

STATE OF ENVIRONMENT (SOE)

REPORT – TIKAMGARH



Executive Summary

Welcome to the Tikamgarh State of Environment Report. The State of Environment Report provides a summary of the environmental attributes and condition of the district and the human impacts on the environment. It also provides a public record of district authority, industry and community activities and achievements in responding to pressures on the environment. State of the Environment Reports can therefore be considered as a mechanism for reporting on progress towards Environmentally Sustainable Development (ESD).

State of the Environment (SoE) Reporting will be an annual requirement of district authority, coinciding with Annual Plan and prepared for each financial year. It involves looking at: the various **pressures** on the environment; the **state** or condition of the environment at the time of reporting; and any **responses** that has been or will be made to better manage environmental pressures or **impacts** to improve environmental conditions.

So the main objective of the SoE Report of Tikamgarh is to bring out an overview of the environmental scenario of the district to serve as a baseline document and assist in logical and information based decision making. It is recognized that to achieve ESD within district the activities of annual plan require a shift in priorities, which involves the integration of environmental considerations into the development of community goals/targets, strategies, economic policies, and decision-making in every sphere of activity. The SoE Report provides a mechanism for identifying sustainability issues and trends, and therefore provides a mechanism for assisting the prioritization of district plan in achieving ESD

The State of the Environment Report prepared for Tikamgarh covers the state and trends of the environmental issues like Agriculture, Forest, Land degradation, Water quantity, and Water quality. Land degradation is taking place through natural and man-made process resulting in loss of nutrients and less production. Loss of biodiversity is main concern since many plants and animal are being threatened. Quantity and Quality of water is one of the major problems in the coming years need to be tackled on priority. The report has been prepared following the Pressure-State-Impact-Response (PSIR) framework. Also the report has been prepared in a participatory process in consultation with all the key stakeholders (Government, Non-government and academic institution).

The SoE report will provide an insight to priority issues of the district, related to state of environment, natural resources and impacts associated with environmental changes. This report also assesses state government current and also the proposed policy, programme as a response to combat further degradation of the environment.

This is the first SoE report of the district and it is structured into three sections:

SECTION – I PROFILE OF TIKAMGARH DISTRICT

- Bio-physical profile
- Socio –economic and cultural patterns
- Governance structure
- Economic base

SECTION – II KEY ENVIRONMENTAL CONCERNS OF THE DISTRICT

The concerns are analyzed under pressure-state-impact-response (PSIR) framework and also provide with policy and institutional options to create the emerging environmental challenges in the district. It is important to focus on various responses for possible solution. Stress must be given to ensure a healthy and sustainable environment in future. Increasing awareness about environment, participatory management and economic instruments will prove to be important tools in dealing with concern environment issues.

The major environmental issues that are captured in the report are under 2 broad themes i.e Land and Water.

Land

- Agriculture
- Forest
- Land degradation

Water

- Quantity
- Quality

SECTION – III PROVIDES THE REFERENCES, LIST OF FIGURES & TABLES

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I. OVERVIEW

1. Bio-physical Profile

1.1 Historical Background

The early history of Tikamgarh district is not chronicled, though the numerous ruins of Kudar, Prithvipur Barana, Lidhora, Digora, Mohangarh, Baldevgarh and Tikamgarh, suggest a glorious past. This district had been a part of the vast empire of the Mauryas, the Sangas and the Guptas. During the first quarter of the 9th century A.D., Mannuka founded a new Chandela Dynasty in this area. Tikamgarh along with Khajuraho and Mahoba was a part of the extended Chandela kingdom. The Khangar Dynasty too established its sovereignty around this region especially Garha Kudar. The rising power of the Bundelas in this region led to the downfall of the Khangars. The Orchha archives trace the descent of the Bundela kingdom from Garha Kudar to Orchha. The name of the district originates from the headquarter town of Tehri of Orchha State. In 1783 A.D., Raja Vikramajit shifted his capital from Orchha town to Tehri and renamed it Tikamgarh. However, Tikamgarh was officially recognized in 1887. This name was adopted in the honor of lord Krishna, Tikam being one of his appellations.



Figure 1. Map of Tikamgarh

1.2 Location and Boundaries

Tikamgarh district is situated in the northern part of Madhya Pradesh. It lies in north-western part of Sagar district. It is situated on the Bundelkhand plateau between Jamuni, (a tributary of Betwa) and Dhasan river. It extends between the north latitude 24°26' to 25°34' and east longitude 78°26' to 79°21'. The shape of the district is triangular. The northern margin is irregular.

The maximum length of the district is 119 km. from north to south. Its width is about 80 km. from east to west. Thus, the total geographical area of the district is 5048 sq. km. The district is bound by chhatarpur district in the East, Lalitpur district of Uttar Pradesh in the west, Distt. Jhansi of Utter Pradesh in the North and distt. Sagar in the South. The western and eastern boundaries of the district are formed by two big rivers.

1.3 Topography

The elevation of Tikamgarh is 426.7 m above the mean sea level. The northern part of the district is at a height of 200 m from the mean sea-level while the southern part is at a height of 300 m. The area is gently sloping from south towards north. It lies at a somewhat level plane, which forms the Betwa-Dhasan Doab. The geology of the area is characterized by what is known

as the Bundelkhand Gneiss in geological terms. The Bundelkhand Gneiss is a hard grayish pink granitoid rock of simple composition, which is traversed by conspicuous quartz fields that are integral part of this formation. These rocks are found in the form of sheets and dykes across the district, thus constituting the topography of the district.

1.4 River System

The district lies in the Ganga Drainage System. The Betwa flows along its north-western boundary. The Dhasan, one of its right bank tributaries and a big stream itself, marks the eastern boundary of the district. Both these rivers flow towards the north-east. The tributaries of the Betwa flowing in the Tikamgarh district are Jamni, Bagri and Barua.

1.5 Lakes and Tanks

According to the settlement records, 962 tanks had been constructed during the Chandela period, most of which were small with low bunds. Out of these tanks, 125 tanks were used for tank-bed cultivation. The number of tanks over the years has now been reduced to 421. However, several of the existing tanks are of considerable size, particularly those at Baldeogarh, Bamhauri Barana, Lidhaura, Jatara, and Bir Sagar. It is noticeable that none of these tanks, with their massive dams built by the Chandela and others, were originally intended for irrigation. They were evidently constructed merely adjacent to the temples, palaces and favorite resorts of the rulers. Their adaptation for irrigation is a modern development.

1.6 Wells

There is massive granite rock found at the depth of 4 to 6 m in the district. The possibility of water-bearing strata is therefore remote and the underground water is available only at a shallow depth. In 1902, there were 14,800 wells in Orchha State. The number of wells has now considerably increased in the district. There are 49,555 wells out of which 43,806 are irrigation wells and 2,356 are abandoned wells.

1.7 Climate

The climate of Tikamgarh district is of the monsoon type. The year may be divided into four seasons. The cold season is from December to February, followed by the hot season from March to about the middle of June. The period from about mid-June to the end of September is the rainy season. The months of October and November constitute the post-monsoon or the transition season.

1.8 Rainfall

There is only one rain gauge station in Tikamgarh district. The average rainfall of the district is 40 inches. It varies from 33 inches to 54 inches, in different parts of the district. It is seen that amount of rainfall in the district in general increases from north-west to south-west. Parts of the Niwari tehsil and Mohangarh of Jatara tehsil come in the low rainfall zone. About 90 per cent of

the annual rainfall in the district is received during the south-west monsoon season, i.e., June – September; July being the rainiest month.

Table 1. Annual rainfall (mm).

Block/Year	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Tikamgarh	950.5	745	839	750	271	1386
Baldeovgarh	951	708	510	387	228	902
Jatara	1138	653	475	413	465	1225
Palera	1342	701	668	508	545	1250
Niwari	1144.5	555	595	349	399	1219
Prithvipur	1365	713	717	374	589	1098
Total rainfall	6891	4075	3804	2781	2497	7080
Average rainfall	1148.5	679.16	634	463.5	416.17	1180

(Source: District Statistical Book 2007)

1.9 Temperature and Humidity

No meteorological observation is being carried out in the district. The description that follows is based on the records of the observations in the neighbouring districts, which have a similar climate. Towards the end of February, the temperature rises progressively. The month of May is generally the hottest with the mean daily maximum temperature at about 43^o C and a minimum of about 29^o C. On a typical summer day temperature may rise to about 47^o C. The relative humidity is high during the monsoon season, it being generally above 70 per cent. During the rest of the year, the air is comparatively dry. The driest part of the year is the summer season when the relative humidity is less than 20 per cent in the afternoons.

1.10 Land Resources

1.10.1 Soil Types

The soils found in the district are primarily of four types, which are:

- i. Bundelkhand coarse-grained reddish brown soils
- ii. Bundelkhand coarse-grained grey to greyish brown soils
- iii. Bundelkhand clay loam black soils
- iv. Bundelkhand clayey-black soils

Locally these soils are known as Rakar, Parua, Kabar and Mar, respectively. The bulk of soil found in the district is the Rakar.

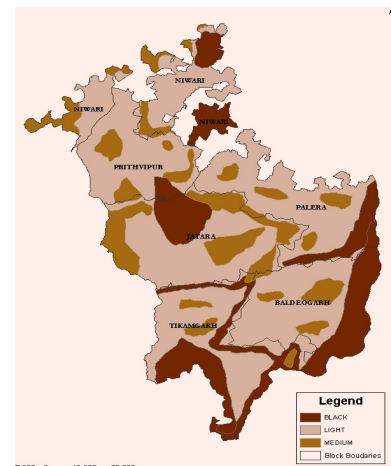


Figure 2. Soil type

Table 2. Types of soil and respective percentage of area of Tikamgarh district.

S No.	Soil Type	Area (%)
1	Heavy-Black	15%
2	Kavar-Black yellow	10%
3	Parua-Red yellow	45%
4	Rakar- Leteritic	35%

(Source: District Statistical Book 2006, Tikamgarh, BRGF)

1.10.2 Land use

The land use data gives vital information regarding areas under different uses namely and reserved/open and dense/ degraded forests, plantation, water bodies, waste bodies, waste land, etc. In the district, the land under agriculture is 53%. Non agricultural land is 19% and other waste land is 5%, which make upto a total of 24% of non utilizable land. Out of the total forests, protected forests constitute 36%, 29% reserved forests and 35% constitute other forests.

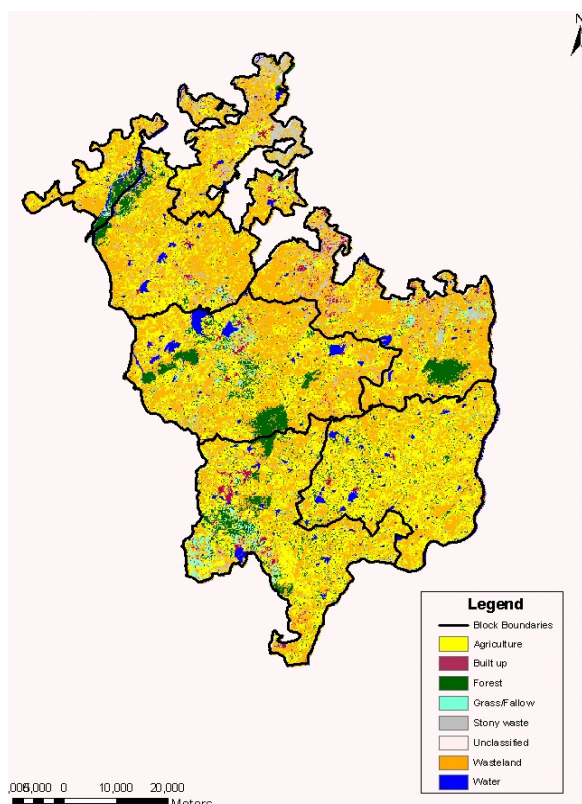


Figure 3. Map showing the land use in Tikamgarh district.

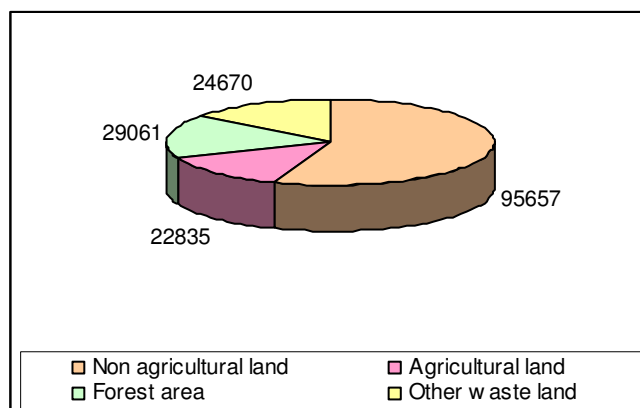


Figure 4. General land use in hectares in Tikamgarh district.

Table 3. General land use of the Tikamgarh district.

Year	Area (ha)	Forest area (ha)	Forest area (%)	Non - agricultural land (ha)	Non-agricultural land (%)	Other waste land (ha)	Other waste land (%)	Agricultural land (ha)	Agricultural land %
2002-03	464499	27813	6	96085	21	20738	4	24757	5
2003-04	464499	28866	6	106912	23	14188	3	18782	4
2004-05	504002	30077	6	103198	20	15066	3	19514	4
2005-06	504002	29438	6	95440	19	23239	5	20969	4
2006-07	504002	29061	6	95657	19	24670	5	22835	5

(Source: District Statistical Book 2007)

Table 4. Blockwise land use in 2006-07.

Block	Area (ha)	Forest area (ha)	Forest area (%)	Non - agricultural land (ha)	Non-agricultural land (%)	Other waste land (ha)	Other waste land (%)	Agricultural land (ha)	Agricultural land %
Tikamgarh	92741	4548	5	19043	21	5344	6	1833	2
Baldeogarh	93024	4131	4	16277	17	6270	7	5120	6
Jatara	101691	8850	9	22385	22	2664	3	6538	6
Palera	84801	4804	6	13123	15	3043	4	4716	6
Niwari	66806	4080	6	11487	17	4423	7	2224	3
Prithvipur	64939	2648	4	13342	21	2926	5	2404	4

(Source: District Statistical Book 2007, Tikamgarh)

1.10.3 Forest

Tikamgarh district has a southern tropical dry deciduous type of forest. About 6% of the total land is covered by forest. Earlier the area comprised dense forests but due to a rising demand for wood and agriculture expansion, the level of deforestation increased. A timber forest lies near Orchha town and around Betwa and Jamuni rivers. The non timber forest of the district consists of Tendu, Seja, Dhawa, Gunja Salai, Mahuwa, Baheda, Palash, Amla, Bel and Bamboo. In the non-timber forest, the medicinal plants have the potential to be a major source of livelihood for the people residing near forest area. But due to the absence of a proper market strategy, the lack of infrastructure for transportation and awareness, this is not possible at present.

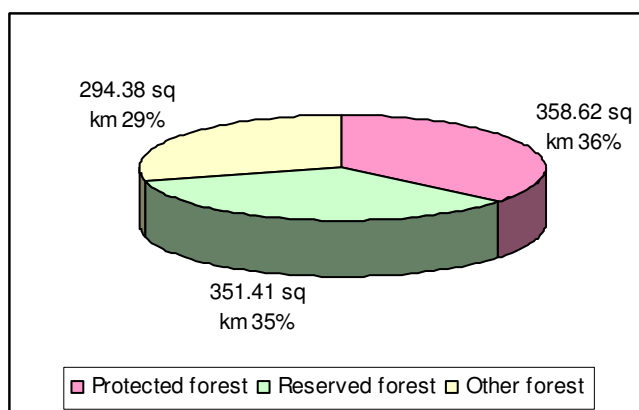


Figure 5. Area under different forests in Tikamgarh district.

1.10.4 Agriculture

The economy of Tikamgarh district is predominantly based on agriculture. Out of its total area of 504002 ha, only 51% of the area is cultivated. Twentynine per cent of the area is double cropped. Tikamgarh district falls in the Jwar Wheat producing areas of Madhya Pradesh. Apart from wheat, the other major crops grown in the area are Rice, Jwar, Maize, Bajra, Kodo, Kutki, Gram, Tuar, Mung, Urad, Soybean, Alsi, Til, Groundnut, Jute and vegetables.

Soybean is a major crop in the area, which has attracted farmers towards it due to its cash value in the market. Soybean gives a high return to the large cultivators. In certain areas of Tikamgarh district, particularly in Niwari block adjoining the markets in Jhansi in Uttar Pradesh, cropping of vegetables and spices is also carried out on a large scale. Perhaps, this is one of the major factors why Niwari is considered to be more developed than other blocks in the district.

1.10.4.1 Crops

The main crops of the district are Jowar, Wheat, Paddy, Urad, Til and Soybean. Sugarcane is grown to a certain extent. Thus, cropwise both cropping seasons, the **Kharif** and the **Rabi** are important in the district.

Table 5. Area in hectares of the main crops cultivated.

S. No.	Block	Wheat	Paddy	Jowar	Maize	Others	Total
1	Tikamgarh	14637	4269	955	98	2949	22908
2	Baldeogarh	12810	5954	438	62	3130	22394
3	Jatara	10806	2221	5004	605	1383	20019
4	Palera	7316	1215	2291	18	949	11789
5	Niwari	7946	196	1544	589	694	10969
6	Prithvipur	4610	630	1459	1020	378	8097

(Source: District Statistical Book 2007)

1.10.4.2 Pulses

Besides Gram, Urad and Moong are other important pulses of the district and are grown generally in the Kharif season. Another pulse, Letil or Masur is also grown to a significant extent while, Tur comes fourth in respect of cultivated area after Urad, Masur, and Moong-Moth.

Table 6. Area, in hectares, under which different pulses are cultivated.

S. No.	Block	Gram	Tur	Urad	Others	Total
1	Tikamgarh	5611	7	11787	3770	21175
2	Baldeogarh	3100	24	11708	2187	17019
3	Jatara	3675	41	14387	3639	21742
4	Palera	6049	197	11533	6517	24296
5	Niwari	2015	24	6044	2429	10512
6	Prithvipur	834	22	6734	588	8178

(Source:- District Statistical Book 2007)

1.10.4.3 Oilseeds

The oilseed crops grown in the district are rape, mustard, groundnut and til. In the eighties, Soybean cultivation gained much popularity.

Table 7. Area, in hectares, under which different oilseed are cultivated.

S. No	Block	Soybean	Til	Groundnut	Mustard	Alsi	Others	Total
1	Tikamgarh	7966	3247	191	2666	19	-	14089
2	Baldeogarh	3919	6053	250	3876	8	-	14106
3	Jatara	5788	4525	1639	1991	3	-	13946
4	Palera	532	4478	2597	2962	85	-	10654
5	Niwari	1472	2256	6490	490	175	21	10904
6	Prithvipur	5192	2307	3685	1845	-	-	13029

(Source: District Statistical Book 2007)

1.10.4.4 Fertilizers

Fertilizer is the key input for obtaining a higher crop production. Soils of Tikamgarh district, in general have low to medium availability of nitrogen. The total consumption of nitrogenous fertilizers in the district is 7418 metric tonnes.

Table 8. Consumption of fertilizers in metric tones in April- March, 2005-06

Kharif season			Rabi season			Total		
Nitrate	Phosphate	Potassium	Nitrate	Phosphate	Potassium	Nitrate	Phosphate	Potassium
649	526	55	6769	3701	464	7418	4227	519

(Source: Fertiliser Statistics 2005-06)

1.11 Wastelands

Wastelands are patches of land, which are not under the productive use owing to some natural and external causes, such as water-logging, high erosion, deposition of salts, etc. Wastelands can be thought of as prospective sites for industrial development or site for solid waste disposal.

1.12 Biodiversity

1.12.1 Flora

Betwa and Jamni river are surrounded by a good forest cover, which is mainly classified as southern tropical dry deciduous forest. In general, dry deciduous forest Teak and Kardhi have good along with other species like Haldu, Sejna, Arjun, Saja, Bija, Kasi, Reunjha, Shisham, Tendu, Palas, Khair, Achar and Mahua. The shrubs and herbs that are found commonly are Adusa, Aak, Baibirang, Chhind, Charota, Dudhi, Gokharu, Harsingar, Karonda, Nagphani and Ratanjot. Among trees, Palash, Bel, Kewanch, Ratti, Ghunchi and Satawar are commonly seen. The grasses like Khas, Phool bohari, Rusa, Doob, Musel, Barru are commonly found in the forests of Tikamgarh. The major aquatic vegetation consists of *Hydrilla verticillata*, *Vallisnaria spiralis*, *Potamogeton*, *Typha*, *Nitella sp.*, *Chara sp.*, along with algae like *Phormidium uncinatum*, *Oscillatoria curviceps*, *Navicula sp.*, *Diatoms*, and *Nostac sp.*, etc.

1.12.2 Fauna

The fauna comprises spotted deer, Blue bull, Peacock, Wild pig, Monkey, Jackal etc. Besides these, birds of many species may also be seen here.

1.12.3 Wetlands

Wetlands are considered the most biologically diverse of all ecosystems. They are generally distinguished from other water bodies or landforms based on their water level and on the types of plants that thrive in them. Specifically, wetlands are characterized as having a water table that

stands at or near the land surface for a long enough season each year to support hydrophytes. Put simply, wetlands are lands of hydric soil. Wetlands have also been described as ecotones, providing a transition between dry land and water bodies.

1.12.4 Orchha Sanctuary

The Orchha Sanctuary was established in 1994 and has an area of 46 sq.km. It is a must visit site for the wildlife and nature lovers. The tourists love the place bestowed with breathtaking natural beauty. The Orchha Sanctuary is covered with lush green vegetation of the Kardhai and Dhawa trees.

Birds and animals like the Sloth bear, Nilgai, Wild boar, Langur, Spotted deer, Jackal and Peacock are found here. The forest is a favorite haunt for trekkers and jungle hikers. The Jamni and the Betwa rivers flow along the Orchha forest.

2. Socio-economic and cultural patterns

2.1 Population

The population of Tikamgarh district is about 12.03 lakhs with a population density of 238 persons per sq. km. The density more than the state average of 196 but less than the national average of 324. The ratio of female per thousand males in the district was 886 in the year 2001. It was nearly the same 883 in the rural areas but remarkably higher in the urban areas 899.

2.2 Livestock

The livestock population of the district consists of cows, buffaloes, goats, poultry and pigs. The cattle of hybrid varieties are few in number due to inadequate infrastructures and facilities with the veterinary department of the district. The topography of the district is such that the interior villages can not be covered by mobile veterinary units.

There are many private dairies as well as co-operative milk societies operating in the district but these are yet to develop established dairy businesses. Dairy has immense potential of being taken as a major economic activity in the district as all other necessary requirements like green fodder and co-operative societies etc. exists here.



Figure 6. Map showing block wise population in Tikamgarh District

Table 9. Livestock population in Tikamgarh district.

Livestock	Cow	Buffalo	Sheep	Goat	Horse	Mule	Donkey	Camel	Pigs	Total
Population	379871	154569	51205	249099	645	135	513	5	7793	843835

(Source: District Statistical Book 2007)

2.3 Scheduled Castes and Scheduled Tribes

The district is not a tribal dominated area with only 24% of the population comprising Scheduled Castes and 4.31% of the population comprising Scheduled Tribes (2001). But among the blocks more than half of Scheduled Castes population is in Palera, Niwari and Jatara, whereas more than half of Scheduled Tribes population is in Prithvipur, Baldeogarh and Tikamgarh block.

2.4 Poverty line survey

As per the poverty line survey result, about 35% of the total rural families are below the poverty line. The figure is little less than state average of 37% but it is higher than the National average of 29 %. Also, from the total rural families below poverty line, about 32% belong to the scheduled castes category. Similarly, a large number of families below the poverty line are landless agriculture laborers or marginal farmers (2006).

2.5 Electricity

Almost all villages (99.8%) are electrified whereas the state average is 97% and the national average is 86%. Though the scenario of electrification in the district does not look very bad but when the rural and urban consumption of electricity is compared, we find that the urban consumption of electricity (54%) is higher than the rural consumption (45%) (2006).

2.6 Education

Due to the efforts made under Sarva Shiksha Abhiyan (SSA), access to primary school is available to every child within 1 km, middle school within 3 km, high school within 5 km and higher secondary school within 8 km radius.

Table 10. Literacy rate in Tikamgarh district.

S. No.	Block	Rural Literacy (%)			Urban Literacy (%)			Total Literacy (%)		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
1	Tikamgarh	66.10	37.60	52.72	84.84	67.36	76.58	72.71	48.21	61.17
2	Baldeogarh	58.79	31.43	46.04	73.01	49.64	62.06	60.27	33.34	47.71
3	Jatara	62.76	34.26	49.51	76.23	51.77	64.59	64.24	36.27	51.20
4	Palera	68.56	39.00	54.79	75.16	50.56	63.60	69.11	39.98	55.53
5	Niwari	76.30	44.51	61.39	81.01	56.29	69.38	77.22	46.81	62.78
6	Prithvipur	68.35	39.06	54.66	70.15	44.46	58.09	68.70	40.11	55.33

(Source: District Statistical Book- 2007, Economics and Statistical Department, Madhya Pradesh)

Table 11. Educational institutions in Tikamgarh district.

S. No.	Block	Primary School	Middle School	High School	Higher Secondary School	Degree College	Professional Institute and others	Others (Ashram Schools)
1	Tikamgarh	363	153	19	12	02	03	-
2	Baldeogarh	336	110	11	07	-	01	-
3	Jatara	342	123	13	06	01	-	02
4	Palera	332	110	08	04	01	-	01
5	Niwari	269	117	12	11	01	-	01
6	Prithvipur	323	102	13	05	01	01	-

(Source: District Statistical Book- 2007)

There are 6 Degree Colleges/Post Graduate Colleges offering various courses in Arts, Science and Commerce. The following are some professional institutions operational in the district:

- Government Polytechnic, Tikamgarh
- Government Technical School, Tikamgarh
- Basic Training Institute, Kundeshwar
- School for the Cultivation of Fine Arts, Music and Dancing
- Government Devendra Sanskrit Vidyalaya, Tikamgarh

The district library was initially established in 1930 and was named Devendra Pustakalaya. In 1976 it had 36,057 books and 28 newspapers and 8 magazines and journals. There is one public library each at Jatara, Niwari, Prithvipur and Palera.

2.7 Health services

In terms of health services, Tikamgarh is considered to be one of the extremely backward districts in Madhya Pradesh. Among the standard outcome indicators in the context of health are the Infant Mortality Rate (IMR) and Mother Mortality Rate (MMR). The district figure of IMR is 713 per 1 lakh live births as against 600 of state and 540 of national average.

In terms of crude birth rates, Tikamgarh district has rate of 42.1 per thousand. The fertility rate is 6.1. Also only 16.9% of the deliveries are safe deliveries and the immunization of the district is only 35.9%. The Multiple Health Worker (MHW) stays in the villages and conducts the deliveries and also attends to minor health problems. The average population being served by a Community Health Centre (CHC) in Tikamgarh is approximately three and half lakh.

The district hospital, known as Rajendra Hospital, Tikamgarh, started functioning in its present shape from 16th January, 1955. The hospital is located at Civil Lines area on Tikamgarh-Niwari road near the Circuit House. The hospital has 143 beds. All modern equipments, such as X-ray, ECG Machine, Boyles Apparatus, Dental Unit etc. are available here. An anti-rabies center was

opened here in April 1958. In 1961 a Public health Laboratory was provided. A family welfare and child health center is attached to this Hospital.

Table-12 Patients treated during past few years in Tikamgarh district.

S. No	Block	Number of patients		Number of Patients	
		Allopathic		Other Systems	
		Indoor	Outdoor	Indoor	Outdoor
1	Tikamgarh	23075	150127	N.A.	112877
2	Baldeogarh	4159	20735	N.A.	30188
3	Jatara	2090	16719	N.A.	39443
4	Palera	0	14873	N.A.	37370
5	Niwari	2214	39361	N.A.	32125
6	Prithvipur	4777	38376	N.A.	47866

(Source: District Statistical Book -2007)

In order to provide medical facilities to the rural population, a number of Primary Health Centres and sub centres were opened during the Second Five Year Plan. They were mostly located in the Community Development and National Extension Service Blocks.

Table-13 Numbers of hospitals, primary health centres and sub centres

S. No	Block	Allopathic Hospitals	P.H.C.	Sub Centers	Ayurvedic Hospitals	Number of beds available	
						Allopathic	Other
1	Tikamgarh	3	2	24	7	163	-
2	Baldeogarh	2	3	27	3	36	-
3	Jatara	1	5	34	6	36	-
4	Palera	1	3	25	5	30	-
5	Niwari	1	4	25	4	24	-
6	Prithvipur	1	3	21	6	30	-

(Source: District Statistical Book -2007)

There are three maternity and child welfare centres in the district. One of them is attached to the district headquarters hospital and other two are located at Jatara and Palera. There are 4 homeopathic dispensaries in the district located at Tikamgarh, Mawai, Lidhora and Bhelsi. The district has in all 8 family welfare centres. The urban family welfare centre is attached to the District Hospital Tikamgarh while 6 rural centres are attached to the Primary Health Centers.

2.8 Telecommunications

The telecommunications infrastructure of the district is satisfactory. Other than BSNL, Airtel and Idea's landline as well as mobile connectivity is available in the district. Almost all the Panchayat headquarters are connected with telephones but some highly backward areas are still to have proper telephone connectivity. Though these villages have phone availability but the lines often are disturbed. Telephone availability in the district is about 9 for one thousand people. There are about 10265 land line phones, 3900 W.L.L. and about 8000 mobile phones.

2.9 Minerals

The northern districts of Madhya Pradesh (Bundelkhand) produce high amounts of minerals such as limestone 'chuna pathar', diasphore and pyrophilite. Mining and quarrying of stones for building materials is very common. pyrophilite diasphore occurs in Tikamgarh district. It is used in refractories, ceramics, paper, rubber, potteries, insecticides, toys as statues industries.

2.10 Tourism

2.10.1 Ahar

This ia a village and has three old Jain temples. One of these temples has an image of Shantinath which is 20 feet high. A tank from the Chadela days with a fine dam is present.



2.10.2 Baldeogarh

This place has a fort which is a fine specimen of its class. The town is known for its betel-leaf cultivation. The town also has the famous temple of 'Vindhya Vasini Devi'. An annual seven-day Vindhyavasani fair is held here in the month of Chaitra and attended by about 10,000 persons.

2.10.3 Jatara

Jatara has a lake called Madan Sagar. This place lies below the level of lake. The lake is long and broad. It is retained by two long dams. These dams were built by the Chandela Chief Madan Varman (1129-67) after whom the lake is named.

2.10.4 Kudar (Garh Kudar)

In Kudar, on the top of a small hill stands a fort built by Maharaja Birsingh Dev. The temple of local Goddess Maha Maya Gridh Vasni stands here. There is a large tank held on the temple Goddess, which is called 'Singh Sagar'.

2.10.5 Kundeshwar

This place is famous for Kundadev Mahadev temple. Three big fairs are held at Kundeshwar annually. An important fair is attended by 50,000 persons held in Pouse/Magh (January) on the occasion of Sankranti. The second fair is held on the occasion of Basant Panchimi and third fair is held on the Kartik Ekadashi in the month of October/November.

2.10.6 Madkhera

The importance of this place lies in its famous Sun Temple. Its entrance is from the east. The idol of Sun is placed here. The other main object of interest of the place is a temple of Vindhya Vasani Devi on the top of a hill.



2.10.7 Niwari

In former days a small fort was there in Niwari but was demolished by the Marathas. It possesses a temple of Khedapati Hanumanji.

2.10.8 Orchha

Orchha is a famous religious centre of the Hindus. It is known for its religious and cultural heritage.

2.10.9 Prithvipur

It is the headquarter town of block Prithvipur. The name of the town is derived from Prithvi Singh. Near the town lies the Radha Sagar Tank. The important temples of the town are Somnath temple, Ramjanki temple and Atan ke Hanumanji. The town possesses a fort.

3. Governance Structure

There are 12 Nagar Panchayats i.e., Kari, Badagaon, Baldevgarh, Khargapur, Jatara, Lidhora, Niwari, Taricharkalan, Palera, Prithvipur, Jeron Khalsa and Orchha, and one Nagar Palika i.e., Tikamgarh, in the district. The names of Police Stations located in the district are Tikamgarh, Digora, Lidhora, Palera, Kudila, Baldeogarh, Khargapur, Orchha, Mohangarh, Niwari, Jatara, Budera, Jeron, Badagaon, Teharka, Sendri, Simra, and Prithvipur.

The main administrative unit in the Panchayati Raj Institutions (PRIs) is now the Gram Sabha. There are 865 Gram Sabhas in the district. The Gram Sabhas have administrative and financial powers to carry out various responsibilities.

The Gram Sabhas are responsible for basic planning of their respective villages under the aegis of Gram Vikas Committee. They issue administrative sanctions and execute works up to Rs 5 Lakhs. The Janpad Panchayat gives administrative sanction upto Rs. 10 Lakh, District Panchayat up to Rs. 50 lakhs and Zila Yojana Samiti up to Rs. 150 Lakhs. The administrative pattern of the district is the same as in the other districts of Madhya Pradesh. The district is the basic unit of the administration. The Collector is the head of the administration. The Collector is the chief functionary of the State Government in the district and is the chief coordinating authority at the district level.

4. Economic base

4.1 Working population

The working population comprises 47% of the total population. The majority of the working population is unskilled and employed in the primary sector. The major part of working population (approx. 80%) is engaged in agriculture and allied activities. Thus the agricultural activities are the major livelihood for the rural families.

Table 14. Blockwise working population of Tikamgarh district

S. No	Block	Main Workers					Marginal workers	Total working population (7+8)
		Cultivators	Agri-cultural Laborers	House-hold industries	Other workers	Total workers (Males)		
1	2	3	4	5	6	7	8	9
1	Tikamgarh	40043	6191	2147	22644	71025	32598	103623
2	Baldeogarh	46728	6258	2056	9249	64291	31421	95712
3	Jatara	58083	8724	2468	11786	81061	35949	117010
4	Palera	52470	6802	1385	6000	66657	19266	85923
5	Niwari	38247	6435	1930	14452	61064	24270	85334
6	Prithvipur	37125	3886	2185	8281	51477	27098	78575
	Total	272696	382296	12171	72412	395575	170602	566177

(Source: District Statistical Book 2006)

Table 15. National Rural Employment Guarantee Act (NREGA)

Employment provided to households	1.23292 lakh
Person days (in lakhs)	
Total	49.53
Scheduled Castes	16.26
Scheduled Tribes	6.05
Women	16.36
Others	27.22
Total fund: Rs.	104.95 Crore
Expenditure	67.52 Crore
Total works	7851
Works completed	1165
Works in progress	6686

(Source :

http://nrega.nic.in/homedist.asp?check=1andstate_name=MADHYA%20PRADESHandstate_code=17anddistrict_name=TIKAMGARHanddistrict_code=1707andfin_year=2008-2009)

4.2 Rural urban classification

Nearly 17.7% of the population of Tikamgarh district lives in its 13 towns and rest 82.3% in the rural areas. The rural areas extending over 4,659.19 sq km contain 963 villages and stain a population of 9,90265 while urban area has population of 2,12,733.

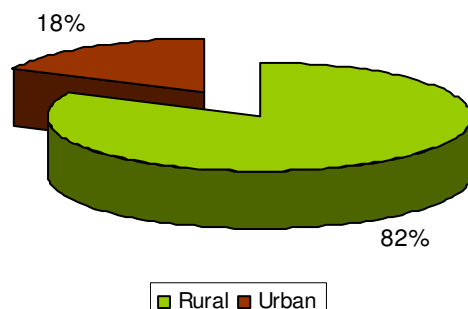


Figure 7. Distribution of Rural Urban Population in Tikamgarh district (2001)

A majority of the population (82.3%) of the district lives in rural areas, which is much higher than the state and national figure of 74.7% and 73% respectively. This shows how important the development of the rural areas is, which only can result in the overall development of the district.

4.3 Industries

No Industry of any significance seems to have been set up in Tikamgarh district during the past. Its an industrial backward district and categorized under 'C' category. However, minor village industries of a rudimentary nature, which are the inherent part of rural economy, exist in this district. These consist of wood work units, handloom, weaving, pottery, brick-making, utensil-making, and gold, silver and lac ornament making. These are mainly run by the artisans class who inherited the skill of their craft.

Table 16. Category wise industries

Block	Small Scale Industries			Medium Scale Industries			Large Scale Industries		
	No.	No. of person employed	Invest in lakhs	No.	No. of person employed	Invest in lakhs	No.	No. of person employed	Invest in lakhs
Tikamgarh	68	106	36.02	-	-	-	-	-	-
Baldeogarh	23	41	2069.00	-	-	-	-	-	-
Jatara	80	173	22.88	-	-	-	-	-	-
Palera	22	29	2.24	-	-	-	-	-	-
Niwari	24	65	13.59	1	5	51.2	-	-	-
Prithvipur	15	24	3.88	-	-	-	-	-	-

(Source: District Statistical Book 2007)

II. KEY ENVIRONMENTAL CONCERNS

The district of Tikamgarh suffers from extreme levels of poverty and environmental degradation. Natural resources, which can provide sustainable livelihoods to people, are being plundered to yield big profits to a few. At the same time, people are being forced to migrate every year in search of an uncertain sustenance. The region has been in the news for starvation deaths, acute drought and exploitation.

Human activities are intricately related with population change, the patterns and levels of use of natural resources, the state of the environment and the pace and quality of economic and social development. Demographic factors, combined with poverty and lack of access to resources in some areas and excessive consumption and wasteful production patterns in others, exacerbate environmental degradation and resource depletion. This creates additional burden for mainly the womenfolk, who are dependent on these natural resources.

It has large tracts of pristine forest which face the threat of rapid erosion from growing urbanization and tourism. It also has regions facing acute water scarcity, loss of biodiversity and industrial backwardness. The resulting loss of livelihoods has led to a poor quality of life and social unrest.

Groundwater supply is poor because of an underlying granite layer that does not hold water. Modern pumps and tubewells are therefore ineffective. Traditional ways of holding water, such as tanks, have fallen into disuse. Drinking water is therefore extremely scarce in many villages.

1. Land resources

1.1 Agriculture

Agriculture provides more than food. It contributes to the economic growth, better livelihood, provision of environmental services, and it is important for poor people both in urban and rural areas. Agriculture has always been the predominant occupation of mainly rural areas and rewards well the tradition bound and hard working farming community.

The economy of Tikamgarh district is based mainly on agriculture. About 61% of the total working populations of the district are farmers and 17% are labors working in fields. It means approximately 80% of the people are related to agriculture.

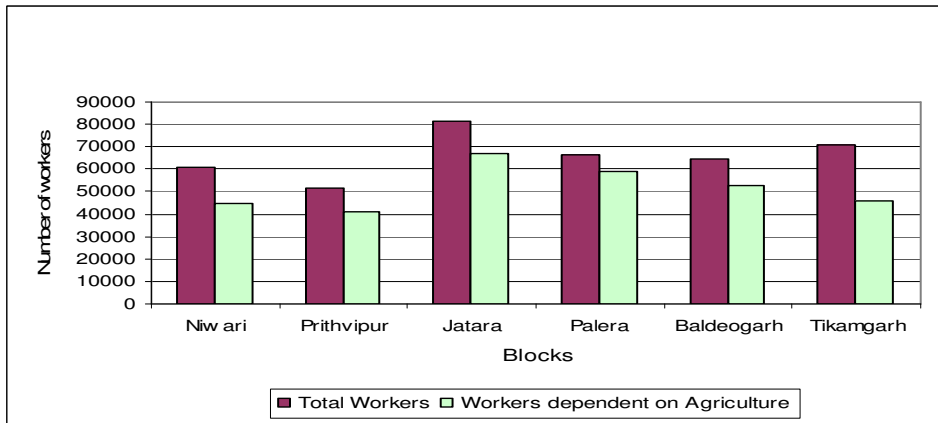


Figure 8. Workers dependent on agriculture in Tikamgarh district

Table 17. Rainfall and Irrigated area in Tikamgarh district.

Year	Annual Rainfall (mm)	Total cultivated Land (ha)	Total irrigated Area (ha)	% total irrigated area
2002-03	676.9	246132	204485	56
2003-04	1148	258172	218034	55
2004-05	679.6	252345	217193	55
2005-06	680.7	240951	206778	48
2006-07	513.6	204146	143939	48
2007-08	417.2	231398	65564	24

(Source: District Statistical Book 2007)

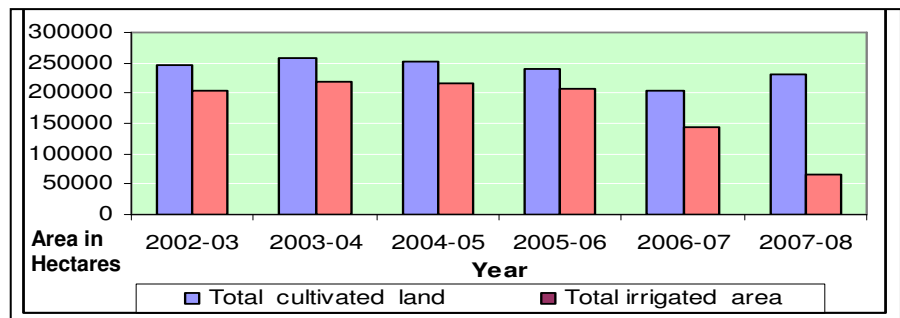


Figure 9. Cultivated and irrigated land in Tikamgarh district.

Crops

Both Kharif and Rabi crops are important in the district. So far, wheat is one of the important crops grown in the district. However, an overall decline in the production of most of the crops has been observed over the years from 1992 to 2006. Table 18 gives the production of some important crops in the district.

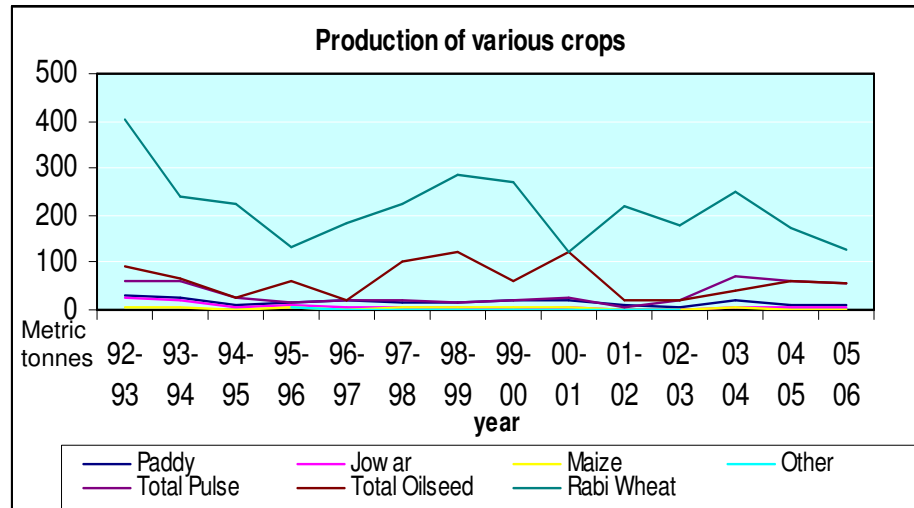


Figure 10. Production of various crops in Tikamgarh district.

(Source: Deputy Relief Commissioner, Madhya Pradesh.)

Pressures

The two major pressures on Agriculture are a) increasing population and b) decreasing water for irrigation.

- Increase in population** - The population of India has grown from 361 million in 1951 to 846 million in 1991 and crossed the one billion mark on 11th May, 2000. The population would grow further to 1.7 billion by 2050 as per the UN's long-range projections for India. While the population of district Tikamgarh was 940829 in 1991, it increased to 1202998 in 2001. This shows an increase of 27.86% in 10 years. Population exerts a huge pressure on agricultural land for food production and other needs.
- Decrease in water for irrigation** - A severe drought has been sweeping the Bundelkhand region since 2003. Data shows that there is continuous decline in the annual rainfall due to which there is a decline in the total irrigated areas. The total irrigated area was above 50% in 2003 and slipped down to less than half i.e. 24% in 2007.

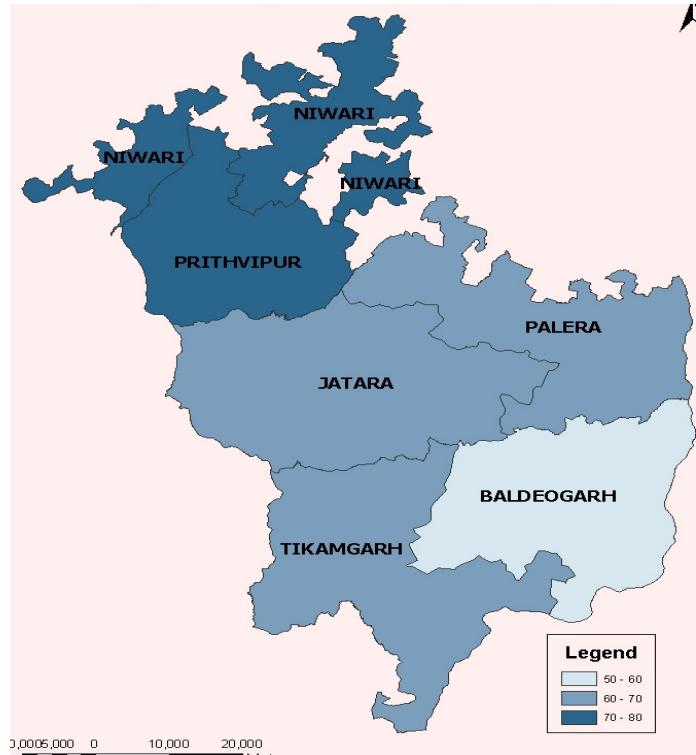


Figure 11. Percentage of Irrigated land in Tikamgarh district

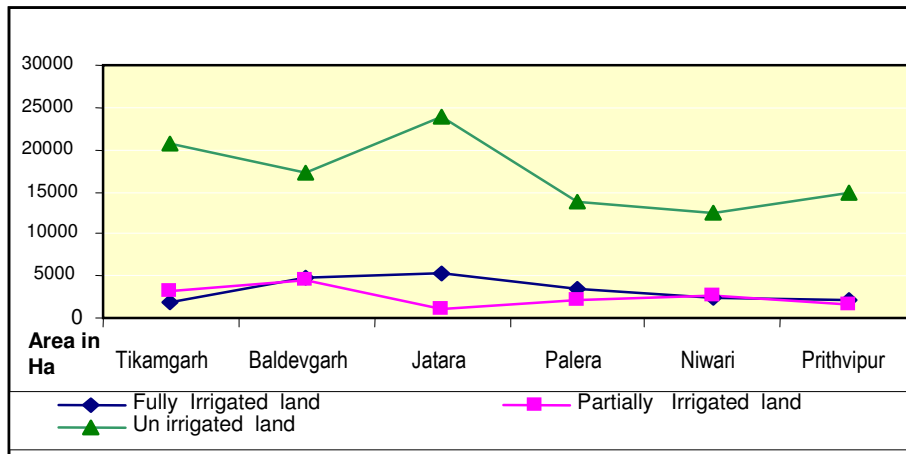


Figure 12. Blockwise detail of irrigated land in Tikamgarh district

State

- The condition of agriculture (especially food grain production) has deteriorated during the last four-five years. The main reasons behind this are inadequate irrigation facilities, scanty rainfall and persistent drought situation.

- The facet of agriculture has changed to a large extent due to shifting in cropping pattern driven by profit-motive and government agricultural policies. Also, the non-availability of sufficient water resources to irrigate the fields is responsible for this changed pattern.

Table 18. Production of various crops in Tikamgarh district.

Year	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06
Paddy	28.3	26.3	10.2	15.7	21.8	13.2	13.6	22.6	22.7	10.1	5.7	19.2	9.4	9.0
Jowar	23.9	20.6	5.7	9.1	6.2	6.6	3.2	1.6	4.2	0.4	1.3	5.1	4.6	5.5
Maize	5.8	4.0	1.6	3.2	1.2	3.7	3.1	2.9	2.6	0.8	0.1	2.8	1.7	2.2
Others	-	-	-	3.0	0.6	0.3	0.1	0.2	0.2	0.1	0.1	-	-	-
Pulse	63.6	61.4	25.2	17.3	21.0	21.4	14.6	19.8	24.4	4.0	22.7	70.9	59.1	56.5
Oilseed	92.1	66.0	26.3	59.8	18.0	100.0	124.3	63.5	124.0	22.6	21.5	40.7	59.5	58.5
Rabi Wheat	405.6	239.2	225.9	131.1	184.4	224.9	287.6	268.2	123.4	221.7	180.7	250.3	174.8	126.3

(Source: District Statistical Book 2007)

- Population-driven pressure on croplands coupled with abject rural poverty has triggered rural migration to urban and industrial centres for wage employment.

Impact

- Low agricultural productivity because of inappropriate agricultural practices makes it an unviable profession. Mono-cropping is practiced by most of the farmers causing adverse impact on the soil fertility. Due to the increase in population, land holding per person has become low that renders low yield and therefore poor income from the land. The production is largely concentrated in the hands of a few landlords.
- Migration: Livelihood from other sources, like forest and traditional crafts is also decreasing. With only 3-4 months of agricultural labour being available and no alternate livelihood of option. So a large number of farmers are forced to migrate to other regions of the country, the estimated migration rate being around 39% for the region.

Response

Several plans have been put in place by the Department of Agriculture for increasing the agricultural productivity as well as irrigation facilities in Tikamgarh district. Brief description of these plans are provided below:

- 1. Nalkoop yojana-** The main aim under this program is to increase the irrigated area of agriculture land through tubewells. For construction of tubewells 75% or maximum Rs. 15000 are released. This scheme is implemented in Jatara and Prithvipur only and not in other blocks.
- 2. Small tanks/ Percolation tanks scheme -** The main aim of this scheme to increase irrigation facility and water levels in nearby wells. Another aim is to provide employment to labourers.
- 3. Maize development scheme-** This is a state level scheme as maize is the staple crop.

4. **Annpurna scheme-** This scheme is mainly for the poor farmers belonging to Scheduled Castes and Scheduled Tribes where they are given financial help for procuring seed for agriculture.
5. **Macro management plan-** This plan covers all the major programs related to the crop production and irrigation. It also covers the water harvesting schemes for overall development of the district. Some of the programs of this plan are mentioned below:
 - a) *Ekikrit anaj vikas mota anaj-* The main aim of this scheme is to increase the production of cereals and the area under them.
 - b) *Sat ganna vikas program-* The main aim of this program is to increase the sugarcane production and the area under it.
 - c) *National water harvesting area development program-* The aim of this program is to harvest surface and rain water.
 - d) *Surface water collection scheme-* Under this scheme percolation tanks will be constructed which will increase the ground water table.
 - e) *I.N. and balance and integrated use of fertilizers-* Balanced and appropriate amount of fertilizers will be used under this scheme.
 - f) *Mechanization of agriculture plan-* The aim of this program is to motivate the farmers to use machines for increasing the yield of the crop.

Suggestions

The following steps are suggested which may increase crop yields and thereby food and livelihood security:

- Credit at low rates of interest to farmers.
- Promote organic farming. Organic farming is a form of agriculture that relies on crop rotation, green manure, compost, biological pest control, and mechanical cultivation to maintain soil productivity and control pests, it excludes or strictly limits the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock feed additives, and genetically modified organisms. By encouraging organic farming the agricultural and land productivity can be increased. With organic farming the land condition will become better and the expenses on agriculture can be decreased.
- Use of neem or other plant-based pesticides.
- Good practices such as moisture and water conservation, increasing green cover and strengthening animal husbandry.
- Innovative use of even small plots of land to combine agriculture with horticulture, herbs and farm-forestry.
- Traditional crop rotation, which helps maintain the fertility of the land. Any new crops/crop rotation should be introduced after proper evaluation and open discussions with farmers.
- Promotion of crops that are specialities of the area.

- Promotion of hardy crops like Pasahi paddy or wild paddy, Savan and Kakun, which can be ready for harvest in 60 days and can provide food security to poor families in difficult times.

**'Impact of Organic Cotton Farming on the Livelihoods of Smallholders':
A case study (Maikaal bioRe project in central India)**

To investigate the economic viability of organic cotton farming and the impact conversion in the livelihoods of the involved farmers, the Swiss Agency for Development and Cooperation (SDC) and the World Wide Fund for Nature (WWF), Switzerland, asked the Research Institute of Organic Agriculture (FiBL) to conduct a research study on organic cotton farming in the Maikaal bioRe project in Madhya Pradesh, central India.

This study assessed the impact of conversion to organic cotton farming on the livelihoods of smallholders in Madhya Pradesh. For this purpose, the study compared farm profile data yield and financial input/output and soil parameters of organic and conventional farms over two cropping periods (2003 – 2005).

The results show that organic farms achieve cotton yields that are at par with those in conventional farms, though nutrient inputs are considerably lower. With less production costs and a 20% organic price premium, gross margins from cotton are thus substantially higher than in the conventional system. Even if the crops grown in rotation with cotton are sold without organic price premium, profits in organic farms are higher. In the perception of most organic farmers, soil fertility significantly improved after conversion. However, the analysis of soil fertility parameters in soil samples from organic and conventional cotton fields has shown only minor differences in organic matter content and water retention.

The results of the study indicate that organic cotton farming can be a viable option to improve incomes and reduce vulnerability of smallholders in the tropics. To exploit the potential it is important to find suitable approaches to manage the hurdles of conversion so that the marginalised farmers are able to adopt the organic farming system.

1.2 Forests

Forests facilitate the conservation of ecological balance, biodiversity. They enhance the quality of the environment by checking soil erosion, water retention and conservation. Forests regulate water cycle, act as a carbon sink which balances the carbon dioxide and oxygen in the atmosphere and facilitate reduction of the greenhouse gases effect. Population pressure, poverty and a weak institutional framework have often been viewed as the predominant underlying causes of forest depletion and degradation.

Forest cover - Forest cover in the district had shown a positive growth during 1997-2001 but later the growth started decreasing. This increase has been mainly due to the inclusion of road side plantation in the forest land along with the inception of tree plantation program by the forest department in the district. This was coupled with the efforts of Joint Forest Management program initiated during the same period. The large scale plantations were of *Tectona grandis* and *Acacia nilotica* raised during early 1990s. Afterwards the forest cover started decreasing.

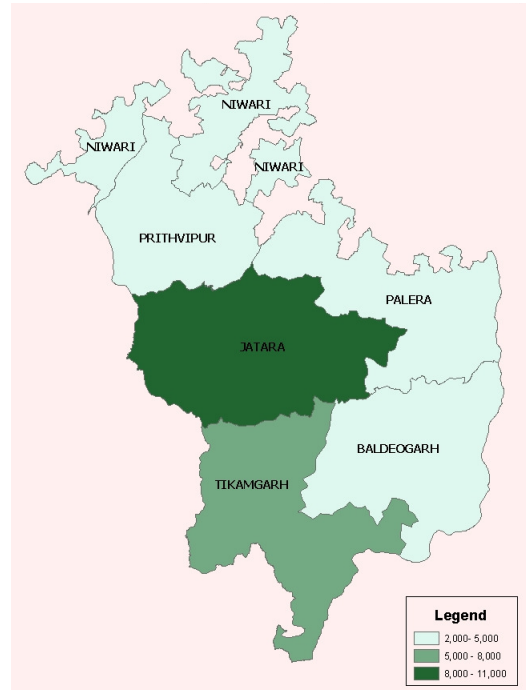
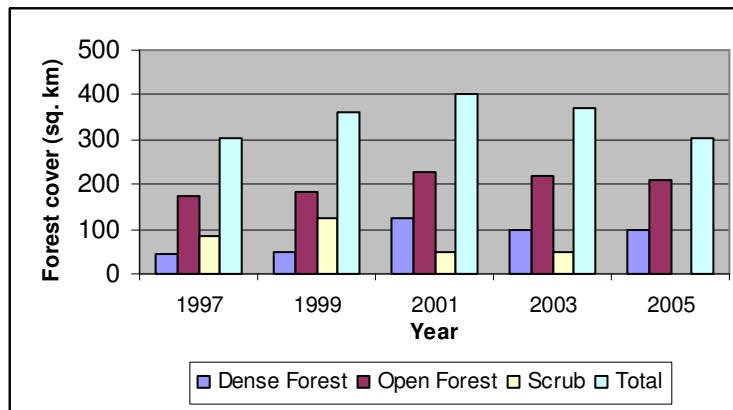


Figure 13 Revenue forest in Hectares in Tikamgarh districts

Figure 14. Trend Analysis of forest cover in Tikamgarh district.



Pressures

Several factors, such as fuel wood collection, grazing etc., put pressure on forests some of these factors are discussed below:

Fuel wood collection and grazing in forest land

A growing demand of fuelwood and fodder is putting enormous pressure on the forest resources. There are a total 865 villages in the district which are dependent on forests. Much of the energy for cooking in rural areas comes from collection of fuelwood from forests. This contributes to the overall deterioration of the quality, stocking condition and productivity of the forest, ultimately leading to deforestation and degradation. Moreover forest land is an important source of grazing and fodder in the absence of adequate pasture land, and it is a viable policy of fodder development. A large population of cattle is also dependent on forests. This results in overgrazing and over-extraction of green fodder, leading to forest degradation through damages to regeneration and compaction of soil. Grazing occurs even in protected areas.

Forest fires

The forests of the Tikamgarh district are mostly dry and deciduous and prone to forest fires in the summer season from February to June. These are by and large incendiary in nature. Most of the man-caused fires are associated with the activities of Mahua and Sal seed collection and the desire to promote better grass growth after the rains. The fires caused by Mahua collectors are the most common fires in March and April, and are the cause of widespread damage to the forest growth.

State

Forest land has been under immense pressure for its diversion for non forestry purposes. Important reasons for such diversion have been mining, irrigation, settlement, encroachments for agriculture, etc.

Table 20 shows that only 6.02 % of the area of district is under forestry with no dense forest and a small area comprising moderately dense forest. Whatever exists is the open forest, which is also decreasing due to deforestation.

Table 19. Percentage of forest cover in Tikamgarh district.

Total Area	Very dense forest	Moderately dense forest	Open forest	Total forest	Percentage of forest (%)
5048	0	96	208	304	6.02

(Source: State of Forest Report 2005)

Table 20. Forest cover in Madhya Pradesh.

Total Area	Very dense forest	Moderately dense forest	Open forest	Total forest	Percentage of forest (%)
308245	4140	36237	34132	76013	24.66

(Source: State of Forest Report 2005)

Impact

Excessive deforestation has a negative impact on the environment at not only the local level but also at the global level. It can also affect the sustainable socio-economic developmental processes in the developing countries as forests have been generating a lot of employment opportunities in the primary, secondary, and tertiary sectors and have been a source of subsistence to the poorest of the poor. Furthermore, the inhuman face of deforestation is characterized by the increasing stress on the poorer sections of the society and women, as they have been primarily involved in gathering fuelwood, fodder and water in the traditional village economies.

Erosion of Soil

When forest areas are cleared, it results in exposing the soil to the sun, making it very dry and eventually, infertile, due to volatile nutrients, such as nitrogen being lost. In addition, when there is rainfall, it washes away the rest of the nutrients, which flow with the rainwater into waterways. Because of this, merely planting trees may not help in solving the problems caused by deforestation, for by the time the trees mature, the soil will be totally devoid of the essential nutrients. Ultimately, cultivation in this land will also become impossible, resulting in the land becoming useless. Large tracts of land will be rendered permanently impoverished due to soil erosion.

Disruption of the Water Cycle

Trees contribute in a large way maintaining the water cycle. They draw up water via their roots, which are then released into the atmosphere. A large part of the water that circulates in the ecosystem of rainforests, for instance, remains inside the plants. When these trees are cut down it results in the climate getting drier in that area.

Loss of Biodiversity

The unique biodiversity of the area is being lost on a scale that is quite unprecedented.

Drought

One of the vital functions of forests is to absorb and store great amounts of water quickly when there are heavy rains. When forests are cut down, this regulation of the flow of water is disrupted, which leads to drought in the area.

Climate Change

It is well known that global warming is being caused largely due to emissions of greenhouse gases like carbon dioxide into the atmosphere. However, what is not known quite as well is that deforestation has a direct association with carbon dioxide emissions into the atmosphere. Trees act as a major storage depot for carbon, since they absorb carbon dioxide from the atmosphere,

which is then used to produce carbohydrates, fats, and proteins that make up trees. When deforestation occurs, many of the trees are burnt or they are allowed to rot, which results in releasing the carbon that is stored in them as carbon dioxide. This, in turn, leads to greater concentrations of carbon dioxide in the atmosphere.

Response

Integrated village development project in Lotna and Singhpura village

As a part of the integrated 50-village development programme, an action project has been undertaken which essentially aims at improved agro-forestry, green manure production through Dhaincha, charcoal and briquetting technology, income generation activities, introduction of energy saving devices, group dynamics, and motivation and empowerment of women for improved living. Development Alternatives, Jhansi has been able to organise Self Help Group (SHG), especially among the women. The project has completed the initial spadework and is ready to launch field level operation.

Joint Forest Management (JFM) Program

After the formulation of the National Forest Policy (NFP), 1988, which highlights people's/ community participation in forest conservation, both the central and state governments formulated the necessary rules and procedures to implement "involvement of village communities and voluntary associations" in the regeneration of degraded forest lands.

The Joint Forest Management (JFM) program is a participatory process of bringing the forest department and the local people together in the management of forest and the degraded land resources. Variants of JFM program have existed long before it was formalized by the government. The central government set out the first set of rules vide, Ministry of Environment and Forests (MoEF) circular dated 1st June 1990 and was formally launched in 1991.

In pursuance of the Government of India (GoI) circular dated June 1, 1990, 22 state governments have so far issued their guidelines to involve the village communities and voluntary agencies in protection and regeneration of degraded forest areas on the basis of their taking a share of the usufructs from the forest areas that they protect and develop.

In January 2000, more than 36,075 Village Forest Protection Committees (VFPCs) were protecting about 10.25 million ha of degraded forests under this arrangement (MoEF, 2000). In order to further strengthen the JFM programme, the guidelines were further revised in February 2000 (MoEF, 2000).

Madhya Pradesh is a pioneer state in implementing the JFM program. The government of Madhya Pradesh issued the first resolution in this regard in 1991, which has been amended from time to time. There were 14173 JFM Committees managing about 6 million ha of forest area as on March 2005, which is about 63% of the forest area of the State. More than 1.7 million families

are involved in this programme, of which around 0.8 million families belong to the Scheduled Tribes.

Nature of Committees

The government resolution makes provision for three kinds of committees i.e., Forest Protection Committees (FPC) for protection of well-stocked forests; Village Forest Committees (VFC) for rehabilitating the degraded forest areas; and Eco-development Committees (EDC) in and around Protected Areas (PAs) with a view to ensure biodiversity conservation in National Parks and Sanctuaries. The Committees are to be constituted within a radius of 5 km from the periphery of the forest. So far 153 JFM Committees have been constituted in the Tikamgarh district, of which 139 are VFCs, 12 are FPCs and 2 are EDCs.

Table 21. Details of Joint Forest Management Committees in Tikamgarh district.

District	VFC	FPC	EDC	Total
Tikamgarh	139	12	2	153

(Source: State of Forest Report 2005)

Forest Land Management

Forest land has been under immense pressure for the diversion of its use for non forestry purposes. Some important reasons for such diversion have been mining, irrigation, encroachments for agriculture etc. To regulate indiscriminate use of forest land for non-forestry purposes, the Forest (Conservation) Act 1980 was enacted. The Act envisages seeking permission of Government of India before diversion of use of forest land. The enforcement of this Act has brought down the diversion of use of forest land considerably. It is evident from the fact that as against diversion of 15.65 lakh ha of forest land prior to 1980, only 1.21 lakh ha has been diverted thereafter. Thus a total of 16.86 lakh ha of forest land has been diverted for other purposes. The use of forest land for non-forestry purposes cannot be avoided. It is, however, necessary to regulate the diversion in a manner so that it is minimal. In the Forests Department, the wing of Land Management is entrusted the task of supervising the cases of diversion of use forest land.

Implementation of development schemes operational in the State

The Madhya Pradesh Forests Department (MPFD) has entered into the Public Service Agreement (PSA) with the Madhya Pradesh Government since 2002-03 for development of forests and its infrastructure. The arrangement under this is that in the beginning of the financial year, every Conservator enters into agreement with the Principal Chief Conservator of Forest, who in turn enters into an agreement with the Government. The Conservators have made agreements with their Divisional Forest Officers for the development activities. For the development of forests an Action Plan is formulated under the PSA for every forest division

annually. The areas to be developed are selected from the working plan. The Action Plan consists of the concise detail of the Division; site-wise work detail; budgetary requirement; Forest Committees with whom the work at a specific site is to be implemented; and area of work including the area treated in the past. The Time Plan for the activities undertaken is given. An Expenditure Plan illustrating the details of spending on each component of development activity, Training Plan containing training schedule for all stakeholders in the activity and site-wise minor detail of the works are also given in the Action Plan.

a) Working Plan

There are 62 Working Plans in the state covering an area of 94.689.38 sq. km. The Working Plan implementation is carried out in three major groups according to broad prescriptions extended. These are Protection, Regeneration and Rehabilitation depending upon the requirements of the site for treatment. Protection is extended to ecologically fragile areas which are prone to rapid degradation due to erosion and biotic pressures. Regeneration is prescribed to forest areas with cover more than 40 per cent and is productive stands. The activity consists of regenerating the area after harvesting and is usually achieved by natural assistance extended to area by protecting it from grazing and fire or by artificial regeneration where soil is good in open areas to support planted saplings. Rehabilitation is achieved by extending protection to areas with less than 40 per cent forest cover and allowing previous root stock to take over. Annual areas allotted to these groups are picked up for formulating Action Plan for the Division. The extent of area treated annually under the Protection, Regeneration and Rehabilitation is 18,000, 1,20,000 and 1,80,000 ha, respectively in the state. Annually the coupes, which are units of forest working, are marked under Regeneration group and harvested for the removal of silvicultural timber. These areas are taken back during the next year and are treated for promoting the Regeneration, a cycle which operates for every ten years.

b) Hi-Tech Plantations

The productivity of important species like Teak, Bamboo, Amla and Ghamar are raised with high technological inputs of irrigation and fertilization. These plantations are raised on a small scale with 2-10 ha of area in Plantation Working Circles under the Working Plan. The planting stock for the plantation is obtained from known progeny with established productive potential. Scheme is two-pronged for raising such plantations. One, to establish the good stock progeny in forests and two, to demonstrate that the best growth requires best inputs (like agriculture) for sustaining high productivity.

c) Fire Protection

The forests are to be protected against induced fires. Forest fires are prevalent during the fall and winters when litter is accumulated on the ground and catches fire caused by the people collecting Mahua flowers and fruits and Bidi leaves mainly in the predominantly deciduous forests. The fire lines are prescribed in the Working Plan and fire schemes are prepared during December to undertake protection activities during the next three months. About two lakh km of fire lines are maintained in the state annually, apart from strengthening of communication infrastructure.

Suggestions

- Proper land use planning and policy must be prepared before allocation and use of any cultivable non forest land. Cultivable non forest land should be endowed with intensive plantation to develop forest cover of dense forest type.
- Soil and water conservation in forest area may improve the forest ecosystem, which in long term action may result in high amount of forest cover.
- Women's sensitization and involvement in forest management and conservation can bring better results towards forest upgradation as women are primarily responsible for collection and processing of fuelwood in rural and forest areas.
- Greater participation from local communities and non governmental organizations can certainly help in faster regeneration of forest resources. Such efforts also require a strong commitment by resource management officials.
- Poverty reduction would certainly facilitate forest conservation and upgradation, as poverty reduces incentives for long-term resource management and natural resources.

1.3 Land

Land degradation

“Land” means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system. “Land degradation” means reduction or loss in arid, semi-arid and dry sub-humid areas of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from landuses or from a process or combination of processes, including processes arising from human activities and habitation patterns such as:

- a) Soil erosion caused by wind / water;
- b) Deterioration of the physical, chemical and biological or economic properties of the soil;
- c) Long-term loss of natural vegetation.

Pressures

Land use changes

The diversion of land from forestry and agriculture to other land uses has been one of the principal causes of land degradation. Diversion of forest lands for non forestry purposes was curtailed with the enactment of Forest (Conservation) Act, 1980 with the objective of arresting diversion of use forest land for non forestry purposes. Wherever diversion of forest land is unavoidable, for instance for developmental projects (energy, infrastructure, transportation, etc.) compensatory afforestation of non forest land is mandatory.

However, the loss of prime forests could have an impact in the long-term stability of the forests. The other land use change is due to encroachments, through violation of forest boundaries and illegal farming in forests. Due to their illegal status, they are unable to receive extension services and improve their farming systems, further accelerating land degradation. The encroachment of forest land, and the socio-economic pressure to regularize them, continues to be the most pernicious problem of forest protection.

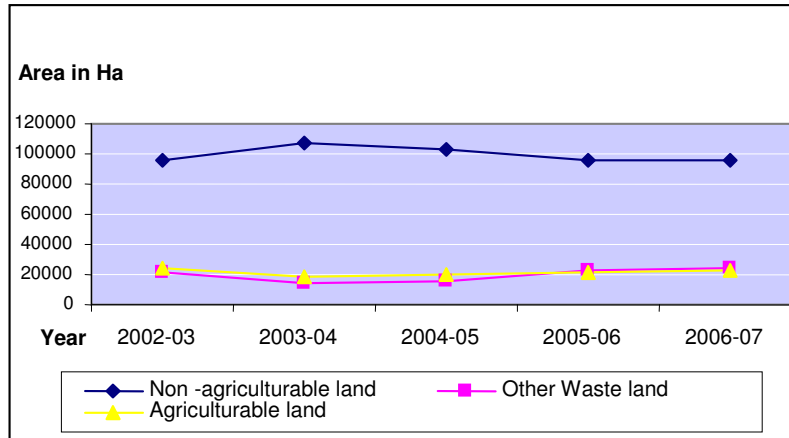


Figure 15. Land availability in Tikamgarh district

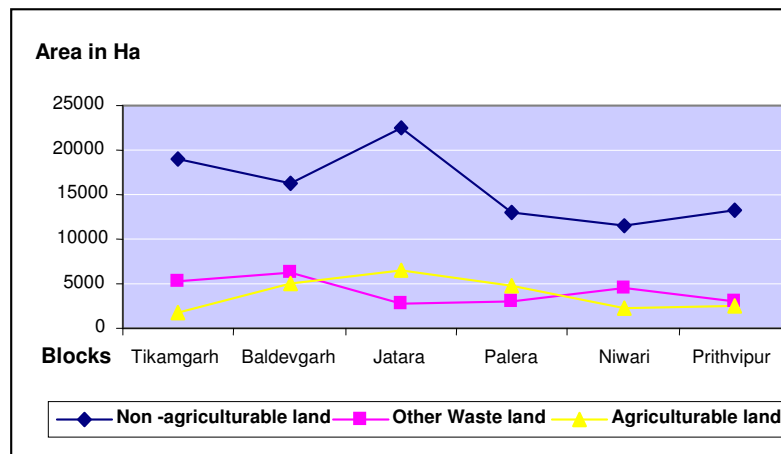


Figure 16. Land use in Tikamgarh district

Unsustainable agricultural practices

Unsustainable agricultural practices include excessive use of fertilizers, pesticides, frequent cropping patterns, inappropriate technologies, or choice of crops/ plants, etc. Non point sources of pollution are a problem in areas with wide application of fertilizers.

Industrial and mining activities

Industrial effluents and mining are also emerging as important agents of desertification. In most cases the root of the problem is the mismanagement by land users and poor implementation of pollution control regulations. Besides productivity decline or complete loss, progressive degeneration of biodiversity is yet another major consequence of land degradation. In many areas the groundwater has been polluted.

Unsustainable water management practices

Poor and inefficient practices and over abstraction of ground water are some of the major unsustainable water management practices, which has led to the problem of land degradation. Over abstraction of ground water without compensatory recharge has led to depletion of ground water table.

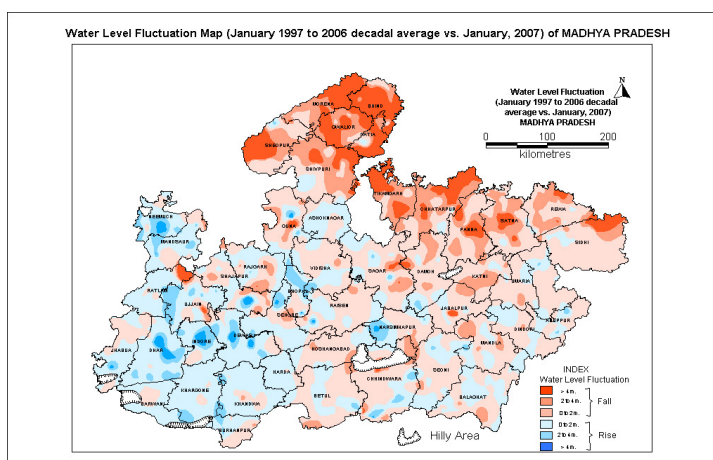


Figure 17. Map showing the water level fluctuation in Madhya Pradesh (Jan 1997 to 2008)

State

Of the total area of the district, 56% is what is termed as the Net Sown Area. Slightly more than half (52% in 2003-04) of the cultivated area was double cropped. The district has a high proportion of wastelands (21.99% of total geographical area with almost 52695 ha being classified as “land with or without scrubs” and the rest as “Barren/ stony sheet rock area” by National Remote Sensing Agency. The total area under forest is 6 % of which 70.5% is degraded forest.

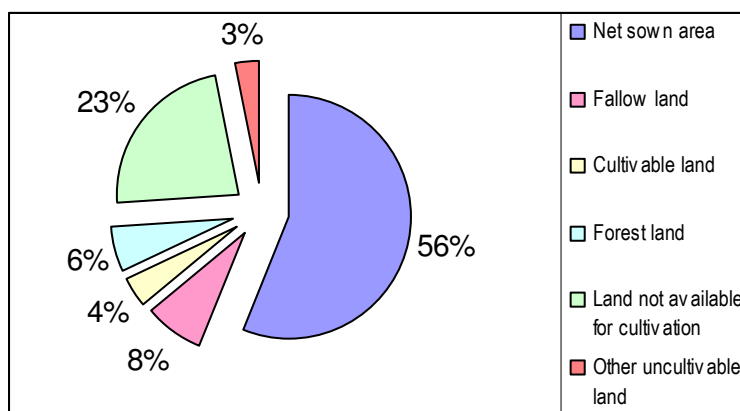


Figure-18 Tikamgarh District – Land Usage

(Source: District Statistical Report, 2004)

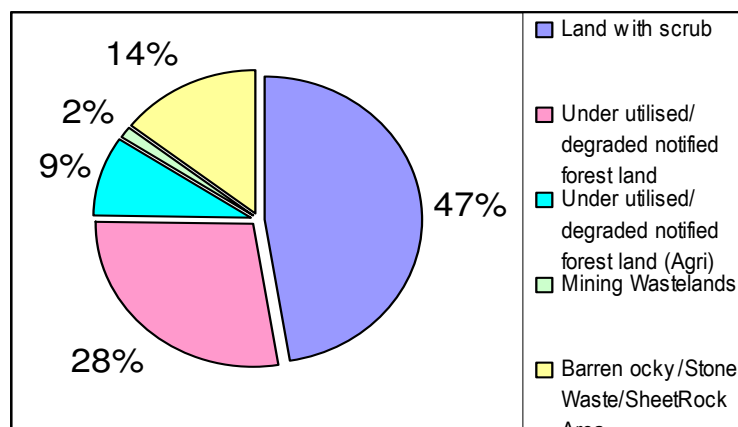


Figure-19 Percentages of different types of wasteland in Tikamgarh District

(Source: Wastelands Atlas of India 2005, NRSA, Ministry of Rural Development, GoI)

Table-22 Categories of Wastelands in Tikamgarh district (sq Km)

Land with scrub	526.95
Land without scrub	0
Waterlogged and marshy land (Permanent)	0
Waterlogged and marshy land (Seasonal)	0
Land affected by salinity/ alkalinity (Strong)	0
Land affected by salinity/ alkalinity (Moderate)	0
Land affected by salinity/ alkalinity (Slight)	0
Shifting cultivation area (Abandoned Jhum)	0
Shifting cultivation area (Current Jhum)	0
Underutilised/ degraded notified forest land	309.12
Underutilised/ degraded notified forest land (Agricultural)	96.8
Degraded pastures/ grazing land	0
Degraded land under plantation crop	0
Sands (Flood Plain)	0
Sands (Levees)	0
Sands (Coastal Sand)	0
Sands (SemiStab.-Stab>40m)	0
Sands (Semi Stab.-StabMoer.High 15-40m)	0
Sands (Semi Stab. To Stab. Low<15m)	0
Sands (Closely Spaced Inter-Dune Area)	0
Mining Wastelands	18.06
Industrial Wastelands	0
Barren rocky/Stone Waste/SheetRock Area	159.06
Steep Sloping area	0
Snow covered and/or Glacial Area	0
Total area of wastelands	1109.99
Total Area of Tikamgarh district	5048
% of wastelands	21.99

(Source: Wastelands Atlas of India 2005, NRSA, Ministry of Rural Development, GoI)

Impact

Land degradation is due to complex interactions between the physical, biological, social, cultural and economic factors. It affects the economic growth of not only the degraded region, but also the country as a whole; its social and economic development. Degradation and drought affect the sustainable development through their interrelationships with important social problems; such as poverty, poor health and nutrition, lack of food security, and other issues arising from these problems such as migration, social conflicts and unrest.

The fertility status and the productivity of soil as a medium for biomass production depends largely on the top soil which, besides being a producer of biomass, is important for many other well-known important functions. Soil erosion, by wind or water, affects these functions adversely and has produced considerable negative impacts both on-site as well as off-site. The problem of soil erosion due to rainwater is severe in Tikamgarh district.

Higher erosion rates have resulted in the sedimentation of river beds, siltation of drainage channels, irrigation canals, and reservoirs. Siltation has changed the hydrology of several watersheds. The storage capacity of many reservoirs has been reduced drastically due to accelerated erosion and deposition.

Response

Watershed Projects of the Department of Land Resources, Ministry of Rural Development

The Department of Land Resources of Madhya Pradesh addresses the task of developing wastelands and degraded lands aimed at checking land degradation, putting such lands into productive use; and increasing the availability of biomass, specially fuel wood and fodder through the two major programmes, namely the Integrated Wastelands Development Programme (IWDP), and the Drought Prone Areas Programme (DPAP). The major activities under these programmes include soil and moisture conservation measures, plantation, agro-forestry, horticulture, etc.

Establishment of Watershed Development Fund (WDF)

Realizing the effectiveness of watershed approach adopted for controlling land degradation and increasing productivity, the Union Finance Minister in his budget (1999-2000) speech announced creation of a Watershed Development Fund (WDF). The WDF has since been established at the National Agriculture Bank for Rural Development (NABARD) with the objective of spreading the message of participatory watershed development.

Rajiv Gandhi Mission for Watershed Development Project in Tikamgarh district

The Government of Madhya Pradesh had launched the Rajiv Gandhi Mission for Watershed Development Project on 20th August, 1994 and has been operating since 1st April, 1995 with the objectives of augmentation and conservation of soil and water resources (inclusive of surface as well as ground water) in rainfed areas as a means of proving sustainable livelihood to the rural population by reducing the vulnerability to droughts and by increasing the productivity of sterile

soil in the state. The watershed programme was started in Tikamgarh District in 1997. The Rajiv Gandhi Watershed Technology Mission was helpful in increasing yields, income and gainful employment of the farmers in this region.

The project has the following aims :

- Maximize people's participation in the concept, planning and implementation of land and water conservation schemes in their watershed area.
- To make the entire crop of schemes both more effective as well as transparent in their working.
- To check ecological degradation and improve the environmental resource base.
- To promote the economic development of the village community, employment generation and development of the human and other economic resources of the village in order to promote saving and other income generating activities.

2. Water Resources

Non availability of water for various uses is a major concern in the region. This chapter seeks to understand the core issues related to water scarcity in the district by systematically looking at the various sources of demand and availability of water resources in the district. A major portion of the water resources in the region caters to the agriculture and allied activities since there is an absence of any major industries in the district. Past experience in management of water resources by Public Sector utilities in the region is replete with low cost recovery, poor operation and maintenance of infrastructure, inequitable and inadequate distribution and overall unviability of the system financed by large subsidies.

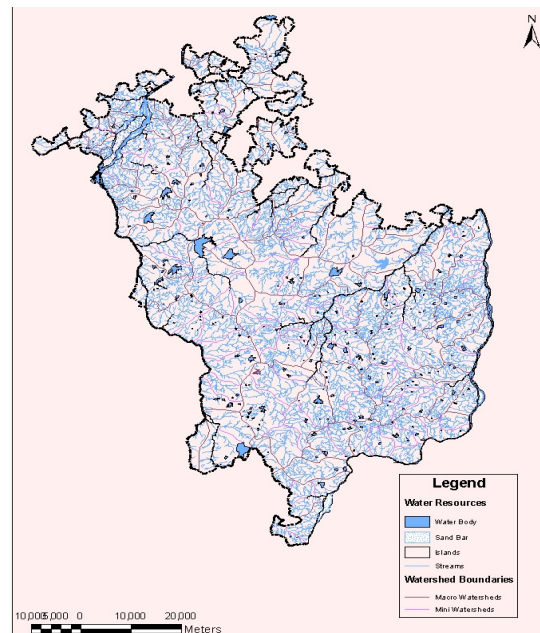


Figure 20. Map showing the watershed areas of Tikamgarh district.

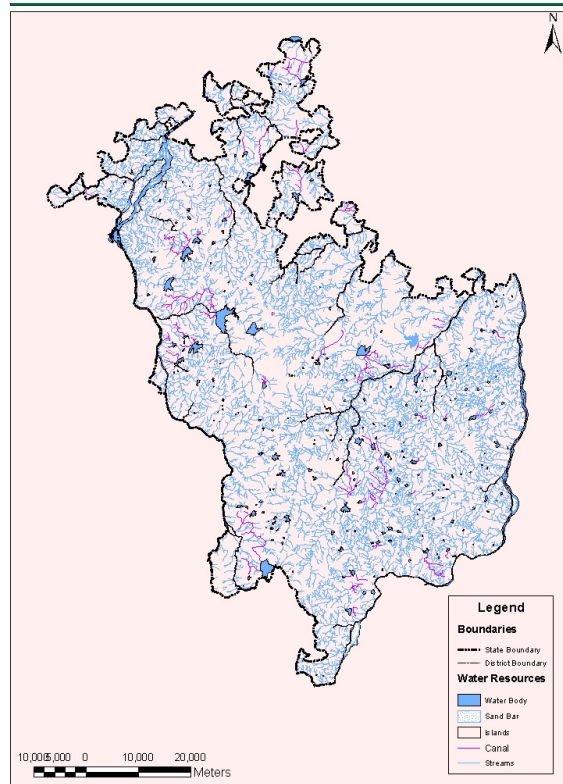


Figure-21 Map showing drainage of Tikamgarh district.

2.1 Water quantity

Due to the difference in altitudes, all the rivers in the district flow from south to north. The drainage can be primarily divided into three major river basins, which are:

- a. **Betwa basin:** Most of the region in this basin comprises the Niwari Block which makes up the north western part of the district. It is comprised of sub basins of two rivers namely Betwa and Jamni.
- b. **Jamni basin:** This is a tributary of the Betwa which flows across on the western boundary of the district that forms the natural boundary of the district. The shape of this basin is in a form of strip which runs along the western boundary. The mean height of this region varies from 300 to 400 meters above mean sea level. At some places it is more than 400 meters. There are various lakes or tanks in this basin due to the undulating topography.
- c. **Ur-Dhasan basin:** The basin falls in Jatara and Palera Blocks of the district.

All the above rivers are non- perennial. Many of them get flooded in the Monsoon and are deficient of water in summers. The excess water in the Monsoon is drained off, due to the slope towards north.

Table-23 Length, area and percentage of areas under water of the Jamni, Betwa and Dhasan rivers.

River	Length of the river (Km)	Area under water (1000 Ha)	Area under water (%)
Jamni	73	116	22.58
Betwa	53.3	57	11.13
Dhasan	100	331	66.29

Table-24 Surface water available from Jamni, Betwa and Dhasan rivers

River	Area under water (sq Km)	% of total water inflow captured (mcm)	Total approx value of water inflow (mcm)
Jamni	1160.00	0.1866	216.51
Betwa	572.30	0.1866	106.79
Dhasan	3308.50	0.2078	687.51

Pressures

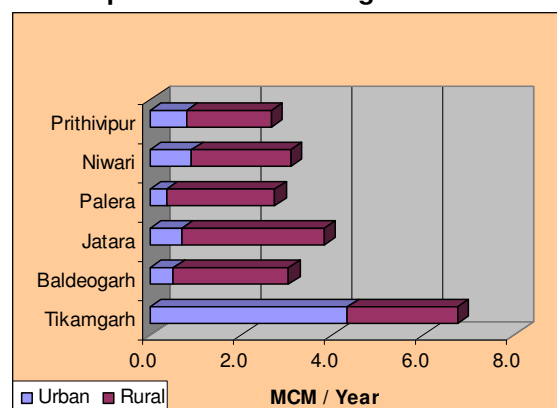
- **Increasing Domestic water demand**

The Rajiv Gandhi National Drinking Water Mission has estimated the per capita domestic water requirement to be 40 litres per day (lpcd) for rural areas, 70 lpcd for towns without sewerage and 140 lpcd for towns with sewerage facilities.

Taking these into account and multiplying by the type of population in the district, the requirement of water for domestic use can be estimated. Utilising population records of 2001, the total domestic requirement for water in the Tikamgarh district is estimated to be around 22 MCM per year.

The main cause for worry, however, is that this demand has been continuously growing over the years due to a massive increase in population. Since 1961, Tikamgarh district has experienced a decadal population growth of more than 25% on an average. The increase in water demand is further contributed by an increase in the concentration of population in urban areas. In 1961, while 15% of the total population was in urban areas, this figure had increased to more than 17% in 2001.

Figure-22 District Domestic Water requirements of Tikamgarh district



Source: Status Report March 2007, Water resources in Tikamgarh district by Development Alternatives.

- **Increasing Agricultural water demand**

It is a fairly well known fact that irrigation accounts for more than 80% of the total water use in India. In Tikamgarh district also, there is a large requirement for water for irrigation purpose. Wheat and rice are the main staple food of the population and although the district lies in the wheat growing belt, rice is also an important crop here.

Both crops are however extremely water intensive. The Kharif crops in the district are

Paddy, Jowar, Maize and Pulses such as Tur, Moong, and Urdu etc. The main Rabi crops are Wheat, Gram, Barley and Mustard. In the areas within the district where water is available, Sugarcane, fruits and vegetables are also grown.

Considering the irrigation water requirement for each crop in the region, the total irrigation water requirement for the district has been estimated to be 1740 mcm per year.

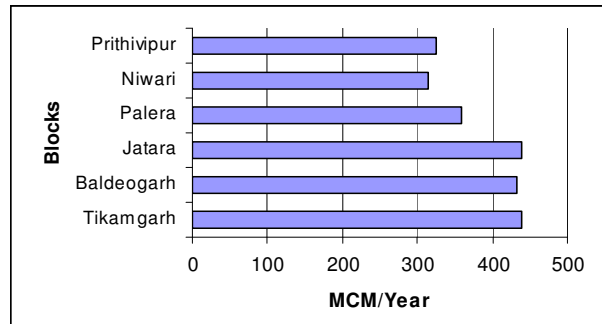
It is however worth mentioning that this requirement is estimated on the basis of the present cropping pattern and the area sown. Increasing income generated in the agricultural sector is a key national objective and an important way through which this can be achieved is by crop diversification and bringing more area into double or even triple cropping system. This will further increase the agricultural demand for water in the district.

- **Limited water availability**

Being a landlocked area, water resource availability to the Tikamgarh district is in form of river streams (seasonal availability), as surface storage (through different reservoirs and dams, which are being constantly degraded), as soil moisture, and as groundwater (stored in aquifers). Whatever the mode of delivery at the user end, the only source is the precipitation occurring either over the area concerned or somewhere else in the watershed.

The entire precipitation is however not usable for the population habitating over the area. This is because a large part of the precipitated water is lost in the form of runoff or evaporation.

Figure 23 Irrigation Water Requirement of Tikamgarh district



Source- Status Report March 2007, Water resources in Tikamgarh & Jhansi district by Development Alternatives.

State

- **Groundwater Resources**

As per the statistics provided by the Central Groundwater Board, Bhopal, the Tikamgarh district has a net groundwater availability of 630 mcm per year. In a large part of the district, the water table has gone down to 50 m below ground level.

- Water level fluctuation -May 1996 to 2005 vs. May 2006

The depth to water level data collected in May 2006 have been compared with average water level data collected from May 1996 to May 2005 and the map so prepared reveals that there has been a fall between 2 and 4 m in water levels in some small pockets of Tikamgarh district.

- Water level fluctuation - May 2006 vs. Nov. 2006

The depth to water level data of May 2006 have been compared with the water level data of November 2006 and the water level fluctuation map so prepared brings out the following details. A fall of up to 2 m in water level was observed in 5.49% of the monitoring wells in many districts including Tikamgarh.

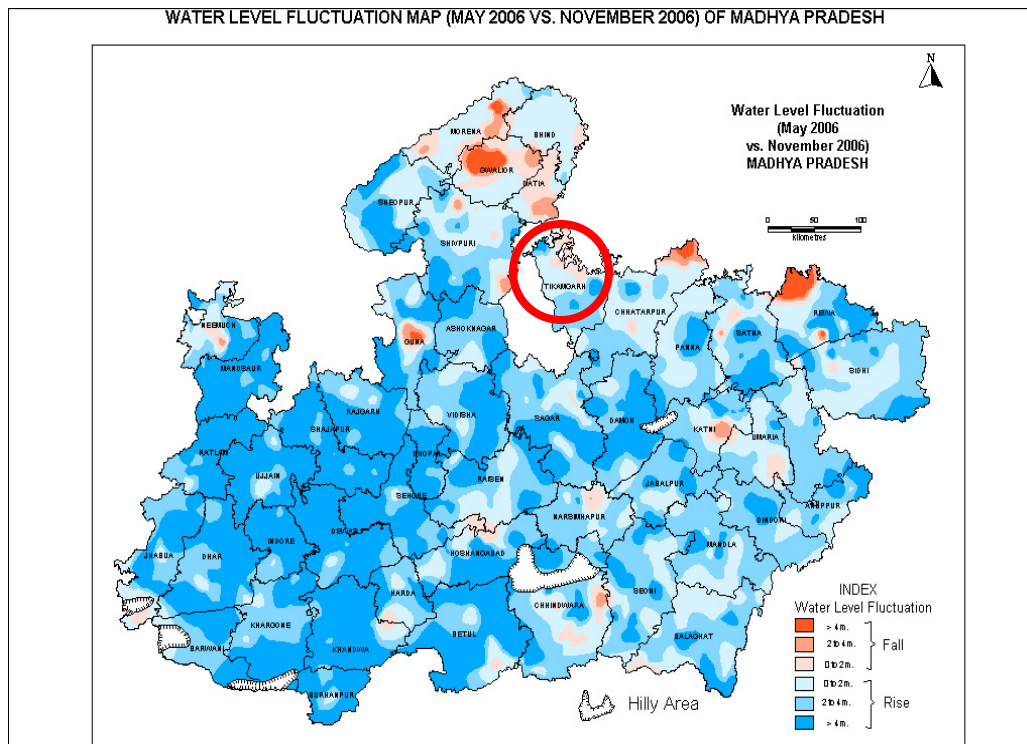


Figure-24 Map showing water level fluctuation in Madhya Pradesh (May 2006 vs. Nov 2006).

- Water level fluctuation decadal average (January 1997 to 2006 vs. January 2007)

The depth to water level data collected of January 2007 have been compared with average water level data collection from January 1997 to January in . A fall between 2 and 4 m in water levels was observed in parts of Tikamgarh district and was noted in 14.27% of monitoring wells. A fall more than 4m in water levels was observed in parts of Tikamgarh district and was observed in 9.27% of monitoring wells.

- **Surface reservoirs**

Water precipitated over the area is either stored in reservoirs or dams are built on the drains for stopping the flowing water for the use in lean periods. In the district there are 24 main reservoirs whose total gross capacity of water holding is about 163047 mcm for the total catchment area of 565 sq km area.

It may however, be noted that total gross capacity does not indicate the water available for storage and many of these reservoirs dry up substantially during the course of the year. At present about 421 tanks exist. Some of them are of considerable size and capacity. In due course of time, needs prompted the use of the existing tanks for irrigation purposes and about 121 tanks have been used for tank-bed cultivation.

It is important to note here is that half of the tanks have become dysfunctional. In the past, these tanks used to be the lifelines of the people in the district. In the dry season, people would desilt them and use the sand to enrich soil in their agricultural fields. Due to decades of artificial fertilizer use, the traditional practice of de-silting the tanks in the dry season has gradually died out and the thicker, impenetrable layer of clay has hindered the recharge of underground reservoirs.

Table-25 Average water level in meters in dug well in Tikamgarh district.

	2003-04		2004-05		2005-06		2006-07		2007-08		2008-09	
	Mar	Jun	Mar	Jun	Mar	Jun	Mar	Jun	Mar	Jun	Apr	Jun
Tikamgarh	18.75	23.35	16.35	21.85	20.75	23.5	13.3	13.07	17	18.15	22.3	22.51
Baldeogarh	18.35	22.85	17.15	22.7	21.65	24	13.86	16.87	17	17.9	22.45	22.98
Jatara	17.9	23.1	18.35	23.85	22.7	23.1	17.85	20.79	23.34	25.15	27.2	27.33
Palera	18.4	22.65	18.35	22.71	21.6	22.5	17.67	23.25	21.05	23.9	25.1	26.13
Niwari	20.15	26.6	19.75	25.6	24.15	26	20.06	32.8	32.07	30.86	30.15	30.15
Prithvipur	21.1	26.35	19.25	24.95	23.25	24.8	22.24	26.98	26.56	28.88	30.05	30.05
Total	114.65	144.9	109.2	141.66	134.1	143.9	104.98	133.76	137.02	144.84	157.25	159.15

(Source - District Statistical Handbook 2007)

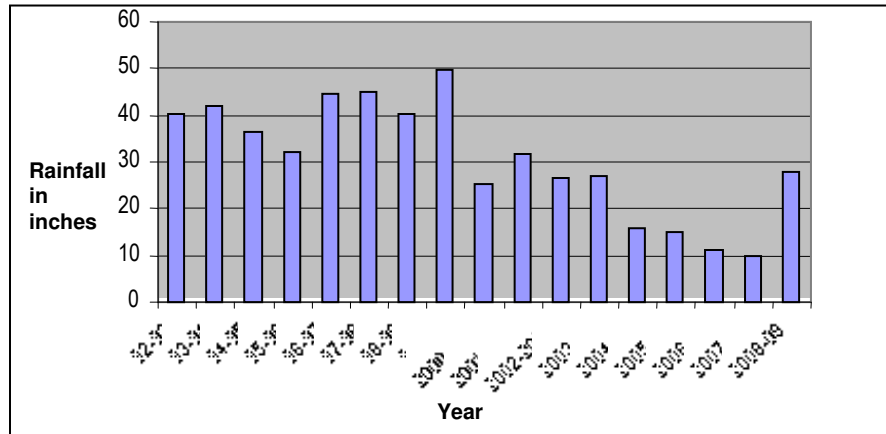


Figure-25 Year wise Annual rainfall in Tikamgarh district (in inches).

Impact

Bundelkhand, with a rich tradition in the past to show the judicious use and collection of water, is today without sufficient water. Chandeli ponds and other such ponds in Tikamgarh were serving the purpose of livelihood to many people, besides serving the irrigation purposes. They were used for fisheries and growing Murar and Kamalgata (lotus). But now these traditional occupations are in danger due to depletion of water in such ponds.

Increasing competition for water severely limits irrigation and constrains food production. It also has influences on other environmental factors like soil degradation. Direct impact can be seen on human health.

MIGRATION

A report on Drought by Madhya Pradesh Apda Niwaran Manch discloses the hard facts about severe migration in Bundelkhand districts. Out of the 600 families in Jatara Block of Tikamgarh district, 400 families have already moved out in Karmaura village.

The migrated are now finding new home in the adjoining states of Delhi, Haryana and Uttar Pradesh. While the wages being offered to these migrated workers in these cities is a matter of concern by itself, the social stigma attached to migration is what the villagers are finding difficult to deal with. Social stigma refers to the fact that people who migrate to cities are looked down upon by others in the village since migration to cities has traditionally been considered a disgraceful activity in the villages.

Response

According to data available in the year 2007-08, the total cultivated area was 41700 ha, irrigation capacity from officially built sources and percentage of irrigated area is given in given below (Table 27):

Table-26 Reporting area of irrigation

District	Total cultivated area (ha)	Officially built irrigation capacity (ha)	Irrigation (%)
Tikamgarh	41700	34339	Due to no rain, irrigation was not done

Table-27 List of plans passed in Tikamgarh district

S. No	Name of Plan	Administrative grant proposed (Rs in lakhs)	Proposed irrigation area (ha)	Present status	Approx time for completion
1	Bagaaj mata plan	963.88	1050	Technically passed and land acquisition is in progress	03/2011
2	Jarua nala pond	575.66	615		03/2011
3	Lahar pon plan	384.40	438		03/2010
4	Kariapatha pond plan	414.08	700		03/2010
5	Rongata ghat stopdam	139.00	200		

- **Necessity of State Water Policy**

Water is a natural resource, fundamental need of living being and invaluable national wealth. In the developmental planning of the state, water is a decisive and multifaceted component. For environmental balance, skillful and planned management for all types of developmental activities, economic use on the equitable basis and in view of the prime importance of water for all human and other living beings, an effective and sound water policy is necessary.

Under the constitution, water resource is recognized as a state subject. State Water Policy is prescribed in accordance to the guidelines and general directions in the National Water Policy, keeping in view the specific necessity for the state of Madhya Pradesh. In view of the inter-state water disputes, the State Water Policy has specific importance.

- **Highlights of State Water Policy: Madhya Pradesh**

Madhya Pradesh also has a State Water Policy but it is in draft form. In terms of allocation priorities identified are drinking water supply, irrigation and afforestation, power generation/ industrial and other uses, and tourism.

The state water policy lays emphasis on:

- **Maintenance and modernization**

A time bound upkeep of the dams and canal systems will be carried out and time-to-time programmes for their rehabilitation will be undertaken. It is an immediate need to reconstruct and rehabilitate the vast irrigation network of the state for future requirements.

- **Ground water development**

The policy says that the ground water should be utilized only to the extent, which can be recharged. For recharging the ground water methods of construction of minor irrigation tanks/percolation tanks should be adopted. Priority will be given to exploitation of ground water resources for drinking water purposes.

Within the jurisdiction of municipal bodies, ground water shall not be utilized without their permission for private use or any other purpose. If availability of ground is more than the requirement of drinking water of a municipal body, then the ground water can be used for any other purpose with due permission of the body.

- **Drinking water and quality control**

The facility of sufficient drinking water shall be extended to the entire urban and rural population. The quality of the surface water and ground water shall be tested on regular basis by concerned departments. It will be made mandatory to treat the industrial and urban waste to the required standards before these are allowed to flow in a stream.

- **Rationalization of water rates**

Water rates should be such that they convey the beneficiary the value of water, its importance, and motivate them for the economical use of water. Water rates necessarily shall be such that the project shall be self-supported. For the use of water for private purposes, rates shall be determined in such a manner that the water can be used strictly in accordance to the prescribed priorities laid down in the policy. Due to the importance of the forest for protection of environment, concessional rates of water shall be fixed for afforestation.

- **Participation in water management programs**

To improve water planning, avoid disparity in water distribution and status of available services rendered to farmers, participation of beneficiary groups in operation and maintenance will be ensured.

➤ **Participation of non governmental organisations**

In the water sector, the non governmental agencies and commercial organizations will have financial and management participation. This type of participation shall be at all levels of project planning, construction and maintenance.

➤ **Research in science and technology**

For effective and economic usage of available water resources, the State Water Policy advocates research in related areas like hydrometeorology, water quality, water harvesting, crops and cropping systems, river morphology and hydraulics, soil research, risk analysis and disaster management etc.

Projects in Tikamgarh district

Tikamgarh has been an area where traditional sources such as the wells, tanks, and perennial streams formed the basic lifeline as far as water is concerned. After independence, when the drinking water became the responsibility of the state government, several rural and urban projects were planned. A brief description of these projects is as follows-

- **Urban Drinking Water Supply**

For supply to the Tikamgarh town, multiple sources are tapped to fulfill the demand. Water supply is mainly done from the river Jamni and its reservoir. In addition, several other sources, mentioned below are used to keep the supply of the town going.

- a) Tal Darwaja well
- b) Bajaj ki Bagiya well
- c) Mahendra Baag well
- d) Haridas Mandir well
- e) Old Tehri well
- f) Mau Nala Bavri
- g) Hospital tubewell
- h) Gol Quarter tubewell
- i) Vinodkunj Tigela tubewell

Besides the piped water supply, several handpumps have also been installed in the town. These are installed and maintained by the Nagar Panchayat, Tikamgarh. As far as the other towns in the district are concerned, piped water supply has been arranged for them also.

However, there is no data available on actual coverage of the population through the formal water supply system. Even the habitations that are covered, low water availability, frequent pipeline breakages and an obsolete pipelines system ensure that the distribution is intermittent (number of hours is limited and pressure is low) and high standards of water quality are not ensured. Several parts of the town do not receive water everyday and duration between successive supply of water increases from one to three or four days as peak summers approach.

Irrigation Water

Tikamgarh has been dependent mostly on masonry wells for its essential irrigation. In 1902, there were 14,800 wells in Orchha State. The number of wells has now considerably increased. There are 49,555 wells in the district out of which 43,806 are irrigation wells and 2,356 are abandoned wells. The usual means of irrigation on wells have been the Moth (the leather-bucket / rope) and the Persian wheels; both powered by a pair of bullocks. This has slowly been replaced by diesel/electrical pump sets.

Tikamgarh district has several artificial lakes and tanks, from where canals have been taken out for irrigation. The latest major project that has significantly benefited the district is the Rajghat canal that passes through several districts of both Madhya Pradesh and Uttar Pradesh. It has recharged water levels in a large number of wells from where the canal passes.

Another major initiative, that may have significant ramifications for the district, is the much debated interlinking of rivers. One of the first feasibility reports published is of the Ken-Betwa link. This project proposes to provide irrigation in 74 villages in Niwari and Jatara blocks of Tikamgarh district, besides other areas. The project may, however, have significant environmental, social and political issues.

Rural drinking water supply

In the Survey of Drinking Water Supply Status in Rural Habitations conducted in 2001, it was found that out of the total 865 inhabited villages in the district, 760 could be categorized as the problem villages. As per the guidelines, the problem villages were :

- those villages which do not have an assured source of water within a distance of 1.6 kilometers or within an elevation of 100 metres in hilly areas.
- those villages where the available water has an excessive salinity, iron, fluoride, arsenic, nitrate or other toxic elements; or
- those villages where diseases like cholera, ague etc. are endemic.

Since then, all the villages have been provided at least one source of drinking water, mostly tube wells. In most of the villages it has been observed that the sources start to dry up from January onwards and the situation becomes worse in the peak summer months. Poor sanitation practices in the region add to the woes by spoiling the water quality also.

Suggestions

In the present scenario the management and distribution of water has become centralized. People depend on the government system, which has resulted in disruption of community participation in water management and the collapse of traditional water harvesting system.

As the water crisis continues to become severe, the following needs have emerged :

- There is a dire need of reform in water management system and revival of traditional systems.
 - A scientific and technological study needs to be carried out to assess the present status so as to suggest suitable mitigative measures for the revival to traditional system/wisdom.
 - Revival process should necessarily be backed by people's initiative and active public participation.
 - Necessary legislation needs to be enacted for preservation of existing water bodies for preventing encroachment and deterioration of water quality.
 - Rain water harvesting and its storage.
- **Why harvest rainwater?**

This is perhaps one of the most frequently asked questions, as to why one should harvest rainwater. There are many reasons but following are some of the important ones.

- To arrest ground water decline and augment ground water table.
- To beneficate water quality in aquifers.
- To conserve surface water runoff during monsoon.
- To reduce soil erosion.
- To inculcate a culture of water conservation.

2.2 Water Quality

Bundelkhand region as whole has been facing severe water quality problems in terms of the presence of fluoride, nitrate, iron and bacteria in the water. In recent years water quality has also emerged as a principal environmental concern in the region. The quality of water is commonly affected due to :

- infiltration of water soluble substances that are dumped, spilled, spread or stored on the land surface.
- disposal of hazardous and infectious solid wastes in natural or man made depressions without adequate scientific considerations.
- the disposal of fluids through wells and sinkholes directly into aquifers.

- release of industrial waste in an unsystematic manner and without pre disposal treatment.
- mixing or interaction with heavy metals from mining.

The chemical characteristics of water depend on various factors like depth of soil, characteristics of soil, and subsurface geological formations through which ground water passes. There are several dissolved constituents like dissolved solids, inorganic ions, organic solids, etc., which regulate the chemical character of water. Some of the common constituents are as under:

Fluoride: Fluorides at high level are toxic to humans. These are low in solubility and the amount present in water is limited.

Nitrate: Nitrate ions are formed from nitrate or ammonium ions by specific microorganisms that occur in soil, water, sewage and digestive tract of organisms.

Coliform bacteria: Coliform bacteria are the commonly-used bacterial indicator of sanitary quality of foods and water. These are present in the environment and in the feces of all warm-blooded animals and humans. They are not likely to cause illness. However, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in the water system.

Pressure

Most of the villages in the district are not facilitated with any kind of disposal mechanisms. They just let all the liquid wastes into nearby agriculture fields or on the streets. Besides causing an overall filthy atmosphere, it also contaminates the soil and groundwater. The traditional manner of waste disposal from the household is the responsibility of each house in the village.

Traditionally, a household would earmark a particular site, known as 'ghoora', not too far away from the house and deposit all the waste in that site. This used to be an open site and would include disposal of faecal matter of the children and the old persons. With rainwater, the ghoora also percolates to the ground water and increase the nitrate concentration in it. Agrochemicals used in agriculture are also get washed off with surface water.

Bundelkhand has vast deposits of minor minerals such as granite, stone chips, stone powder, silica sand and riverbank sand. These are being mined indiscriminately. Both the environment and the health of workers suffer. Fluoride and iron are mainly present naturally in the groundwater due to the rocks and minerals that form the geology of the region.

State

One of the largest Chandeli ponds, Nandanwara in Tikamgarh, is in danger due to uncontrolled mining in the area. Mining may damage the dam made over it. There is the need to watch that mining in the area does not damage the traditional and useful resources of water.

The primary survey conducted by Development Alternatives in Tikamgarh (2007) revealed the following information.

- In almost 59 out of 64 samples, the drinking water was contaminated with either coliform bacteria, nitrate, fluoride or iron, which made the water unfit for drinking without treatment.
- The presence of coliform bacteria and nitrate presence in the drinking water sources is primarily due to poor sanitation practices (water sources were seen to be surrounded by domestic sewage and cow dung heaps nearby water sources) and agricultural operations (run-off from agricultural fields, use of fertilizers)
- Fluoride and iron are mainly present naturally in the groundwater due to the rocks and minerals that form the geology of the region.
- Due to poor quality of drinking water, there is high prevalence of diseases such as diarrhoeal infections, cholera, typhoid, hepatitis A, gastro-enteritis, skin diseases and dental problems.

There has been an inconsistency in the concentrations of water quality parameters over three seasons. In winter bacterial contamination found maximum in comparison to other two seasons (summer and monsoon). This phenomenon generally is not observed: Figures 24-26 shows the water quality in the three seasons.

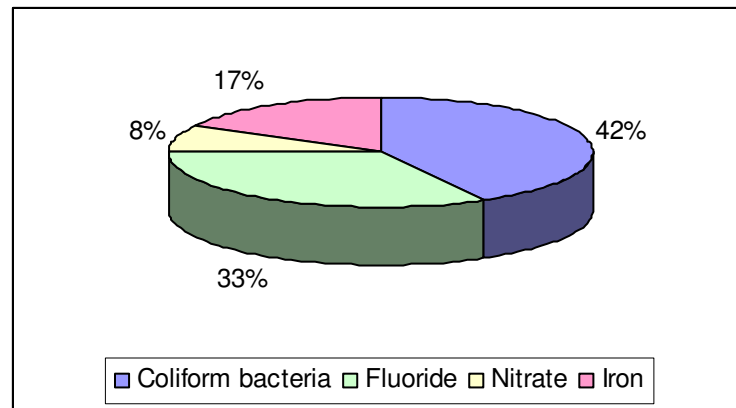


Figure 26. Water quality in winter in Tikamgarh district

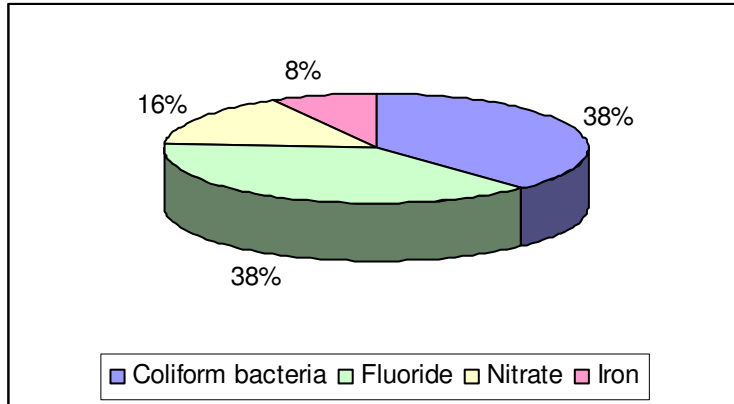


Figure 27. Water quality in summer in Tikamgarh district

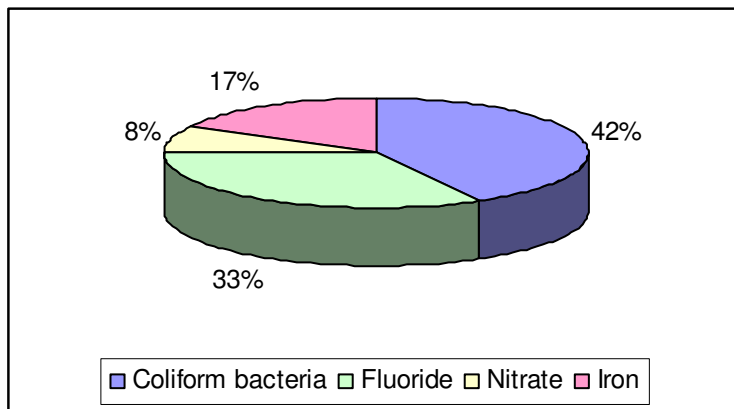


Figure 28. Water quality in monsoon in Tikamgarh district

From the above graphs, the following inferences can be drawn:

- **Coliform bacterial contamination**

- **Possible Reasons**

- Release of domestic waste water into the fresh water bodies which generally contaminated with pathogenic bacteria
- Open defecations in an around the water sources, Sewage contamination
- Contamination due to unhygienic practices

- **Fluoride contamination**

- **Possible reasons**

- Severe exploitation of ground water (over pumping)
- Fluoride might have reached ground water through weathering of primary silicates and associated accessory minerals present in rocks.

- Application of some chemical fertilizers containing fluoride as base
- Heavy mining activities in the area.

- **Nitrate contamination**

- **Possible reasons**

- Open defecation near the source introduces ammonia which further gets converted to Nitrate.
 - Leakage of Industrial waste and domestic sewage into the water source.
 - Run-off from agricultural fields into surface water bodies or leaching into the ground water.

Impact

Ponds and surface water sources are mostly contaminated with bacteria that makes the water unfit for direct consumption. Interactions with villagers have revealed that the maximum numbers of animals are affected by diseases during monsoon when the weather is hot and humid and the water is dirty. The main diseases that the animals suffer from are diarrhea, protozoa diseases, bacterial diseases, viral, fungal diseases, ghatrunda (Throat disease), khurpaka and muhpaka (Foot and the mouth diseases).

As a result of the increasing scarcity and deteriorating quality of water, the accessibility of water resources for people in Tikamgarh district is reducing day by day. Households and other consumers are therefore adopting alternate but costly strategies (digging tube wells, installing electric pumps and constructing reservoirs, drawing unauthorized power connections, etc.) to offset the meager supply. For slum dwellers, the inadequate supply results mostly in a time opportunity cost as they spend on an average 2-3 hours to fetch water. In addition, they have to rely on multiple sources to ensure a sufficient supply for their families. The number of sources itself is very low (one source for almost 75-100 households).

- **Impact of mining on water quality**

Mining activities normally cause the following adverse impacts on water availability and quality during mining and post-extraction processing :

- Drastic reduction in the water quality in the immediate neighborhood of mines through an increase in harmful chemicals (such as heavy metals) due to mining.
- Contamination of local surface and groundwater due to discharge of untreated effluents into water body bodies during treatment of mined ores.
- Significant changes in local hydrology, thereby disturbing water percolation and groundwater recharge patterns, and consequently reducing local freshwater availability.

- In some cases, post-mining operations may create fine dust, which pollutes the surface of the water bodies, causing lung diseases for workers and neighboring populations, and destroying the productive capacity of adjacent agriculture lands.
- Irreversible destruction of vegetation cover due to improper mining methods and lack of restoration efforts.
- Contamination of drinking water sources by radioactive mining wastes.

Response

In the district, the water supplied to habitations through the piped system is treated Public Health Department.

- **Public Health Engineering Department:**

The Public Health Engineering Department is an independent department under Government of Madhya Pradesh. The major activities of the department are enumerated below:

- Survey, investigation, preparation and execution of water supply schemes for towns and villages.
- Survey, investigation, preparation and execution of sewerage and sewage disposal schemes for towns.
- Execution of rural sanitation schemes.
- Supply of safe drinking water at places of Fair.
- Coordination in prevention of pollution of water bodies due to discharge of industrial wastes.
- Giving technical advice to various Government departments and local bodies on Public Health Engineering topics.

Suggestions

- Promote optimum fertilizer usage; the chances of nitrate contamination might be reduced.
- Promotion of health and hygiene practices among the communities.
- If the sources are microbiologically contaminated, then the cleaning, raising boundary walls of wells, proper covering of the sources, chlorination and promotion of point of use water treatment techniques might reduce contamination.
- Trainings on different issues of water quality monitoring and management should also be done at the Panchayat or village level by involving communities.
- Regular monitoring and evaluation of the interventions should be conducted so that the gaps can be immediately addressed. Regular quality monitoring of all the water sources should be carried out thrice a year (once for every season), so that appropriate timely action can be taken. Water purification systems should be setup immediately after the recognition of the problem.

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