by effective media. Model project profiles of probable industry will be made accessible to entrepreneurs at District Trade and Industries centres for the District; and

Exemption/Concessions for Promotion of Industrial Investment: Industries shall be granted subsidy/exemption/concession in following items as per their entitlement: interest subsidy, fixed capital investment subsidy, and exemption from electricity duty.

Chhattisgarh, situated in the heart of India, is endowed with a rich cultural heritage and attractive natural diversity. The State is full of ancient monuments, rare wildlife, exquisitely carved temples, Buddhist sites, palaces, waterfalls, caves, rock paintings, and hill plateaus. Most of these sites are untouched and unexplored and offer a unique and alternate experience to tourists compared to traditional destinations which have become saturated. The State has taken a conscious decision to do away with past legacy issues and to adopt a fresh approach to Tourism Development. The Tourism Policy is focused on showcasing the uniqueness of the State and to position it as an attractive destination for both domestic as well as foreign tourists.

Propelled by its huge mineral reserve, Chhattisgarh has been the preferred hub for investments. The products like sponge iron, Steel Castings, Special Alloy Castings, Steel Fabrication etc. have high demand and are exported. The State witnessed export of ` 19,178 million in the 2009-10.

Investments made in Chhattisgarh include the following:

- 418 industries already established with fixed investment of more than Rs. 4,250 million in URLA growth centre
- 48 industries established with fixed investment of around
- ` 7,160 million in Siltara industrial growth centre
- 324 industries already established with fixed investment of more than ` 4,470 million in Sirgitti industrial growth centre
- 44 industries established with fixed investment of more than ` 1,360 million in Boral industrial area. Investments approved/proposed in the State. The State Government has approved project cost (excluding cost of land) for developing Large Industrial Area at Bilaspur for an amount of ` 591.3 million; at Raipur for an amount of 1,770 million; and at Rajgarh at an amount of 915 million respectively

- Bharat Aluminium Company (BALCO) is executing ` 47,439 million expansion plans to increase its Aluminium plant production capacity from 100,000 tonne per annum to 345,000 tonne per annum.
- To promote Engineering Industries in the State, an Engineering Park is proposed to be set up in Industrial Area Bhilai on 120 ha of land
- Establishment of Poly Park at Tilda district, Raipur on 37 ha has been proposed. This will be developed as a cluster of polymer industries.
- Three New Rail Corridors being developed in the State having total length of 452 Km with a proposed investment of ` 4,500 Cr – (a) Eastern Corridor (180 Km) - Bhupdevpur- Garghoda- Dharmarajyagarh- Korba- Dongamoha; (b) East-West Corridor (122 Km) - Gevra road- Dipka- Katghora- Sindurgarh-Pasan- Pendra road; and (c) Northern Corridor (180 Km) - Katghora- Parsa- Surajpur. The railways, SECL and the State Government are the key stakeholders with provision for allowing private users in future.

Chhattisgarh attracted foreign direct investments (FDI) in power, manufacturing, services, and mining and construction sectors. The power sector attracted highest FDI of around 70 per cent of total foreign fund inflow. This confirms the State's reputation of being the "Power hub of India." The State has huge potential to attract investments in Power sector. A summary of key investments planned in Power sector include:

- Korba is termed as the Power Capital of India with National Thermal Power Corporation's (NTPC,) super thermal power plant working at 90 percent PLF. In the next three years, Korba would start generating 10,000 MW of power. This would be facilitated by South Eastern Coalfields Ltd, Bilaspur, which is doubling its production from 35 million tonnes to 70 million tonnes per annum.
- NTPC has invested in constructing a 2,640 MW Sipat Super Thermal Plant. In addition, foreign private players such as UK based KSK Power Venture Plc are investing over ` 188.7 billion to set up a 3,600 MW thermal plant in the State.

As in the case of the power sector, the CECB has also been playing an important regulatory and recommendatory role in the industries and mining sectors. It recommends and has been advocating for the use of waste-heat recovery based systems for co-generation, for sponge iron and cement plants. It also advocates fuel saving by not re-heating of billets and direct transfer in sponge iron plants having steel re-rolling mills. It has also benefited the cement sector by giving permissions for using new technologies for use of hazardous wastes for co-generation in cement kilns, thereby ensuring coal replacement by 2-3 percent. In the mining sector, CECB suggests a phased/controlled approach to forest felling in large mining leases.

10.4 Priorities

Going by the principles of the market Chhattisgarh has nearly all that it takes to attract large number of industries and huge investments inflows. Compared to other States, it has relatively better availability of 'modern' factors of production- locally available and abundant raw material, good quality land, adequate and clean water, low-cost labour, surplus power, and proximity to two major ports of the country. However, despite these qualifications the State has been unable to attract the scale of investments that it has potential for, primarily owing to reasons cited earlier- poor physical infrastructure, limited skilled labour, locked resources and LWE.

Box 4: Priorities for industrial development

1. Improve industrial and physical infrastructure in the state
2. Encourage labour-intensive industries through cluster-based industrial development
3. Promotion and incentives for units engaged in agro-processing and value-addition of NTFPs
4. Attract large downstream industries for state's mineral reserves & natural resources-including capital/ consumer good and pharmaceutical
5. Technical, financial and consultancy support for state-based MSMEs
6. Encourage growth of rural industries and the service sector
7. Special incentives for industrial development in rural areas
8. Improve revenues from mining and mineral extraction

Industrial growth in the first three years of the current plan was 11 percent against a growth target of 12 percent. Though the State has been addressing other issues for speeding growth with great urgency, changes in national policy are required for either unlocking its natural resources or creating alternative paths for growth.

In terms of scale of contribution to national production- 15 percent of India's cement, 30 percent aluminium, and 27 percent Steel and Sponge iron is produced in Chhattisgarh. While cement industry is dominated by large private manufacturers, industry profile of the State is marked by mega mineral-based units of major Public Sector Undertakings of India. A number of MSME and ancillary clusters have developed around these establishments to cater to their ancillary needs.

Industrial sector is the second largest employer with more than 28 percent of the workforce engaged in manufacturing and processing, including small-scale and cottage industries. Bulk of the State industries are mineral based- cement, steel, aluminium and coal-based thermal power, owing to its rich reserves of coal, iron-ore, bauxite, tin, dolomite and limestone. While Chhattisgarh has an unquestioned comparative advantage in mineral-based industries, it will now look at attracting industries that work in diversified sub-sectors and has set in motion initiatives for establishing special industrial zones for herbs-medicines/ food processing/ gems-jewellery/ engineering.

Thrust of Chhattisgarh's Industrial Policy (2009-14), which covers part of 12th Plan period, has been on attracting investments for industries that generate employment and encouraging private sector participation in industrial infrastructure development. Added incentives have been offered to industries choosing to locate in economically backward areas and for employing local youth to correct the regional imbalance; these incentives will continue.

Priority in this policy has been placed on agro-processing, automobile and auto-ancillary, white/consumer goods, IT/ITeS, logistics & warehousing, pharmaceutical, plant/ machinery/ engineering industries and units manufacturing downstream products from non-ferrous metals. Rural industries as a whole have been identified as a priority and incentives created for them.

Due to persistent government efforts at drawing large private players, major corporate groups are now setting integrated steel plants with investments of more than ` 17,000 crore. An additional production capacity of nearly 10 million ton steel is being created in the economically backward districts. The plants will be functional during the 12th Plan and boost local employment and development around these areas. The State has already established itself as the steel, aluminium, and cement hub of the nation; in the 12th Plan it will aggressively sell its locational advantage to capital and consumer goods industries that use steel and aluminium as their basic raw material.

To improve industrial infrastructure and simplify its business environment, Chhattisgarh has been developing industrial areas/parks throughout the State to encourage cluster-based industrial development and providing single-window clearance for reducing transaction costs to the investors. It is also promoting PPP based partnerships for infrastructure development in these industrial areas. The State has already established four Growth Centres, 3 industrial areas and two dedicated industrial parks (for Metals and Apparel), Small Industrial Areas in Mahasamund, Kabirdham and Surguja districts and is establishing five Integrated Infrastructure Development Centres -IIDCs at Janjgir-Champa, Bilaspur, Raipur, Dantewada, and Raipur.

Further improvement in infrastructure is proposed for developing three mega-industrial projects in Raipur, Bilaspur, and Raigarh for steel, ferro-alloys, power plants/captive power plants and other core industries. For all upcoming industrial development projects, the State will aim to provide quality physical and IT infrastructure and undertake a modernisation and upgradation of existing industrial areas.

Potential benefits and impact of Primary sector (especially agriculture) remain limited unless one is able to work along the commodity value-chain for reaping the benefits of secondary and tertiary processing. An area where the State falls behind is agro-processing. While there is a huge volume of inter-state trade of agricultural commodities and NTFPs, processing facilities within Chhattisgarh are few. Promotion of agro/ agro-processing industries will be the utmost priority in the next plan. At least 50 percent of all agro-processing units will be mandatorily set-up near the farm gate for facilitating direct transactions between producer groups and processing units. To boost agro-processing, a good network of rural warehousing, cold storages, and cold chains is required and has been identified as a priority. Incentives on investments in rural areas are being provided and PPP projects for setting up such facilities at vantage locations will be encouraged.

Another sub-sector where State's potential is vastly untapped is pharmaceuticals. Many drugs use plant-based derivatives and there is availability of raw material- medicinal and aromatic plants for many such formulations. This provides the economies of scale for large pharmaceutical and herbal medicine companies to explore business ventures. A dedicated industrial park has also been set-up to encourage investments in this area.

Export promotion is another area that needs urgent attention. Current exports stand at around ` 2000 crore, but only include steel, iron, aluminium, cement, mineral, and engineering products and blended yarn. Very few value-added and finished products are being exported. Emphasis needs to shift from export of raw material to that of value-added products that match global standards and help boost export earnings.

Till recently, one of the biggest constraints of the secondary sector was lack of skilled local labour and professionals for the industry. To bridge this gap, new technical training institutions have come up and Chhattisgarh can now offer quality human resource to meet the industry requirements-current and future. Close link between industry and technical training institutions will be developed for offering knowledge and skills relevant to the industry profile of the region. Local ITIs and polytechnics will be linked to industrial areas and offered skills based on local demands. More Apparel Training and Design Centres (ATDCs) will be established in backward districts and industry associations encouraged to establish private ITIs and polytechnics to develop skilled work force in new trades.

MSMEs absorb a large workforce and contribute nearly 40 percent to the industrial output. They will be promoted in the next Plan and incentives created for supporting existing and new units. As declared in State's Industrial Policy, provisions have been made to reserve 20 percent land of all industrial area/ parks for micro and small industries.

With small scale of operations, shifting market preferences and reducing margins in a highly competitive market, MSMEs need State support for retaining their competitiveness through continuous process strengthening and technology improvement. Process and product

standardization has been encouraged among small enterprises for availing Global Quality Certifications and developing technical patents. Entrepreneurship development will be promoted and extended technical and skill-upgradation support for business development. A State-level Consultancy organization will be established to provide technical support and encourage innovations /green-field projects.

In 2009-10 the national production of major minerals was valued at ` 89,500 crore to which Chhattisgarh contributed 13.36 percent or ` 11,963 crore- but received just ` 2461.46 crore as mineral royalty. There has been a consistent increase in the production of all the major minerals mined in the state. In terms of revenue- Coal brings the highest royalties- 47 percent of mineral revenues, followed by Iron-ore- 42 percent. However, there have been pipeline breaks in supply of raw material for State-based industries in the past. The first charge upon any national resource should be of its domestic industry, and looking at the additional iron-ore requirements of the domestic steel and sponge iron industry, the Central Government will need to review its policy on iron-ore export and make it available locally. Similarly, long-term coal linkages should be provided for power plants based in the State.

Being the trustee of a large natural resource base of the country, the State has the added responsibility of ensuring that its natural resources and population does not suffer negative impacts of polluting industries. While encouraging industrial development, several steps have been taken for strong enforcement of environmental protection laws. Periodic energy audit, effluent treatment, utilization of recycled water and hazardous waste disposal has been made mandatory for such industries. Several new Public and Private sector thermal power plants are coming up and given their huge demand for water, the creation of dedicated water reservoirs for industrial use will be explored in near future.

Balanced regional development requires creation of employment opportunities in rural/backward areas. Small industrial areas have already been established in Mahasamund, Kabirdham and Sarguja districts and two more are being set-up in Dantewada and Janjgir-Champa. IIOCs are also being established at nine rural locations- five of which will be in LWE affected areas, primarily to promote closer agriculture-industry linkage and generate local employment. The state aims to create at least four more Small Industrial Areas in Kanker, Jashpur, Sarguja and Kabirdham in near future.

Incentives are extended to industries employing high unskilled labour and those setting up units in backward areas. Additional incentives created in the State's Industrial Policy, for SC/ST and women entrepreneurs, through higher Capital and Tax subsidy, exemptions in land premium/diversions, margin-money subsidy for meeting working capital and capital expenditure requirements will continue.

Rural Industries are a priority and several initiatives to promote and encourage them have been taken. For the handloom sector (engaging more than 80,000 weavers) eight Integrated Handloom Development Clusters have been developed and linked with skill upgradation, design support, credit, and subsidies to produce export quality fabric. Support in the form of credit, subsidies and technical inputs will be further extended for such family-based enterprises in coming years.

Handicrafts from the State are steeped in its rich culture and each region has its signature style and a preferred medium. Terracotta, wood, wrought iron, and bell metal are the four media through which the artisans of Chhattisgarh express their creativity. There is a huge demand for Chhattisgarh handicrafts not only in the domestic but also in the international market. Support will be continued for better market linkages and design modifications to suit contemporary tastes and improve their export potential.

10.5 Perceived Climate Impacts

While there have been no Chhattisgarh specific detailed studies on climate change available evidence shows several pointers, as in the case of the energy sector. Industry is likely to be vulnerable to a variety of climate risks, including extreme weather events that can adversely impact industrial infrastructure. Agro-based and food processing industries that rely on agricultural resources can be particularly vulnerable. Likewise, industries that are either water or energy intensive could also be similarly vulnerable to climate change and its impacts. Because of their financial and technical resources, large industrial organizations typically have a significant adaptive capacity for addressing vulnerability to weather extremes. SMEs typically have fewer financial and technical resources and therefore less adaptive capacity. As such, climate change is likely to disproportionately impacts smaller industrial establishments, in particular those in high risk or highly dependent on climate vulnerable resources such as agriculture.

On the other hand, industries could also contribute to climate change. The industrial sector emissions of GHGs include CO₂ from energy use, from non- energy uses of fossil fuels and from non-fossil fuel sources (e.g., cement manufacture); as well as non-CO₂ gases. Many industrial segments also emit a range of non-CO₂ GHGs including N₂O from the chemical and food industries. Industries can also contribute to climate change by a variety of other means, including energy inefficiency.

10.6 Strategies

Towards improving scientific knowledge and evidence base and understanding of climate change and its impacts, the Department will commission cluster-wise or district-wise studies to estimate the carbon footprint of industrial clusters in the State. This would include a baseline study, as well as periodic studies.

In line with the overarching State objectives of improving governance mechanisms, institutional decision-making and convergence, the State, through the Industries Department and other agencies and together with various industries associations will initiate the following:

- Carry out a review of the current industrial policy and strengthening it with reference to climate change including explicit incorporation of climate concerns and the institutional and governance framework for climate change initiatives vis-à-vis industry will be enshrined in a proposed new Industrial policy;
- Constitute a state-level Task Force, comprising representatives of the state government, industry, and technical experts to drive the climate initiatives of the CSAPCC. The possibility/viability of establishing cluster-wise or district wise Sub-Task Forces will also be examined.

The Industries Department recognises that many options exist for mitigating GHG emissions from the industrial sector, in three broad categories:

- *Sector-wide options*, for example more efficient electric motors and motor-driven systems; high efficiency boilers and process heaters; fuel switching, including the use of waste materials; and recycling;
- *Process-specific options*, for example the use of the bio - energy contained in food and pulp and paper industry wastes, and various heat/energy recovery technologies as well those to reduce process specific emissions; and
- *Operating procedures*, for example control of steam and compressed air leaks, reduction of air leaks into furnaces, optimum use of insulation, and optimization of equipment size to ensure high capacity utilization.

As such, the State will identify and put into motion processes for leveraging these options in existing industrial units, as well examine ways to build these into plans for the development of new industrial units. While it is clear that industries will not invest in GHG mitigation if other factors provide a return on their investment, the State will examine ways of incentivising such investments and linking it to initiatives such as energy efficiency projects, through which economic gains can accrue. Where industries lack of the financial and technical resources needed to implement mitigation options, and have limitations in the ability to access and absorb technological information about available options, the State will seek to build adequate linkages with financial institutions as also to build capacities of industrial establishments (potentially in partnership with other relevant agencies/institutions/industries associations).

The State will also seek to develop appropriate policy and regulatory instruments that encourages the implementation of existing and new mitigation technologies that could lead to lower GHG emissions, and seek to develop policy portfolios that reduce the barriers to the adoption of cost-effective, low-GHG-emission technologies, including CDM. The State will also examine the possibility of promoting voluntary agreements between industry and government to reduce energy use and GHG emissions as part of its policy package.

The State will promote and build awareness, and develop and deploy measures to incentivise industries to adopt a range of management practices including energy audits, adoption of energy efficiency measures and technologies, benchmarking, etc. Likewise, the State will also build awareness on options, opportunities and benefits of fuel switching, including the use of waste materials, energy (especially heat and power recovery), cogeneration, use of renewable energy including biomass and by-product wastes based generation, and materials efficiency and recycling. Efforts will also be initiated to undertake infrastructural improvements in industrial areas in the State.

The State will also examine the options for developing and deploying a range of financial instruments such as taxes, subsidies and measures to improve access to capital as these could potentially lead to energy savings and corresponding emission reductions and can create a larger market for energy efficient technologies. At the same time, the Department will also examine options for budget allocations for research and development on innovative technologies, subsidy, or legislation to stimulate specific environmental technologies, or regulation/disincentives to reduce/eliminate use of unsustainable technologies.

The State will also take proactive steps to build partnerships with industry associations, and through them, initiate sustained process to stimulate technological innovation and change to reduce dependency on imported fuels, to improve resources use efficiency, waste management, water and air pollution reduction, and enhance use of renewables, while providing health benefits and improved services to communities. Sector specific studies will also be undertaken, to examine options for improvement – these will include, for example, the brick making sector, which generates significant emissions from a large number of brick kilns in the state.

The State will undertake a study of the mining sector, its status, and prospects from the standpoint of climate change and its impacts in association with the Department of Minerals and/or other appropriate agency. Appropriate strategies and actions for the mining sector, if required, will be developed on the basis of the findings of the study.

10.7 Institutional Linkages and Stakeholders

Institutional linkages are envisaged various agencies/departments including CSIDC, SIPB, the energy/power related agencies/departments, Water Resources Department, Forest Department, and others in addition to linkages with various industries associations, industrial groups and entrepreneurs, as well as with academia, civil society, international development agencies, private sector and financial institutions, and communities in general.

10.8 Linkages with the NAPCC

The outlined strategies herein are consistent with the NAPCC in general, as well as with the National Mission on Energy Efficiency, the National Solar Mission, the National Mission for Sustainable Agriculture, and the National Water Mission.

10.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

11 Human Health

11.1 Overview, Characteristics and Status

Key Health Indicators and Performance

Chhattisgarh is continually recording considerable positive growth in the field of Health and development, but still has a long way to go to reach parity with National levels.

Table 28: Table: Demographic Profile of Chhattisgarh²³

Indicators	India				Chhattisgarh			
	2000	2005	2008	2010	2000	2005	2008	2010
IMR Total	68	58	55	53	79	63	59	57
IMR Rural	74	64	61	58	95	65	61	59
IMR Urban	44	40	37	36	49	52	49	48
Birth Rate Total	25.8	23.8	23.1	22.8	26.7	27.2	26.5	26.1
Birth Rate Rural	27.6	25.6	24.7	24.4	29.2	29	28	27.6
Birth Rate Urban	20.7	19.1	18.6	18.5	22.8	20	19.9	19.3
Death Rate Total	8.5	7.6	7.4	7.4	9.6	8.1	8.5	8.1
Death Rate Rural	9.3	8.1	8	8	11.2	8.4	8.5	8.5
Death Rate Urban	6.3	6	6	5.9	7.1	6.9	6.5	6.4
Natural Growthrate- total	17.3	16.3	15.7	15.4	17.1	19.1	18.4	18
Natural growth rate-rural	18.3	17.5	16.8	16.5	18.1	20.6	19.5	19.2
Natural growth rate-urban	14.4	13.1	12.7	12.6	15.7	13.1	13.1	12.9

The Total Fertility Rate of the State is 3.4 a little high above the national level of 2.9. The IMR for the state has come down currently to 57 from previous figure of 95 at the time of formation of the state. This is a major achievement for the state considering the fact that any reduction in IMR requires synergistic efforts from several departments and improvement in social status. The Maternal Mortality Ratio of 335 is slightly higher than the National average. The Sex Ratio in the State is 989 a favourable one, compared to 933 for the country.

Over the last ten years the State has taken several strides to improve the delivery of health services and has been able to achieve some progress in bringing down its adverse health indicators. Sectoral allocation for Public health currently stands at 5 percent of Plan Expenditure and 0.7 percent of the NSDP. There is much scope for increasing the outlay on health in the 12th Plan, as also recommended by Planning Commission's Approach Paper.

Health Infrastructure

The overall health infrastructure of the state has been quite poor when the state received its own independent status. Until recently, there was only one medical college for modern medicine in the state at Raipur. Similarly, the number of sub centres, primary health centres or community health centres were way below the requirement, keeping in mind that the state was sparsely populated with very remote and difficult to reach terrain with almost half of its land covered with dense forests. In the past attention was focused on improvement of health infrastructure to increase coverage and to subsequently make a dent on these indicators. As a result, facilities have seen a quantum increase in numbers from six District Hospitals to 16, Community Health Centre (CHCs) from 114 to 148, Primary Health Centre (PHC) from 512 to 757 and Sub-Health Centre from 3818 to 5112 in the past decade. Additionally, the number of approved Anganwadi Centres (AWCs) has increased from 20,289 in 2001 to 43,763, and mini-AWCs from 836 in 2001 to 6,548 by 2011, mainly for reaching the remote and dispersed populations. Integrated Child Development Services (ICDS) beneficiaries have also doubled in this period. During Eleventh Plan period alone 9000 new AWCs and 4200 mini-AWCs have been constructed so far. The state is also having presence of large number of indigenous practitioners in the form of Ayurveda, Unani, Siddha, and other systems along with Homoeopathy.

Table 29: Health Infrastructure of Chhattisgarh²⁴

Health Institution	Number(2007)	Number(2008)	Number(2009)	Number(2010)
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²³ Source: NRHM PIP 2011-12, Chhattisgarh

²⁴ Source: RHS Bulletins, Ministry of Health and Family Welfare, Government of India

Medical College	3	3	3	3
District Hospitals	14	14	17	17
Community HealthCentre	113	137	143	148
Primary Health Centre	659	721	716	741
Sub-centre	4164	4758	4776	5076
Ayurvedic Hospitals	6	6	6	6
Ayurvedic Dispensaries	633	634	634	635
Unani Hospitals	0	0	0	0
Unani Dispensaries	6	6	6	6
Homeopathic Hospitals	0	0	0	0
HomeopathicDispensary	52	52	52	52

11.2 Key Issues

The State had developed its own health targets that were more ambitious than the Millennium Development Goals. These were to reduce malnutrition by 33 percent, IMR by 66 percent and MMR by 75 percent, but Chhattisgarh still has a long way to go. While the achievement is significant, challenges remain high in terms of further reducing under-five malnutrition, anaemia among children of 6-36 months age group and importantly addressing the gender gap in health status on priority.

A major challenge posed to the state is the need to arrest severe and acute malnutrition grappling more than half its children. Limited ante and post-natal care, poor feeding practices among pregnant/ nursing mothers and among children, lack of adequate sanitation are among the reasons for this high level of malnourishment. About 45 percent children under 3 years of age are stunted and nearly 18 percent are wasted. As per NFHS-3, only 55 percent women in the state received the mandatory three ANC check-ups and only 25 percent received post-natal care within 2 days of delivery. While exclusive breastfeeding is practiced by more than 82 percent of the nursing mothers, colostrum is being fed by only one-fourth of the nursing mothers. The rural sanitation coverage in the state is only 57.26 percent, one of the worst amongst major states after Bihar and Jharkhand.

The biggest bottleneck is the placement and retention of medical practitioners. Additional incentives are required for retention of senior health personnel, especially those serving in LWE areas. Current ownership of health services by PRIs is weak, as a result of which local accountability of health services is poor. Functionaries report to their line department and PRIs having little role in monitoring services. Though Panchayat Health Committees are supposed to perform this oversight, at present it is more in terms of tracking financial progress and quantitative indicators and less with quality. The primary reason for this is lack of institutional linkage with health services, something that has also been flagged in 12th Plan Approach Paper.

11.3 Existing/On-going Initiatives

The State has been undertaking extensive initiatives in the health sector. Some of these are outlined below.

Governance Reforms: Empowerment of Panchayati Raj Institutions and improved efficiency of health systems are two cornerstones of National Rural Health Mission (NRHM). The mission document envisages setting up a platform for involving the Panchayati Raj institutions and community in the management of primary health programmes and infrastructure; train and enhance capacity of PRIs to own, control, and manage public health services. Further, it counsels to strengthen existing PHCs through better staffing and human resource development policy, clear quality standards, better community support and an untied fund to enable the local management committee to achieve these standards. Integrating vertical Health and Family Welfare programmes at State, District, and Block levels is another dimension of this mission. Chhattisgarh initiated several reforms in view of the above objectives. Some of the important ones are briefly described below.

- One of the key efforts of the state is appointment of a Health Commissioner at state level. The Commissioner will supervise and coordinate the activities of three state level Directors, viz. Directors of Family Welfare, Health Services and Health Training;
- Devolution of Powers to Block Medical Officers -- This is a bold step taken by the State. The Block Medical Officers have been given the power of Drawing and Disbursal Officer. Through this measure, more decentralized decisions making on health activities and quick fund release and utilization have been materialized. This effort will bear fruits after sometime and then it is likely to be held as key step in decentralised planning and implementation process; and
- Integrated Health Equipment Management System -- Health sector is mainly a service sector with 60 – 65 % of the cost going for remuneration. However, 25 – 30 % of the cost is spent on drugs and equipment. Therefore, this area offers an opportunity to undertake measures for cost containment. Keeping this in mind, the Chhattisgarh Health Equipment Management System has been created as a part of an integrated inventory management system. There are one State Cell and two regional workshops under this system. This system is taking care of rationalized procurement, immediate repair of small equipment, supervising the annual maintenance contract for costly

equipment. Moreover, this system is undertaking capacity building measures to improve the skills and knowledge of different cadres of technicians in preventive maintenance and repair.

After the state formation, health sector reforms in the state have been given a major thrust and the state has achieved stupendous success in bettering basic health indicators, in ensuring quality health services and in improving the public health infrastructure. The rural infant mortality rate has registered a major decline during this period. In 2003, the Rural IMR was 77 per 1000 live births whereas presently it is 57, which is equal to the national average.

It could also be seen that the health service indicators like Contraception prevalence rate, women receiving antenatal care (ANC), Children receiving full immunisation has improved in a much visible manner and malnourishment among children has decreased. One of the major community level achievements marked is the growth in breastfeeding- the colostrum feeding, early initiation of breastfeeding as well as exclusive breastfeeding- that has extreme potential in reducing the neonatal mortality. Another achievement has been the reduction of malnourishment among children below three years. Apart from above, the state was able to record major achievements in disease control – such as for yaws, polio, leprosy, etc. Towards achieving better impact of tuberculosis (TB) control programme, the first step that the State adopted was to expand the programme to cover all 16 districts whereas it was covering only four districts earlier. In Malaria control, the major achievement is the very efficient level of control in malaria epidemics- this is despite the fact that the state is highly endemic if compared to any other state of the country. The death tally, which was 98 during the period 2000-03, has been brought down to 15 in the last 3 years. The Annual Parasite Incidence (API), which was 10.6 in 2003, has been brought down to 5.6 as result of the dedication rendered by the Health Department. Still, three of the southern districts where API is high are under high focus.

Towards Controlling HIV/AIDS, the awareness programmes as well as voluntary counselling/testing has been optimised. Effective target intervention as well as blood transfusion facilities has been achieved as well as the state was able to successfully negotiate for making anti-retroviral (ARV) treatment available for the state which was not available till 2004. Fifty-two integrated counselling and treatment centres and 33 STD clinics initiated. Initiation of state of the art model blood bank and the constitution of state blood transfusion council are also notable achievements.

The Scenario of Blindness control has improved to one of the best programmes of the country during this period. We could initiate a Public Private Partnership also, in the area of advanced eye care, with MGM Eye Institute, Raipur. In order to make advanced health care facilities, especially cardiac surgery, available to the people, the MoU with Escorts hospital was renewed with more pro-poor clauses and conditions. Similarly, a new 100-bedded cancer hospital is coming up in Raipur as a joint venture with Vedanta. A special programme to control Sickle Cell Anaemia, a specific disease prevalent in the state is also being run. Operational research, mass screening and counselling as well as other measures initiated where support from Red Cross society is also availed. An Integrated Disease Surveillance Programme has been launched in order to sharpen the operations related to disease control initiatives.

The Reproductive & Child Health Programme as well as National Immunisation Programme also has been implemented by the state with utmost priority. Under Janani Suraksha Yojana, the institutional delivery level has gone up which was about 33 percent better planning, of optimum use of technical efficiency and of bringing together all stakeholders. The government has taken major initiatives to improve the community participation in health, quality of health care services as well as adequate health infrastructure and work force provisions. An innovative institutional model has been set up in the form of state-civil society joint initiative, the State Health Resource Centre to shape the reform processes and to initiate them wherever it is necessary. Some initiatives that the state took are widely appreciated, like:

The Mitani Scheme of community based health services, what began, as very small community level project has become a model and path paver scheme for the entire country. The scheme has undergone a major expansion during the last few years to a massive coverage of about 60000 Mitanis or voluntary health activists who are giving their voluntary services in every hamlet and in every nook and corner of the state.

In order to improve the quality of management of the government run hospitals and to change the perceptions of general community about the poor quality of services in government hospitals, a pioneering hospital reform scheme called the Jeevan Deep Scheme has been put in place in the state. Under this novel scheme a more responsive, more representative, more people oriented and more target centric hospital management committees called Rogi Kalyan Samitis (Jeevan Deep Samiti, in Chhattisgarh) have been created for every level of government hospitals up to the PHC. Chhattisgarh is the pioneer state to have launched such a people friendly target oriented scheme. It will be a marked departure from the old Rogi Kalyan Samitis, which were running the hospitals earlier. Korba, Ambikapur and Durg are Silver Star hospitals. The Korba and Kanker District Hospitals have been certified for ISO 9001:2000.

Under NRHM, adequate funds are available for improvement of existing infrastructure and supply of necessary equipment as per IPHS norms. Many infrastructure assets have been already developed so as to provide specialist services and emergency health care to the people especially in the rural areas. But the most daunting task is to ensure availability of qualified specialists. Considering all this aspects in the state, department decided to operationalize the selective health facilities to improve the service delivery and better coverage.

A new web site for the Health Department has been designed in which all the important correspondence and guidelines will be incorporated and updated on a regular basis. All the demographic and statistical information of all the programmes have been uploaded. The information of state specific programmes information is also given. The National level newly started programmes of RSBY and JSY have been given due importance. All the guidelines and instructions to the district and block level would be uploaded regularly.

Moving towards health for the poor, a state health mission has been constituted under NRHM, Chaired by the Hon. Chief Minister. State, District, and Block programme Management Units are supporting the mission activities at respective levels. Decentralised planning and management of resources to address local needs has become a reality. Taking all stakeholders on board, the State Health & Population Policy has been prepared and this shall be notified soon. In addition, Vision-2020 for health sector has been adopted. A new act for regulation of clinical establishments under private sector is drafted and approved. Further the rules for the same are being conceptualised and draft in process.

A Human Resource Development policy for health has been adopted and a State Institute for Health and Family Welfare (SIHFW) has been created to take forward the implementation of this policy. A state of the art building for SIHFW has been completed and the institution has given adequate work force and logistical support in terms of achieving its goals. It is aimed that the capacity and motivation gaps among the field force be addressed through systematic planning and implementation of training programmes initiated by SIHFW.

In the area of medical education, a promising scene has been created. One more medical college has been opened in Jagadalpur and another one for the northern part of the state is under consideration. The existing Medical College of Raipur has been given all necessary technological inputs as well as institutional support so as to develop it as a state-of the art medical institute of the area. Rapid allocations and steps have been made for the completion of the new building for Dental College. An attractive land policy is at the final stage in order to motivate non-governmental players to start new medical/nursing colleges and super speciality clinics. A Medical University to lead entire medical education arena within the state was also realised this year.

The Indian Systems of Medicine have been given top priority by the state. Initially the Raipur Ayurveda College was declared as a model Ayurvedic College with maximum funding and logistic support ended up ultimately as an Ayurvedic University. Pharmacy as well as drug testing facility for Ayurveda is available in quite a few states of the country as on now, and Chhattisgarh is one among them. Panchakarma therapy centres and speciality clinics have been started in a number of Allopathic health facilities so as to provide choice for the community. As many as 86 Primary Health Centres and Ayurvedic Dispensaries have been merged. All 60000 Mitanins are being trained on household herbal remedies. "AyurvedGram" concept has been developed to popularise Ayurveda based lifestyle practices.

A package for medically underserved areas with special incentives and promotional support for doctors is drafted and a pilot proposal on this is submitted for approval. This comprises a block headquarter based health department colony, transport facilities to peripheries, insurance schemes and family support for education etc. In addition to this, a special strategy for areas in conflict situation is also envisaged, as many areas within Dantewada and similar districts are facing such a situation. Filling medical officer gaps by placing Ayurvedic doctors and RMAs have been adopted as a strategy in these areas and a special training package is being developed for these doctors (Ayurvedic) so that they can handle almost all those cases that an MBBS doctor can manage at the PHC level. An additional compensation package is being approved for these doctors.

Another major intervention, for difficult areas is to post Rural Medical Corps- this envisages a number of initiatives to the doctors and other health staff a number of benefits over and above the salary, including a health workers colony, insurance support, and study support for kin. Similarly, more staff nurse positions on contract in order to operationalize the 24 x 7 PHCs and CHCs with focus to difficult areas a total of 833 of 3-year medical diploma holder have been posted in this areas and at all PHCs level and even at CHCs, especially lady RMAs.

In 2005-06, a specific programme to improve panchayat role in health was initiated by the state under RCH/NRHM called the Swasth Panchayat Scheme. This derived an indicator based status presentation of each and every panchayat on health using a unique tool called Panchayat Health & Human Development Index followed by planning by Panchayats to overcome the issues identified as part of the indexing. In 2006, this process was initiated in more than 90 percent of the Panchayats of the state. The introduction of Village Health & Sanitation Committees has strengthened this further.

The state has four major cities amongst which, Raipur, Durg, Bilaspur, and Korba are the highly populated and growing. The growth of these cities is tremendous after Chhattisgarh has become a state. Migration to these cities from village sides is high, and development of these cities is leaving behind a large number of new health challenges to be handled. The populations here are largely served by private providers. The growth of urban slums is the most challenging feature in terms of health services provision where affordability levels are very low and public systems are must. The strategies planned to address this were to set up urban health centres per thousand populations for the poor population particularly leaving in the slums, peer education programme for the urban vulnerable, and community health workers per thousand populations. The implementation of these strategies is at the very early stage and is being strengthened.

11.4 Priorities

Several State-sponsored schemes have been launched for children, women and adolescents like CM Kanyadaan Yojana, Mitanin programme on health extension and awareness, Ayushmati, CM Bal Sandharbh Yojana and nutrition surveillance programme. The local food model for supplementary nutrition under ICDS has helped reduce malnutrition and will be further strengthened. Efforts to improve nutritional security of the most vulnerable have improved access to food grains, iodised salt, and pulses under CM Khadyaan Sahayata and Amrit Vitran schemes and will be continued.

The Annual Health Survey begun since last year by the Office of Registrar General will help the state to closely tracking the health outcomes and focus attention on deserving areas- both curative and preventive. The State will strive to ensure a better convergence between sub-sectors that impact health and ensure coordinated working of institutions providing drinking water, health, nutrition, and sanitation for better achievement of outcomes.

Box 5: Priorities for public health under the 12th FYP

1. Strengthen capacities of health cadres to provide quality services, particularly for women and children
2. Improved coverage of routine immunization & institutional deliveries
3. Convergence of related-schemes for better health impact
4. Universal health insurance for all vulnerable groups
5. Reduce mortality and morbidity among women and children
6. Enabling environment for retention, better performance and local accountability of health staff
7. Revival and promotion of traditional health practices

Key to the provision and quality of health services is a motivated cadre that is community friendly and accountable. Chhattisgarh has improved health extension and created an innovative PPP model on training of health functionaries. Attention in the 12th Plan will be on refining the curriculum and giving due attention to quality of trainings provided by private institutions to the Nurses/ Auxiliary Nurse Mid-wife (ANM)/Accredited Social Health Activist-ASHA/Local Health Worker (LHW)/Multi-Purpose Worker (MPWs).

Steps will be taken for creating a favourable environment and generating demand for services through increased ownership, involvement of Citizens/ User Groups and Community Monitoring. Information Education Communication-IEC activities for raising awareness on disease symptoms and treatment particularly Tuberculosis, Malaria, HIV/AIDS, smallpox, polio, measles and hepatitis will be a priority for a more inclusive access to services. Considering the health challenges posed, Chhattisgarh will also require assistance for setting up research institutions for undertaking meaningful research on Malaria and Sickle Cell Anaemia - which affect a significant proportion of its population. Special initiatives will also be made for creating awareness on communicable diseases like smallpox, polio, measles, hepatitis, and HIV/AIDS.

The state has initiated a campaign since 2009 to create community awareness about malnutrition and to bring children with Severe-Acute Malnutrition (SAM) under the fold of ICDS. Nutrition surveillance has been started since 2009 and children with SAM are being provided free healthcare and medicines as a part of the Bal Sandharbh Yojana. While ICDS is being reviewed nationally to correct its systemic weaknesses, applying the lessons of PDS implementation the state will work to improve the Supplementary nutrition component of ICDS to make it more targeted and acceptable. It will also strengthen the follow-up services provided to severely malnourished, so that they don't slip back into malnourished categories. The sanitation coverage of some pockets of the state have improved significantly in last plan period and effort will be to replicate the same success in other parts of the state by improving awareness and improving community ownership of interventions.

Steps will be taken for revival of the State's rich heritage of traditional health practices. Such healing traditions have been strong in Chhattisgarh but the dominance of modern medicine has led to their neglect and this traditional knowledge is being lost. Special incentives will be created under AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy) for traditional healers and local health practitioners, who use the local knowledge of herbs and medicines for treating common ailments.

Govt has agreed to extend the benefits of RSBY to all job-card holders of MGNREGA, but this leaves out a large workforce in urban unorganized sector that is equally vulnerable and deserving. Through MGNREGA coverage of approximately 70-80 percent of population has been ensured. Catering to such a vast population will have its own errors of inclusion. Looking at the need to promote inclusion, and the encouraging response this scheme has received, universalized Health Insurance covering all vulnerable groups- rural and urban will be important.

In the last few years Chhattisgarh invested in medical education, creating incentives for private players to set up training institutions for health professionals (Nurses/ANM/ ASHA/LHW/MPW).As a result, there has been a quantum jump in the number of health personnel trained, which form the first referrals. In last 2-3 years the number of nurses trained has increased from 160 to 2000 and ANMs from 400 to 2800. Policy support is now required for placing these trained health personnel into the public health system to serve in rural areas.

While efforts are being made to ensure representation from all districts in the training of health functionaries, there is a concentration of participants from few regions- which will result in migration of trained staff to urban areas or out of Chhattisgarh. Retention of trained staff requires sponsorship of girls for these courses from vulnerable sections and backward regions, so that they can go back and serve in their own district/block/village. Formal government sponsorship will be sought for these trainees, to ensure presence and retention of minimum staff at local health facilities.

Another priority in the coming Plan period will be to bring district hospitals to standards proposed by National Board of Hospital and Healthcare Facility Management. This will have significant financial implications for upgrading the existing infrastructure, getting necessary equipment and increasing the range of medical services offered, especially secondary and tertiary care. Since National Rural Health Mission-NRHM funds will be inadequate, State will have to seek additional funding-either from within or from GoI to transform district hospital into medical institutions of international standards.

Current ownership of health services by Panchayati Raj Institutions-PRIs is weak, as a result of which local accountability of health services is poor. Functionaries report to their line department and PRIs having little role in monitoring services. Though Panchayat Health Committees are supposed to perform this oversight, at present it is more in terms of tracking financial progress and quantitative indicators and less with quality. The primary reason for this is lack of institutional linkage with health services, something that has also been flagged in 12th Plan Approach Paper.

On the other hand, ANMs are responsible for a cluster of revenue villages, spanning 7-8 Gram Panchayats-GP and are expected to continuously provide quality services through regular visits. To make health services more realistic & accountable it is important to rationalise responsibilities of health workers. The State would explore making ANMs responsible for one Gram Panchayat each and making their area co-terminus with a GP. This will ensure better accountability to PRIs, closer monitoring of quality and a more manageable area for the functionary to show results. Partial transfer of control of this cadre to PRIs by transferring ANM's salary to them will also be considered in future as part of the State's efforts at devolution.

11.5 Perceived Climate Impacts

No detailed studies are currently available documenting climate vulnerability and risk to the health sector in Chhattisgarh. However, a range of other studies has shown that climate change is bound to affect the basic requirements for maintaining health. It leads to extremes and violent weather events; resurgence of disease organisms and vectors; affects the quantity of air, agriculture and water; and the stability of the ecosystems.

The current burden of disease due to climate sensitive health outcomes is considerable. Direct impacts of climate change on human health could include exposure to thermal extremes – leading to morbidity and mortality due to thermal extreme such as cardiovascular and respiratory diseases; and altered frequency and/or intensity of other weather events – leading to injuries, psychological stress; damage to public health infrastructure, by floods and other natural calamities.

Indirect impacts of climate change on human health could include effects on range and activity of infective vectors and parasites – leading to changes in geographic areas and incidence of vector borne diseases e.g. malaria, dengue fever and several types of encephalitis; altered local ecology of water borne and food borne ineffective agents because of higher temperatures – leading to changed incidence of diarrhoeal and other infectious diseases. Cholera and higher ambient temperatures foster the growth of pathogens that thrive in or on food e.g. Salmonella infection. Other impacts could include altered food (especially crop) productivity due to changes in climate and extreme weather events, and associated pests and diseases – leading to malnutrition and hunger, and consequent impairment of child growth and development. Climate change can also potentially impact the levels and biological impacts of air pollution, including pollen and spores – leading to asthma and allergic disorders, other chronic respiratory disorders and deaths. Likewise, climate change could impacts freshwater availability fresh water, in turn leading to lack of hygiene and thus increase water born diseases. They can also compound the ever-increasing traffic and exhaust as well as industrial emissions are raising concentrations of SO₂, NO_x, and O₃ – leading to health hazards. Thermal stress – heat and cold waves are also another potential impact of climate change in human health, as are indirect impacts arising out of other climate related disasters such as floods and droughts.

11.6 Strategies

The State Health Department is committed to the health and well being of all citizens and visitors to the State, and as such, the Department will stake the necessary steps to gear up for the potential health impacts from climate change, while continuing to contribute to the achievement of the State's health targets as well as the national health targets plan for 2012 – 2017.

As the highest priority agenda, a Climate Change Cell will be constituted in the Health Department, as well as district level sub-cells, and these will be mandated the task of coordinating all climate related activities of the Department under the CSAPCC as well as liaising with the State institutional and coordination mechanisms outlined in an earlier section of this report. The Department will undertake collation and review of all available material and evidence related to climate change impacts on human health, and also undertake a review of health policies, plans, and institutional frameworks in the State with a view to incorporating climate concerns.

In line with the overarching principle of improving scientific knowledge, evidence base and understanding of climate change and its impacts on human health, the Health Department will begin building a strong evidence base including collecting, compiling, and analysing relevant data and information in terms of perceptions of affected people and communities. Based on the results of the comprehensive vulnerability analyses to be undertaken by the State, will review the adequateness of its current plans and institutional frameworks to respond to climate concerns in the health sector at all levels. Plans at all levels including the District health Plans will be suitably amended.

Based on current evidence, it is anticipated that the Department will initiate action relating to:

- Undertaking measures to manage increased vector borne and water borne disease burden;
- Design and deploy improved approaches to deal with heat and wave conditions;
- Dealing with the physical and psychological impacts post-extreme weather events.
- Addressing drought, malnutrition, and food security issues; and
- Addressing food safety arising due to increased ambient temperature and extreme events.

Towards building adaptive resilience and reducing vulnerability across communities and sectors, the Department will initiate mechanisms to build adaptive capacities both within the Department and potentially, among the citizens by:

- Undertaking reviews of the State's health infrastructure and potential climate change related vulnerabilities and risks (and where such infrastructure is found to be at high risk, retrofit to make these more climate resilient);

The Department will initiate a range of capacity building measures including:

- Awareness of people about health hazard from climatic change, covering all areas like rain water harvesting, energy efficiency, health hazards, water conservation, protection from extreme climate etc.;
- Information, education and communication efforts;
- Behavioural change communications interventions in relation to the impacts of climate change;
- Trainings and Sensitizations for Department personnel;
- Capacity Building of the all medical personnel of in districts including frontline functionaries and personnel associated with various programmes such as the Integrated Disease Surveillance Programme (IDSP), ANM, AWC, ASHA & all the medical NGO's in the district to identify the early signs of extreme climatic effects on the population; and
- Developing and strengthening of disaster management teams in every district hospital specifically to respond to the effect of extreme climate changes.

The Department also recognises the need to mount an extensive health surveillance and analyses exercise integrated with monitoring of climate and other environmental conditions that facilitate outbreak of diseases and will work towards developing such a framework. In addition, the Department will initiate mechanisms to carry out the necessary research and other activities necessary to integrate climate concerns into public health emergency response strategies of the State. Where appropriate, the Department will coordinate research efforts with various universities and other academic centres for excellence and collate lessons and pointers to inform policy and practice.

The Department also recognises that climate change can have especially disproportionate adverse health impacts on the poor, women, and children, and can therefore also adversely impact livelihoods. As such, it will examine various options for planning investments in information and education programmes, designing them with a gender perspective, including gender-disaggregated data, etc.

The private sector already plays a significant role in the health sector of the State, in terms of bringing in healthcare financing, management, and service provision. The Department, in close coordination with the PPP Cell of the Bihar Government, will begin exploring the possibilities of incorporating climate related health concerns into such projects and also the possibilities of private sector involvement in new initiatives to address the emerging challenge of climate change and its impacts on human health.

11.7 Institutional Linkages and Stakeholders

Institutional linkages are envisaged various agencies/departments including the Agriculture Department and the Water Resources Department, in addition to linkages with various industries associations, industrial groups and entrepreneurs, as well as with academia, civil society, international development agencies, private sector and financial institutions, and communities in general.

11.8 Linkages with the NAPCC

The outlined strategies herein are consistent with the NAPCC in general.

11.9 Sectoral Action Plan and Budgets under the CSAPCC

See Part C, Action Plans and Budgets

Part C: Annexures, Climate Change Action Plan Budgets

Note: All Tables in Annexures are for example only and need to be validated/vetted by the respective State Department/Agency, and budgeted for in the Total Cost Column provided.

Annexure 1: Summary Proceedings of Regional Stakeholder Consultation Workshops

The workshops of 21, 22, and 24 January 2013 are part of the stakeholder consultation processes for developing the CSAPCC. Systematically (and regularly) documenting perceptions of climate change – in the form of observed impacts on natural resources, infrastructure assets, and on communities and their livelihoods will be one of the key strategies of implementation under the CSAPCC for each of the focus sectors that have been adopted. Consultations will be held in all three agro-climatic zones of the state.

As such, the basic objective of the workshops being conducted at the regional levels in the State is to seek voices/inputs from the districts and various sectoral government personnel (regional heads of the Departments of Agriculture, Forest, Water Resources, Energy, Urban Development, Transport, Industries, Mining, and Health), communities (especially from the grassroots), academia, and civil society/NGOs from across regions on their perceptions of how climate has been changing and how it has impacted the region.

The proceedings in all the three workshops were scheduled as per the agenda given below:

Time	Session Details
10.30 AM to 10.35 AM	Introduction and Welcome by Dr.Arvind Boaz, APCCF, Forest Department
10.35 AM to 10.40 AM	Opening Remarks by Sunder Subramanian, Consultant, UNDP (in Raipur, by Ms.PreetiSoni, Energy and Environment Unit, UNDP, New Delhi)
10.40 AM to 11.30 AM	Opening Remarks by CFs, Forest Department
10.45 AM to 11.30 AM	Sharing of experiences on climate change and impacts by farmers/grassroots communities/JFMC members
11:30 AM to 11.45 AM	Tea Break
11.45 AM to 1.30 PM	Sharing of experiences on climate change and impacts by Industries representatives
1.30 PM to 2.30 PM	Lunch Break
2.30 PM to 4.00 PM	Sharing of experiences on climate change and impacts by Sectoral Departments
4.00 PM to 4.15 PM	Tea Break
4.15 PM to 4.45 PM	Sharing of experiences on climate change and impacts by CSOs/NGOs/Academia
4.45 PM to 5.00PM	Summation of the day's proceedings; brief remarks on next steps for the CSAPCC.
5.00 PM to 5.15 PM	Closing Remarks, Vote of thanks, etc.

Bilaspur, 21 January 2013

The Regional Stakeholder Consultation Workshop was widely attended by over 100 participants. Some of the comments/inputs/suggestions received included the following:

- Small nalas/rivers should be conserved; if necessary appropriate rules/regulations should be made;
- Hillocks near towns(especially Bilaspur) should be protected and no permission to break the hillocks for boulders;
- Encouragement should be given for plantations on private land by providing technical/financial help;
- Religious/sacred grooves should be conserved
- Effluent from industrial units should not be allowed to drain in rivers/ nalas without treatment;
- Community based Forest management should be added in this scheme -- although JFM/FDA is going on but the attachment of people with Forest Department is very less;
- Along with agriculture, farmers should go for diversification of income by adding dairy/hatchery units;
- Reduce hybrid seed utilisation (which have resulted in increased use of insecticide/fertilizer);
- Each family per year utilizes about 25 quintals fuel wood - to reduce the pressure on forest.bio- gas plants should be established, especially in BPL households;

- A pollution tax/cess should be imposed on polluting industrial units; this can be used to grow trees in the vicinity of such units;
- In plantations, the present formula of survival of plants is 40% but there is no consideration of height and girth, which is necessary;
- Instead of making pucca stopdams on hilly nalas, boulder check dams should be made;
- Upgradation of agriculture may reduce the illicit felling of forest;
- Extension/renovation and modernization of existing water bodies; construction of water bodies within forest areas; formation of a joint committee of forest and water resources officers can be made to manage this;
- Carry out soil erosion and flood Protection works;
- Recycle of water – use recycled water for non-potable uses;
- Annual Report on climate change should be issued every year;
- In Mainpot and Samaripat of Sarguja district open cast mining is going on for Bauxite. Due to this surface water is going very deep with because of newly developed cracks due to blasting-- these mining areas are not being planted, and the amount deposited for plantation in these mining areas are being utilized for plantation on another places.
- Along with the overall State Action Plan, there should be microplans for implementation at local level;
- Interdepartmental coordination is very necessary and should be enabled/facilitated;
- SHGs should be encouraged and made aware for climate change impact issues and resilience building;
- There is a need to build better friendly relations between Forest Department staff/personnel and forest dwellers/forest fringe communities;
- Academic institutions such as universities can play a major role in monitoring the works being done in landscape forestry; scientific parameters should be determine to understand the changes in water table and role of forest/tree cover, humus as carbon sinks; and
- For knowledge sharing there should be demonstration/visit of identified model works/success stories.

Raipur, 22 January 2013

The Regional Stakeholder Consultation Workshop was widely attended by about 50 participants. Some of the comments/inputs/suggestions received included the following:

- Traditional and indigenous knowledge systems especially in agri-setting is being lost; need to document and revive these;
- Industries and mining activities contributing to localised environmental degradation and thus will exacerbate climate change impacts;
- Increased incidence of human-wildlife conflicts;
- Need for enhanced diversity in wildlife populations;
- Need to enhance veterinary extension services such as mobile clinics;
- Need to analyse vegetation change especially from the standpoint of food sources for wildlife, especially elephant populations;
- Need to construct water bodies for wildlife;
- Increasing incidence of invasive weed species; these are impacting lower canopy and grasses in forests;
- Need to deliver crop specific solutions based on vulnerabilities to climate change; also need to give sufficient emphasis to food security issues in the State Action Plan;
- Need to optimise water usage, and especially improve irrigation efficiency; also need to give additional emphasis to watershed management in the state;
- Need to focus on fodder availability and improvements;
- Biomass fuel usage continues to remain an issue; need to develop specific strategies to reduce this and/or improve efficiencies;
- Need to reduce emissions from the large number of dhabhas and road-side eateries;
- Energy plantations on roadsides and forest fringes could be taken up using fast growing and area specific indigenous species;
- Need to focus on NTFP based livelihoods especially on the management and value chain and marketing aspects;
- Need to build the lower and middle canopy of forests – these have degraded in many areas;

- In urban areas, need to improve overall urban environment – including sanitation, transport systems, water management, urban energy usage efficiency and demand side management; need for car-free pedestrian/cyclist friendly areas, etc;
- Raipur is one of the cities chosen under the National Solar Cities Programme – need to leverage this to fullest extent;
- Need to reclaim mined areas and afforest these; overburden plantation in mining areas not being done – this needs to be examined and done;
- Need for catchment area treatment and slope stabilisation; and
- Need to examine the possibility of giving additional focus to and documenting/popularising folklore based medicine.

Jagdalpur, 24 January 2013

The Regional Stakeholder Consultation Workshop was widely attended by over 75 participants. Some of the comments/inputs/suggestions received included the following:

- There is a need to develop alternative land-use plans and diversify agriculture, with an emphasis on re-introducing crops such as maize, sorghum, millets/minor millets, etc.;
- Need to develop strategies for soil and water conservation and ground water re-charge;
- Definitive change in climatic patterns is being observed – earlier the state had a humid tropical climate, now it is semi-humid tropical;
- Short-duration paddy can be one of the suggested crops instead of long duration varieties;
- Need to take up more agro-forestry plantations to increase productivity and carbon sequestration;
- Need for enhanced integrated livelihoods promotion, especially for vulnerable tribal and other forest/ forest-fringe communities. Many families migrate to Andhra Pradesh for wage labour for a period of 3-4 months after the paddy harvest in Chhattisgarh;
- Consider linking SHGs to JFMCs;
- Promote indigenous seeds and species, focus on documenting and disseminating indigenous knowledge;
- Need to re-emphasise bottom up planning especially in panchayats and JFMCs;
- Most pattas being given under the FRA in the upland areas of the region – need to examine this;
- There appears to be a prevalence of sickle cell anaemia in the region – need to examine this and develop strategies to address this issue;
- Significant iron ore mining related pollution problems in the area, especially from suspended particulate matter emissions. This is causing landscape and landuse characteristics;
- Many areas with wildlife habitats threatened by NMDC mining activities; water sources/resources also being adversely impacted;
- Need to develop specific strategies for LWE affected areas since major works are not possible in these areas;
- Need to focus on productivity of forests and improve the use of less gestation species;
- Need to dovetail forest activity with poverty reduction action – but Forest Department does not have sufficient funds; need to find solutions/alternatives;
- Need for new and innovative methods for area treatment;
- Sacred groves need to be identified, documented, and rigorously protected; and
- Huge cattle populations in the Bijapur and some other areas – need to evolve management strategies.

Annexure 2: Overarching State Level Actions

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Coordination and networking	Coordination/management	Setting up of State Climate Change Action Plan Coordination Cell	1 year		Multi-sector coordination across all departments	Streamlined mechanisms for coordination of all activities under the CSAPCC
Climate risk assessments	Risk management	Detailed vulnerability assessments across all focus sectors	1 year		Multi-sector approach	Improved understanding of climate change vulnerabilities and risks across sectors and districts
State Centre for Climate Change	Scientific research, cooperation and capacity building	Setting up of State Centre for Climate Change	1 year		Coordination across scientific community in state and elsewhere; coordination with Chhattisgarh Space Applications Centre and other remote sensing centres/agencies	Coordination mechanisms for scientific research and capacity building on Climate change
		Roadmap for Sector climate change impacts evidence base strengthening and documentation	1 year		Coordination across scientific community in state and elsewhere; convergence with focus sectors	Detailed strategy for collation and strengthening of evidence base towards improving scientific understanding of climate change and impacts
Capacity Building	Human resource development	Capacity needs assessment and roadmap for capacity building at State level	1 year		Convergence with focus sectors	Clear understanding of capacity needs at State level vis-à-vis climate change and its impacts
Monitoring and Evaluation	Monitoring	Development of detailed reporting and M&E plan	1 year		Convergence with all line departments	Comprehensive framework for M&E for the CSAPCC
Knowledge management	Knowledge management	Development of detailed KM strategy	1 year		Convergence with all focus sectors	Detailed multi-year strategy for KM under CSAPCC
Medium-term actions						
Climate Change Coordination Cell	Coordination/management	<i>To be detailed by GoCG</i>	5 years (12 th FYP period)		Convergence with all focus sectors	Fully functional Climate Change coordination cell
State Centre for Climate Change	Scientific research, cooperation and capacity building	<i>To be detailed by GoCG</i>	5 years (12 th FYP period)		Convergence with all focus sectors	Fully functional State Centre for Climate Change

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Capacity building	Human resource development	<i>To be detailed by GoCG</i>	5 years (12 th FYP period)		Convergence with all focus sectors	Improved state capacities to understand and address climate change issues
Monitoring and evaluation	M&E	Quarterly CSAPCC monitoring reports	5 years (12 th FYP period)		Convergence with all focus sectors	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of CSAPCC implementation	5 years (12 th FYP period)		Convergence with all focus sectors	
		External mid-term review of CSAPCC Implementation	5 years (12 th FYP period)		Convergence with all focus sectors	
		Evaluation of CSAPCC implementation	5 years (12 th FYP period)		Convergence with all focus sectors	
Knowledge Management	Knowledge Management	Hosting of geo-portal on climate change	5 years (12 th FYP period)		Convergence with all focus sectors	Significantly improved awareness of and understanding of climate change in the State, and among its citizens/communities
		Host-hub for knowledge/information sharing related to climate change; detailed dissemination planning and dissemination	5 years (12 th FYP period)			
		Identification of potential research and development domains concerned with climate change issues in the state	5 years (12 th FYP period)			
		Knowledge repository	5 years (12 th FYP period)			
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change	5 years (12 th FYP period)			

Annexure 3: Agriculture and Allied Sectors

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy reviews	Policy	Review of state agriculture and allied sector policies; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as water resources, energy, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with districts	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Development of agro-climatic zone-wise adaptation plans, incorporation into Agriculture Roadmap	1-1.5 years		Convergence with districts	Zone-specific climate response plans in place
		Poverty, equity and livelihoods study and strategy formulation			Convergence with districts	Enhanced understanding of poverty and equity issues in the sector; integrated into policy and planning
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with districts	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>	Within/over 5 years (12 th FYP period)		Convergence with all focus sectors	Improved sector capacities to understand and address climate change issues
Forecasting and early warning	Risk management	Weather services and early warning systems through enhanced agro-met technology deployment and information	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as	Improved risk management and early warning systems

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
systems		dissemination	FYP period)		water resources, energy, etc.	
Improved varieties and practices	Science and technology	Development and deployment of improved crop varieties (drought and flood tolerant)	Within/over 5 years (12 th FYP period)		Convergence with scientific research institutions/academia	Improved crop resilience
Irrigation	Research, technology adoption/transfer	Study on irrigation efficiency improvements	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Improved irrigation efficiency; diversified and climate resilient irrigation infrastructure
		Study on irrigation infrastructure improvements/adaptation				
		Revival/rehabilitation of traditional irrigation systems				
		Micro-irrigation systems augmentation				
		Solar and wind power systems for irrigation				
Soil and water conservation	Watershed development	Agroforestry, integrated watershed management	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Improved soil and water management practices; improved climate resilience in intervention areas
Integrated nutrient and pest management	Risk management; research/technology transfer	Study on integrated nutrient and pest management based on sector climate vulnerability assessment; development of management options	Within/over 5 years (12 th FYP period)		Convergence with scientific research institutions/academia	Improved nutrient and pest management practices and climate resilience
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 4: Forests and Biodiversity

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy reviews	Policy	Review of state forest sector policies; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as water resources, energy, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Review of forest working plans and incorporation of climate concerns	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Revised working plans explicitly incorporate climate concerns
	Institutional arrangements	Activation of State Biodiversity Board; development of multi-annual action plans covering 12 th FYP	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Functional State Biodiversity Board in place, with action plans
Interventions in forest and non-forest areas	Forest/biodiversity protection, conservation, and green cover augmentation	Interventions in very dense forests initiated	1 – 1.5 years		Convergence with districts and linked sectors such as water resources, energy, etc.	Initial interventions on-stream
		Interventions in moderately dense forests initiated	1 – 1.5 years			
		Interventions in open forests initiated	1 – 1.5 years			
		Interventions in scrub forests initiated	1 – 1.5 years			
		Specific interventions in the protected areas initiated	1 – 1.5 years			

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		Specific interventions in notified wetlands initiated	1 – 1.5 years			
		Specific interventions in non-forest areas initiated	1 – 1.5 years			
Research	Research	Study on forest and NTFP dependence of communities	1 – 1.5 years		Convergence with district administrations and social sector departments	Comprehensive understanding of community – forest interface and dependence, especially on NTFPs
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with districts	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with districts and linked sectors such as water resources, energy, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>			Convergence with districts and linked sectors such as water resources, energy, etc.	Improved sector capacities to understand and address climate change issues
Interventions in forest and non-forest areas	Forest/biodiversity protection, conservation, and green cover augmentation	Interventions in very dense forests	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Improved quality and management of forest areas including green cover augmentation; improved protection, infrastructure, and visitor facilities in protected areas and notified wetland areas
		Interventions in moderately dense forests				
		Interventions in open forests				
		Interventions in scrub forests				
		Specific interventions in the protected areas initiated				
		Specific interventions in notified wetlands				
		Specific interventions in non-forest areas				
Planning	Research; Planning	Study on and development of plans for interventions in non-notified wetland areas			Convergence with districts and linked sectors such as water resources, energy, etc.	Detailed strategy and management plans for interventions in non-notified wetland areas in place
Fire Management	Management	Measures for fire management in all forest	Within/over 5 years (12 th FYP period)			Lower incidence of forest fires/improved fire control

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		types	FYP period)			
Research	Research; planning	Study on potential for REDD+	Within/over 5 years (12 th FYP period)		Linkages with academia, consulting organisations/individuals	Enhanced strategies and actions for forest and biodiversity conservation
		Studies on indigenous trees species to assess their vulnerability to climate change				
		Assessing and documenting additional threats to biodiversity and wildlife				
Biodiversity	Biodiversity conservation	Survey, identify, catalogue, document, protect, and improve/enhance the status of biodiversity in the State	Within/over 5 years (12 th FYP period)			Biodiversity registers in place/progress; publication/s on state's biodiversity resources; enhanced biodiversity conservation/management practices in place
		Population dynamics and movement of key indicator wildlife species				
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 5: Water Resources

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy Formulation	Policy	Formulation of State Water Policy; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, energy, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with linked sectors such as agriculture, forestry, energy, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, energy, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Formulation of State Water Sector Roadmap	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, energy, etc.	Comprehensive water sector plan in place
Research	Research	Study on projection of water resources availability in time and space	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, energy, etc.	Enhanced understanding of key sector issues; improved management practices
		Study on poverty and equity issues in the water sector; incorporation of findings into Water Sector Roadmap	1 – 1.5 years			
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with districts	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with districts and linked sectors such as water resources,	Sector KM strategy in place
		Comprehensive water data base in public	1 year			

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		domain and water resources information system initiated			energy, etc.	
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department) including Panchayati Raj Institutions, urban local bodies and primary stakeholders such as WUAs in participatory management of water facilities</i>	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Improved sector capacities to understand and address climate change issues
Planning	Research; Planning	Study on and development of plans for interventions in non-notified wetland areas	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Detailed strategy and management plans for interventions in non-notified wetland areas in place
Infrastructure/resource management	Water infrastructure/resource augmentation/conservation/management	Inventory of and revival/ repair of traditional systems of water initiated	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Enhanced water sector infrastructure assets and management practices; improved sector resilience
		Conservation and preservation of wetlands and maintenance of optimal wetland hydrology	Within/over 5 years (12 th FYP period)			
		Groundwater resources regulation and recharge/replenishment	Within/over 5 years (12 th FYP period)			
		Actions for water use efficiency across sub-sectors	Within/over 5 years (12 th FYP period)			
		Actions for improving water quality	Within/over 5 years (12 th FYP period)			
		Actions for adaptive retrofitting of infrastructure assets and O&M improvements	Within/over 5 years (12 th FYP period)			
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources,	Results for programme implementation improvements and mid-course corrections; lessons
		Internal Annual Review of sector implementation under CSAPCC				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
					energy, etc.	learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with districts and linked sectors such as water resources, energy, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 6: Urban Development

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy review	Policy	Review of urban development policy; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Formulation of Urban Sector Roadmap incorporating climate concerns	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Comprehensive water sector plan in place
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department) including ULBs</i>	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Improved sector capacities to understand and address climate change issues
Energy demand	Energy efficiency	Energy efficiency and conservation measures	Within/over 5			Enhanced energy efficiency and

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
reduction and efficiency		Promotion of and codes for green/energy efficient buildings, including in urban housing projects under various programmes	years (12 th FYP period)			reduced demand
Adoption of renewables	Alternative energy sources	Promotion of renewable energy sources and technologies	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Enhanced energy source mix
Management of water, municipal solid waste and waste water	Urban utility management	Comprehensive approach in the management of water, municipal solid waste and waste water with a view to realize their full potential for energy generation, recycling and reuse, and composting, rainwater harvesting, etc.	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as Water Resources Department, etc.	Improved utility performance, services delivery, and infrastructure resilience
		Retrofitting of urban infrastructure for climate resilience based on vulnerability and risk assessment				
Urban transportation	Transportation	Evolving integrated land use and transportation plans, achieving a modal shift from private to public mode of transportation, encouraging the use of non-motorised transport, improving fuel efficiency, and encouraging use of alternate fuels	Within/over 5 years (12 th FYP period)		Convergence with Transportation Department	Improved urban transportation systems
		Adaptation in terms of realignment and relocation, design standards and planning for roads, rail and other infrastructure to cope with risks from climate change				
		Promote and foster alternative fuels such as CNG, bio-fuels				
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 7: Transport

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy review	Policy	Review of transport policy; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Formulation of Transport Sector Roadmap incorporating climate concerns	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Comprehensive water sector plan in place
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Improved sector capacities to understand and address climate change issues
Transport	Infrastructure, planning,	Improve access to bus services and	Within/over 5		Linkages with Urban	Enhanced and resilient transportation

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Infrastructure, planning, and management	management	service quality	years (12 th FYP period)		Development Department, Roads Department, Energy Department, etc.	infrastructure and systems in place
		Improve the poor image of bus and public transport	Within/over 5 years (12 th FYP period)			
		Mechanisms for proper planning and provisioning of infrastructure facilities	Within/over 5 years (12 th FYP period)			
		Improve route and traffic planning, and regulate issue of permits through surveys and scientific data	Within/over 5 years (12 th FYP period)			
		Provide/improve passenger information systems, and remove institutional and regulatory hurdles	Within/over 5 years (12 th FYP period)			
		Promote initiatives such as vehicle pooling, etc., especially in cities and towns	Within/over 5 years (12 th FYP period)			
		Rigorously implement measures for vehicular pollution control	Within/over 5 years (12 th FYP period)			
		Promote the use of ensure availability of cleaner fuels such as CNG and bio-fuels	Within/over 5 years (12 th FYP period)			
		Systematise and ensure uniformity in institutional arrangements for providing public transport services	Within/over 5 years (12 th FYP period)			
		Promote access instead of mobility; shift to less harmful modes of transportation; and improve vehicles towards lower carbon intensity and pollution	Within/over 5 years (12 th FYP period)			
		Enable and promote environmentally efficient modes such as public and non-motorised transport (for passenger transport) and to rail and water transport (for freight)	Within/over 5 years (12 th FYP period)			
Invest in public transport and	Within/over 5					

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		infrastructure that promotes walking and cycling	years (12 th FYP period)			
		Improve vehicles, vehicle maintenance, and fuels as a priority to reduce urban air pollution and greenhouse gas emissions	Within/over 5 years (12 th FYP period)			
		Adopt green transport policies will also reduce road accidents and alleviate poverty by improving access to markets and other essential facilities	Within/over 5 years (12 th FYP period)			
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 8: Energy

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy review	Policy	Review of energy sector policies; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Research, Climate Impacts Needs Assessment	Research	Develop comprehensive Chhattisgarh specific energy sector vulnerability analyses, and options for developing in-house skills for data analyses, modelling, and forecasting will be considered	1-1.5 years			
Risk Management	Risk Management	Templates to screen individual energy projects for climate vulnerability and risks, either retrospectively or during project planning and implementation will be developed	1-1.5 years			
Standards Development	Management	Develop adaptation standards for the energy sector -- defined, codified and adopted into standard operating procedures in all aspects of energy sector planning and implementation	1-1.5 years			
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Research	Research	Study on poverty and equity issues in energy sector; incorporation of findings into energy sector planning	1-1.5 years			

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Planning	Planning	Formulation of Energy Sector Roadmap incorporating climate concerns/Revision of existing Roadmap to incorporate climate concerns	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Comprehensive water sector plan in place
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Improved sector capacities to understand and address climate change issues
Generation Improvements	Power generation infrastructure enhancement/adaptation and management	Renovation and modernisation of existing units to restore original efficiency along with reduced auxiliary power consumption and reduced chimney emissions.	Within/over 5 years (12 th FYP period)			Enhanced generation systems
		Adoption of super critical technology for all upcoming coal based power stations to have better efficiency and reduced emissions				
		Fly ash utilisation management				
Transmission Improvements	Power transmission infrastructure enhancement/adaptation and management	Expansion of high voltage transmission network with latest and state of the art technologies and adequate coverage network to prevent loading beyond limits	Within/over 5 years (12 th FYP period)			Enhanced transmission systems
		Use of sufficient reactors and capacitors in the network				
		Replacement of old and jointed conductors				
		Better load management, efficient				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		scheduling and use of information systems to achieve optimum network utilisation				
		Proper upkeep of GSS transformers				
Distribution improvements	Power distribution infrastructure enhancement/adaptation and management	Replacement of old and jointed conductors	Within/over 5 years (12 th FYP period)			Enhanced distribution systems
		Procurement of start rated distribution transformers and load balancing of existing ones				
		Tariff structure review and revision; incentivisation for lower energy withdrawal promotion of conservation				
		Underground cabling in green areas				
		Addition of adequate capacitors and upkeep of PSS transformers and distribution transformers				
		Expansion of network with high HT/LT ratio				
		Adoption of HVDS systems where feasible and putting into place effective anti-power theft measures				
		Facilitate power supply for monorail and metro-rail schemes envisaged for Patna as part of improving public transportation systems				
Demand Side Management	Energy conservation and efficiency improvements	Promoting the use of energy efficient pumps and motors in the State	Within/over 5 years (12 th FYP period)			Enhanced demand side management in place
		Promotion of CFLs in identified areas and expanding the scheme to other parts of the state in a phased manner				
		Building consumer awareness about energy efficient equipment and energy conservation measures				
Renewable energy	Renewable energy promotion and adoption	Electrification of rural villages through renewables based DDGs	Within/over 5 years (12 th FYP period)			Increase in the share of renewables in stake energy mix; cleaner sector
		Encourage local private sector participation in renewable energy power generation projects including solid waste and				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		sewerage gas based projects or decentralised distributed generation (DDG)				
		Fix the renewable energy procurement quotas and tariffs for renewable energy based power				
		Provide banking and wheeling facilities for all grid connected renewable energy electricity generation projects up to 25 MW				
		Waive entry tax capital costs for equipment for DDG based renewable energy plants of less than five MW				
		Encourage project developers to install or adopt mechanisms such as Clean Development Mechanisms (CDM) for leveraging funds for renewable energy based projects				
Infrastructure adaptation	Infrastructure adaptation	Based on climate vulnerability analyses, retrofitting of existing energy infrastructure	Within/over 5 years (12 th FYP period)			Improved infrastructure resilience
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 9: Industries and Mining

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy review	Policy	Review of industries and mining policies; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cells; setting up of Task force at State and Cluster levels	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, private sector, industries associations, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
		Build partnerships with industry associations, and through them, initiate sustained process to stimulate technological innovation and change to reduce dependency on imported fuels, to improve resources use efficiency, waste management, water and air pollution reduction, and enhance use of renewables				
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Formulation of Sector Roadmap incorporating climate concerns	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Comprehensive water sector plan in place
Research	Research	Cluster-wise or district-wise studies to estimate the carbon footprint of industrial clusters in the State; This would include a baseline study, as well as periodic studies	1 – 1.5 years			Improved understanding of key emissions and carbon footprint issues in clusters, and industry sectors
		Studies on brick making industry (and associated mining issues) and on mining industry				
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with linked sectors such as agriculture, forestry,	Sector M&E framework in place

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
					water, etc.	
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Improved sector capacities to understand and address climate change issues
Promoting GHG Mitigation	Mitigation	Build awareness of and promote sector-wide, process-specific, and operating procedure based mitigation options for industries	Within/over 5 years (12 th FYP period)		Linkages with academia, financial institutions, industry associations, media, private sector, etc.	Increased adoption of GHG mitigation options
		Actions for incentivising adoption of GHG mitigation options				
		Build capacities of financial institutions to finance GHG mitigation options				
		Develop regulatory instruments and promote CDM				
Promoting Energy efficiency	Energy efficiency	Promote and build awareness, and develop and deploy measures to incentivise industries to adopt a range of management practices including energy audits, adoption of energy efficiency measures and technologies, benchmarking, etc.	Within/over 5 years (12 th FYP period)		Linkages with academia, financial institutions, industry associations, media, private sector, etc.	Enhanced energy efficiency in industries/industrial clusters
		Build awareness on options, opportunities and benefits of fuel switching, including the use of waste materials, energy (especially heat and power recovery), cogeneration, use of renewable energy including biomass and by-product wastes based generation, and materials efficiency and recycling				
		Developing and deploying a range of financial instruments such as taxes, subsidies and measures to improve access to capital to adopt energy efficiency technologies and processes				
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry,	Results for programme implementation improvements and mid-course corrections; lessons
		Internal Annual Review of sector implementation				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
		under CSAPCC			water, etc.	learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						

Annexure 10: Human Health

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Short-term actions						
Policy review	Policy	Review of health policies; incorporation of climate concerns (based on sector vulnerability assessment)	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector policies explicitly reflect climate concerns
Coordination and networking	Coordination/management	Setting up of Climate Change Cell at State level, and sub-cells at district levels	1-1.5 years		Convergence with linked sectors such as agriculture, forestry, water, private sector, industries associations, etc.	Streamlined mechanisms for coordination of all sector activities under the CSAPCC
Capacity Building	Human resource development	Sector capacity needs assessment	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Clear understanding of sector capacity needs at State and sub-state levels vis-à-vis climate change and its impacts
Planning	Planning	Formulation of Sector Roadmap incorporating climate concerns	1 – 1.5 years		Convergence with linked sectors such as agriculture, forestry, water, etc.	Comprehensive water sector plan in place
Building programme based resilience	Programme enhancements	Design and deploy to manage increased vector borne and water borne disease burden	Within 2 years		Convergence with State Health Society, programme such as VBDCP, IDSP, NRHM, etc.; also with linked sectors such as agriculture, forestry, water, etc.	Improved health sector programmes, geared to address increased climate change induced morbidity/health burden
		Design and deploy improved approaches to deal with heat and wave conditions				
		Design and deploy measures for dealing with the physical and psychological impacts post-extreme weather events				
		Design and deploy measures to address drought induced malnutrition, and food security issues				
		Design and deploy measures for addressing food safety arising due to increased ambient temperature and extreme events.				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Monitoring and Evaluation	Monitoring	Contribution to CSAPCC Monitoring Plan	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector M&E framework in place
Knowledge management	Knowledge management	Contribution to CSAPCC KM Strategy and roadmap	1 year		Convergence with linked sectors such as agriculture, forestry, water, etc.	Sector KM strategy in place
Medium-term actions						
Capacity building	Human resource development/awareness	<i>Capacity building of department personnel and stakeholders (to be detailed by Department)</i>	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Improved sector capacities to understand and address climate change issues
		Build people's awareness of health hazards from climatic change through IEC				
		Behavioural change communications interventions in relation to the impacts of climate change				
		Developing and strengthening of disaster management teams in every district hospital specifically to respond to the effect of extreme climate change				
Research	Research	Study on poverty and equity dimensions of health, disease burden and morbidity as a result of climate change; design of appropriate measures to incorporate findings into health policy and programming	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Enhanced understanding of poverty and equity issues in health sector in relation to climate change and its impacts
Health Infrastructure resilience	Infrastructure improvements; asset management	Reviews of the State's health infrastructure and potential climate change related vulnerabilities and risks (and where such infrastructure is found to be at high risk, retrofit to make these more climate resilient)	Within/over 5 years (12 th FYP period)			Increased resilience of health infrastructure assets
Monitoring and evaluation	M&E	Quarterly sector monitoring reports	Within/over 5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Results for programme implementation improvements and mid-course corrections; lessons learnt on what worked and what didn't; input for improved annual plans for 13 th FYP.
		Internal Annual Review of sector implementation under CSAPCC				

Interventions	Intervention Type	Activities	Duration	Total Cost (in lakh)	Possibility of convergence	Expected Outcome
Knowledge Management	Knowledge Management	Identification of potential research and development domains concerned with climate change issues in the sector; initiating studies	5 years (12 th FYP period)		Convergence with linked sectors such as agriculture, forestry, water, etc.	Significantly improved awareness of and understanding of climate change in the sector and its stakeholders
		Knowledge repository, strengthening evidence base				
		Technical demonstration, research and development, extension and transfer of technology protocols, relating to climate change				
		Sector co-benefits identification study				
		Documentation on community perceptions of climate change and impacts				
Networking and linkages	Networking and coordination	Institutional linkages with research/academic institutions	Within/over 5 years (12 th FYP period)		Linkages with academia, civil society and communities	Improved networking and communications with academia, participatory sector processes
		Consultations with civil society				
		Consultations with communities				
Total Budget for 5 years (12 th FYP period)						