



Sustainable agriculture for attaining food security and poverty alleviation of district Anuppur, Madhya Pradesh

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Abstract

Agriculture is the primary source of livelihood and poverty alleviation for the major portion of human society. In some cases, considerable progress in poverty reduction may have been achieved at the cost of sacrificing environmental sustainability. For example, the Green Revolution that transformed agriculture and, in some cases, boosted food production also degraded agricultural land and water catchments through soil erosion and excessive use of chemical inputs. Unsustainable agricultural practices have often deteriorated the environmental sustainability as well as the long-term productivity of agricultural land. The Indian government has implemented various poverty alleviation programs and social welfare initiatives to address these issues, but all of these have not successfully alleviated the poverty of rural areas. Sustainable agriculture's capability to reduce poverty can significantly encourage policy discussions, create knowledge-sharing opportunities, and enhance capacity-building possibilities. Such initiatives would assist in disseminating innovative technological developments and policy approaches to promote sustainable agriculture and eliminate poverty, thus improving livelihood opportunities in rural agricultural regions. This paper aims to assess the status of agricultural resources and suggest sustainable planning measures.

Keywords: Sustainable agriculture, food security, poverty alleviation, sustainable planning

Introduction

Agriculture is a primitive work for the survival and development of human society. With increasing population development, agriculture has also developed, but compared to the population's needs, it is not sufficient for the survival of some populations. The majority of the people in India depend for their survival directly or indirectly on farm-related economic activities because agriculture is an integral part of everyday life in Indian society, not only because it employs about 70 percent of the workforce of the country but also because it provides food to the population, raw materials for the industries, wood for fuel and shelter, herbs for medicines, and above all means of sustenance and livelihoods (Hasnain, T.). The agriculture sector for developing economies like India is the primary source of livelihood in both the farm and non-farm sectors and sustainability in the agriculture sector means boosting the rural livelihood system. Livelihood refers to adequate stock and flow of food and cash with an individual to meet their basic needs and livelihood security means secured ownership of, access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet possibilities (Acharya, S. S.). A rural livelihood is "the capabilities, assets and activities that rural people require for a means of living." Sustainable agriculture and rural development are integral and necessary components of sustainable development. Sustainable agriculture involves all three pillars of development - economic, social, and environmental. Agriculture and rural development are sustainable when they are ecologically sound, economically viable, socially justified, culturally appropriate, humane, and based on a holistic scientific approach. This means that sustainable agriculture and rural development action programs, including farming, forestry and fisheries, must meet the nutritional requirements and other human needs of present and future generations,

provide durable and decent employment, maintain and, where possible, enhance the productive and regenerative capacity of the natural resource base, reduce vulnerability and strengthen self-reliance (Hurst, P., Termine, P. and Karl, M.). Rural men and women, especially in poor households, engage in diverse and multiple activities to improve their livelihoods by maximizing income-generating activities while minimizing vulnerability and risk and achieving other household objectives (improved health, nutrition, education, etc.). These activities may include farm and non-farm actions, often linked with other activities carried out by rural as well as non-rural households. The effectiveness and profitability of these diverse livelihood systems will vary depending on the general development environment, each household member's access to and control of the asset base, their productive and reproductive roles and responsibilities, their capabilities and their linkages with other rural and urban sectors. The rural sector includes a broad and diverse range of stakeholders, including large and small landholders, landless workers, non-agricultural entrepreneurs, public institutions, private firms, providers of inputs and services, farmer organizations, and non-governmental organizations (NGOs). Hence, rural livelihoods reflect this diversity and, therefore, comprise a mix of agricultural, fisheries, forestry, mining, tourism, and a wide variety of non-agricultural enterprise activities involving interactions among different classes of rural and urban economic actors. Therefore, improving rural livelihoods needs to consider rural diversity (Shoji Lal Bairwa *et al.*).

"The future we want," the conclusion statement of the United Nations Conference on Sustainable Development, which was held in Rio de Janeiro, Brazil, in June 2012, reaffirmed the significance of assisting developing nations in their endeavours to eradicate poverty and to promote the empowerment of the poor and those who are in vulnerable

circumstances for the purpose to achieve the development goals that have been accepted internationally. A comprehensive policy approach must be implemented to increase private and governmental investment in rural development, land management and sustainable agriculture practices. Strengthening rural infrastructure, developing sustainable agricultural technologies and practices, improving market and trading effectiveness, creating strong agricultural cooperatives with profitable value chains and building the capacity of institutions and individuals for relevant stakeholders are a few examples of important areas that require investment. Mahatma Gandhi had a vision that after its independence, India should achieve self-sufficiency in villages where everyone would have adequate food, shelter, clothing, proper hygienic and sanitation facilities, and every person willing to work would be provided gainful employment. Let not the history of India record that Mahatma Gandhi brought political independence for India, but the government could not bring economic liberation for the rural poor. The Food and Agriculture Organization (FAO) has defined sustainable agriculture as the management and conservation of the resource base and the orientation of technological and institutional changes to ensure the attainment and continued satisfaction of the human needs of present and future generations. Sustainable agriculture is a path of agricultural development that is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable (Shah T. and Koppen B.V.).

Objective

To assess the human, land and water resources for sustainable development of agriculture for livelihoods and poverty alleviation in the district of Anuppur.

Methodology

The present study has been done on the basis of secondary data, which have been collected from various government and non-government organizations.

Meaning of Food Security

Food security is defined as a state in which every individual, at all times, has reliable physical, social and economic access to a sufficient supply of safe and nutritious food that satisfies their dietary requirements and personal food choices, enabling them to lead an active and healthy lifestyle. The 1995 World Food Summit declared, "Food security at the individual, household, regional, national and global levels exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996, p.3). The declaration further recognizes that "poverty eradication is essential to improve access to food". Food security is a complex and multidimensional concept encompassing the various aspects of availability, access, utilization, stability, sustainability, affordability, resilience, nutritional security and Zero Hunger for individuals and communities. The Sustainable Development Goal 2 (SDG 2) aims to achieve "Zero Hunger" globally by 2030. This involves ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture. The government has implemented various policies and programs to achieve food security goals, e.g., the Public Distribution System (PDS),

National Food Security Act (NFSA), Mid-Day Meal Scheme, Integrated Child Development Services (ICDS), Buffer Stock and Price Stability, etc. Despite these efforts, challenges continue, including issues of distribution efficiency, regional disparities and the impact of climate change on agricultural productivity. India continues improving food security through various policies and initiatives, including agriculture, irrigation and technology investments to enhance productivity and reduce post-harvest losses.

Poverty Status of India

Poverty in India has been a longstanding and complex issue. The country has made significant economic progress in recent decades, but a large section of the population still faces poverty and inequality. The poverty rate is often measured by the percentage of people living below the national poverty line. Several factors contribute to poverty in India, including income disparities, unemployment and underemployment, educational challenges, healthcare issues and social inequality. An International Monetary Fund report states that severe poverty in India, which the World Bank defines as surviving on US\$1.9 or less in Purchasing Power Parity (PPP) dollars, was as low as 0.8% in 2019 and was maintained in 2020 despite the unprecedented COVID-19 pandemic. The United Nations Millennium Development Goals program reveals that 84% of Indians lived on less than \$6.85 a day in 2019, whereas 80 million of the country's 1.2 billion citizens, or roughly 6.7% of the total population, lived below the poverty line of \$1.25. The second edition of Niti Aayog's on July 17, 2023, the Multidimensional Poverty Index (MPI), which evaluates concurrent deprivations in health, education and standard of living with equal weight for each dimension, estimates that 14.96% in 2020-21, whereas it was 24.8% in 2015-16 in India. The report estimated that between 2015-16 and 2020-21, 135 million Indians were lifted out of multidimensional poverty.

Poverty Status of Madhya Pradesh and District Anuppur

Madhya Pradesh is primarily an agricultural state, with about 90% of the rural population working in primary sector occupations like agriculture, animal husbandry, forestry, material collection, mining and allied fields. The majority of farmers are small-scale growers whose earnings have decreased over time due to population growth. The per capita production of food grains is declining because of the reduced per capita agricultural land. The poverty line is reached by nearly one-third of the state's population. In comparison to rural areas, poverty rates are significantly higher in metropolitan areas. According to the 61st round of the National Sample Survey Organisation (NSSO), 210.97 lakh (32.4%) of the state's population were classified as BPL. Of this, 141.99 lakh (38.4%) lived in urban areas and were considered poor. Per capita expenditure can also be used to determine the level of poverty in a state. Only 4.6% of people living in M.P. villages have a monthly per capita expenditure of Rs. 890 or more, while 58.3% of people have a monthly per capita expenditure of less than Rs. 410. In urban M.P., where prices are greater, the proportions are 53.5% and 6.7%, respectively. The situation is terrible in rural areas, where a sizable percentage (21.1%) had a monthly per capita expenditure of less than Rs. 260 per month. Therefore, nearly 98% of rural residents and 96% of

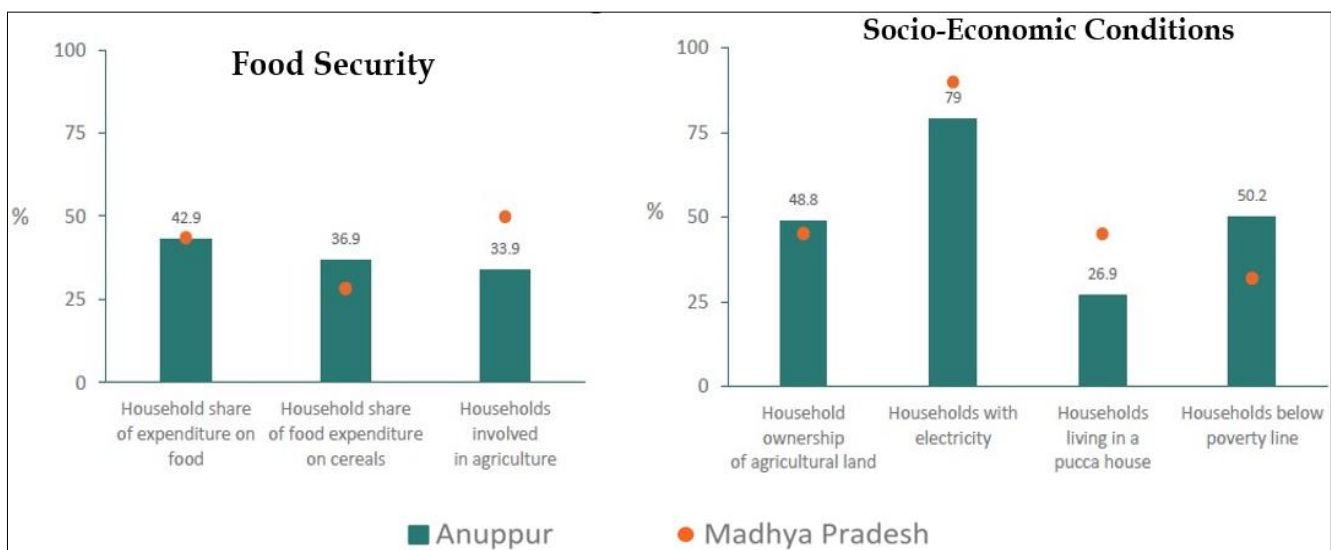
city people live on less than Rs. 38.50 a day (Baseline Survey of Bhopal District, M.P., Minority Concentrated

Districts Project, Ministry of Minority Affairs, Govt. of India 2001).

Table 1

Years	Poverty Status of Madhya Pradesh			Poverty Status of Anuppur		
	Headcount Ratio	Intensity	MPI	Headcount Ratio	Intensity	MPI
2015-16	36.57	47.25	0.173	41.65	45.26	0.189
2019-21	20.63	43.70	0.090	20.04	40.76	0.082
Burden of Nutrition Outcomes of District Anuppur (2021)						
Indicators	No. of Children (<5 yrs)		Indicators	No. of Women (15-49 yrs)		
Stunted	21,716		Underweight	65,348		
Wasted	16,657		Overweight/obesity	38,124		
Severely wasted	4797		Hypertension	59,824		
Underweight	27,705		Diabetes	26,608		
Overweight/Obesity	768		Anemia (Non-Pregnant)	129,512		
Anaemia	39,907		Anemia (Pregnant)	10,104		
Total children	90,332		Total women (Pregnant)	18,781		
			Total women	246,596		

Source: NFHS-4 and NFHS-5, NITI Aayog, March 2022



Source: NFHS-4 and NFHS-5, NITI Aayog, 2022, 2023

Fig 1: A & B

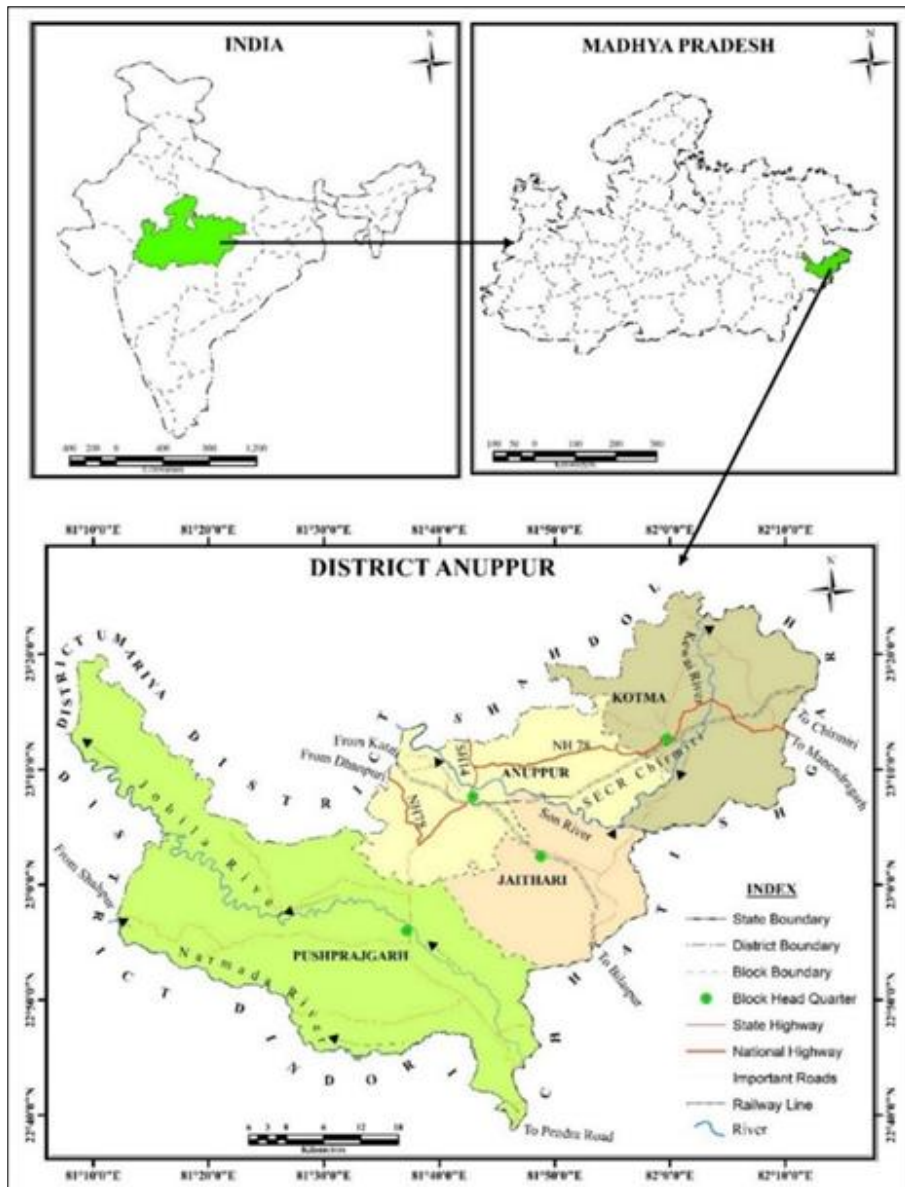
According to the NITI Aayog's "National Multidimensional Poverty Index: A Progress Review 2023," Madhya Pradesh has significantly reduced multidimensional poverty. Between 2015-16 and 2019-21, the state's Multidimensional Poverty Index (MPI) score decreased from 0.173 to 0.090, indicating a substantial improvement in living standards. During this period, approximately 1.36 crore people in Madhya Pradesh moved out of multidimensional poverty, marking a 15.94% reduction in the poverty headcount ratio. According to the NITI Aayog and NFHS-5 report (2022), the following table clearly explains the headcount ratio and multidimensional poverty index (MPI) of Madhya Pradesh and Anuppur district, which is a comparatively low headcount ratio of poverty (20.63%) and MPI (0.082) of Anuppur district (Table:1). The figure 1 shows the food security and socio-economic conditions of Anuppur and Madhya Pradesh, in which a very low percentage population is involved in agriculture and maximum income expenditure on food collection. Socio-economic conditions are not good

compared to Madhya Pradesh, which means the district Anuppur faces poverty in this developing scenario.

Result and Discussion

Location of the District Anuppur, M.P.

The district Anuppur is geographically located in the eastern portion of Madhya Pradesh in central India and occupies 45th place in the state according to population and 44th rank according to area. The Anuppur district lies between 22°30' to 23°30' North Latitude and 81°10' to 82°15' East Longitude. It is bounded from north to Shahdol district, from the west by Umariya district, Dindori district in the southwest, and from the south and east portion by Pendra-Gaurela-Marwahi and Korea districts of Chhattisgarh State (figure 2). The district Anuppur is spread over 86 Km from north to south and 117 Km from east to west, with a total geographical area of 3,747 Km² (3,74,671 hectares). The Anuppur is a tribal-dominated district of Madhya Pradesh, with 47.85% of the tribal population living with different groups.



Source: Toposheet District Anuppur, M.P., 2010.

Fig 2: Location Map of District Anuppur, M.P.

Population Resources

Population growth represents the increase in the number of individuals in the population. Population growth refers to increased number of persons within a territory during a specific period. This change may be positive or negative in any area. According to the 2001 census in 1951, the total population was 2,05,240, which increased from decade to decade and reached 7,49,237 in 2011. The tribal population in Madhya Pradesh consists of 1,53,16,784 (21.1%) and is 3,58,543 (47.85%) in the Anuppur district. According to the 2011 census, in the district, only 46.24% population is working, of which 33.32% are cultivators, 37.63% are agricultural laborers, 2.04% are household industry and 27.01% are involved in other workers. The rest of the 53.76% population is not engaged in any work.

Land Resources

Spatio-temporal variation of land use patterns reflects cultural development and human relationships with land for the needs of human society. Land use is linked with human activity in a given piece of land. Agriculture land, villages and plantations are some examples of land-use types. The

land use term denotes a piece of land used for a specific purpose. “Physical and cultural aspects mainly determine the region’s land use pattern. Physical variables such as climate, geography and soil are the prime determinants of the land’s broad capacities constrained. Following that, human factors such as the period of occupation of the place, population density, social and economic conditions, and people’s technical levels dictate the level to which the land’s physical capabilities are utilized to a significant degree” (Manivel and Thirumalai, 2015). “Land use pattern is the product of interaction between society’s cultural background and its physical needs, and the natural potential of land on the other hand” (Balak and Kolarkar, 1993). The total area of the Anuppur district is 3,74,671 ha. Table 2 expresses the patterns of land use in the district of Anuppur. According to 2016-17 forest occupied 76,448 ha (20.40%), Area Not Available for Cultivation is 62,964 ha (16.81%), Other Uncultivated Land Excluding Fallow Land is 7,498 ha (2%), Cultivable Waste Land is 19,498 ha (5.2%), Fallow Land is 56,446 ha (15.07%), and Net Sown Area is 1,51,817 ha (40.52%) in the district. The table clearly shows the area not available for cultivation and fallow land has increased

from 1999 to 2017. All those lands used for crops sown in an agricultural year are under the Net Sown Area. Net Sown Area is part of the principally cultivated land, indicating the actual portion of sown land used for cropping at least once a crop year. In any region, the proportion of the Net Sown Area is a very prominent indicator of agricultural production and development. The total Net Sown Area of the district

was 1,76,880 ha (47.21%) in 1999-00, which declined to 1,51,817 ha (40.52%) in 2016-17. The leading causes of the decline in the Net Sown Area are increasing urban and industrial areas, encroachment in settlements, mining activities, lack of irrigation facilities, erratic rainfall, undulating topography, and other encroachment and construction activities on agricultural land in the district.

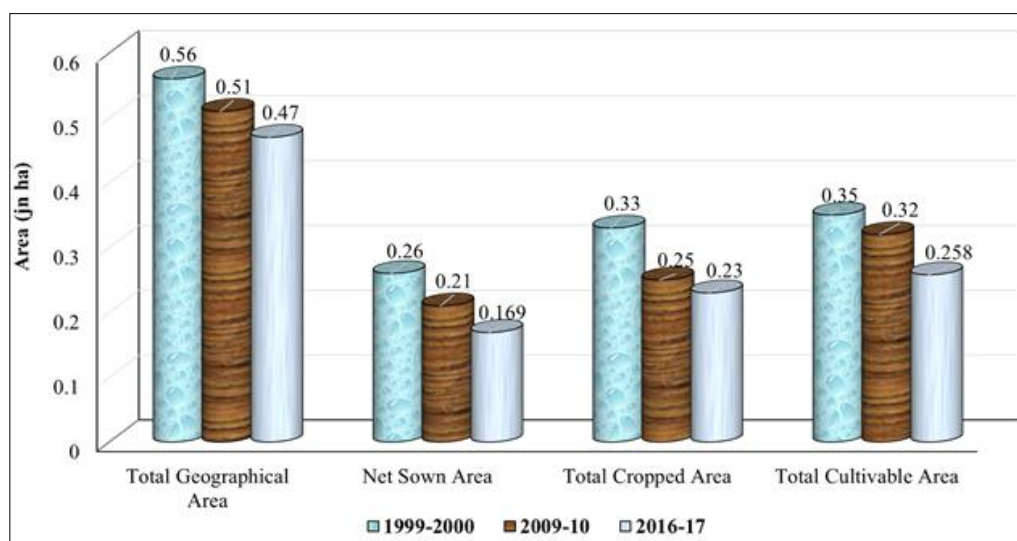
Table 2: Land Use Pattern of District Anuppur, M. P. (1999-2000 to 2016-2017)

S.N.	Classification	Area										Change	
		1999-2000		2004-05		2009-10		2014-15		2016-17		1999-00 to 2016-17	
		Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
1	Total Geographical Area	374,671	100	374,671	100	374,671	100	374,671	100	374,671	100	0	0.00
2	Forest	76,448	20.40	76,448	20.40	76,448	20.40	76,448	20.40	76,448	20.40	0	0.00
3	Area Not Available for Cultivation	53,854	14.37	52,913	14.12	53,542	14.29	59,068	15.77	62,964	16.81	+9110	+2.44
	a) Area Under Non-Agricultural Uses	32,506	8.68	31,248	8.34	31,837	8.50	36,375	9.71	39,089	10.43	+6583	+1.75
	b) Barren and Unculturable land	21,348	5.70	21,665	5.78	21,705	5.79	22,693	6.06	23,875	6.37	+2527	+0.67
4	Other Uncultivated Land Excluding Fallow Land	8,889	2.37	4,380	1.17	4,409	1.18	5,228	1.4	7,498	2.00	-1391	-0.37
	a) Permanent Pastures and other grazing lands	8,678	2.32	4,038	1.08	4,112	1.10	4,864	1.3	7,035	1.88	-1643	-0.44
	b) Land under misc. tree crops and groves	211	0.06	342	0.09	297	0.08	364	0.1	463	0.12	+252	+0.06
5	Cultivable Waste Land	20,948	5.59	28,915	7.72	29,950	7.99	25,567	6.82	19,498	5.20	-1450	-0.39
6	Fallow Land	37,652	10.06	49,884	13.32	54,808	14.63	55,065	14.7	56,446	15.07	+18794	+5.02
	a) Other than current fallows	17,873	4.77	24,803	6.62	25,729	6.87	25,642	6.84	25,586	6.83	+7713	+2.06
	b) Current Fallows	19,779	5.28	25,081	6.69	29,079	7.76	29,423	7.85	30,860	8.24	+11081	+2.96
7	Net Sown Area	1,76,880	47.21	1,62,131	43.27	1,55,514	41.51	1,53,295	40.91	1,51,817	40.52	-25063	-6.69
8	Area Sown more than once	38,454	10.26	32,308	8.62	32,913	8.78	35,624	9.51	37,728	10.07	-726	-0.19
9	Total Cropped Area	215,334	57.47	194,439	51.90	188,427	50.29	188,919	50.37	189,545	50.59	-25789	-6.88

Sources: Land record office, District Anuppur 2001, 2011, 2017 and District Statistical Year Book 2008-09, 2016-17

Figure 3 clearly shows the availability of per capita Net Sown Area, Cropped Area, Cultivable Area, and geographical area in the district. The figure reveals that the district's per capita land availability decreased year-to-year from 1999-2000 to 2016-17. The per capita Net Sown Area was 0.26 ha in 1999-2000, which decreased and came to 0.19 ha in 2016-17, which is below the standard requirement (0.4 ha) for sustenance. The total cropped area in the district per capita decreases year to year (0.33 ha to 0.23 ha from 1999-2000 to 2016-17). The per capita availability of

cultivable areas in the district is declining too, which was 0.35 ha in 1999-2000 and 0.28 ha in 2016-17. It indicates the population pressure on agricultural land in the study area. There is very little availability of per capita Net Sown Area (only 0.19 ha), which is insufficient for the sustenance of the population in the area. In this way, it is identified an opposite relationship between population and net sown area in the district and represents the population pressure on agricultural land.



Sources: Land Record Office, District Anuppur 2001, 2011, 2017 and District Statistical Year Book, 2016-17

Fig 3: Availability of Per Capita Land (in Ha) in District Anuppur, M. P.

According to the district statistical yearbook 2020-21, 49% of the landholding, or around 11% of the total cultivable land, is less than 1 hectare. With 17% of the land covered

and 29% of the landholding more than 2 hectares, or 72% of the total cultivable land, 22% belongs to the abovementioned group. Accordingly, 72% of all cultivable

land is owned by large farmers who own more than 2 hectares, even though they only comprise 29% of the total. The leading causes of the decrease of agricultural land in the district Anuppur are increasing growth rate of urban and industrial areas, construction of roads, railway, dams, institutional building, settlements, mining (Boulder, Bauxite, Coal, Murum, and Sand), etc., erratic rainfall, lack of irrigation facility, undulating topography, and high population growth rate and poor economic capacity of society so that the patterns of land use in the district will be highly transformed.

Crop Production

Table 3 show that only paddy production usually is sufficient but not equally distributed. Paddy constitutes almost 81.48% of the total crop production and is used

59.31% of the total cropped area in the Anuppur district, followed by Wheat 6.05% (8.53% area). Pulses production contributed 3.63% in 11.55% area of the district and other major crops in the Anuppur district are Maize with 2.91% of total production and Kodu Kutki with 1.34% of total production in 2020-21, while in 2018-19, the Paddy constituted almost 74% of the total crop production and is used 50% of the total cropped area in the Anuppur district, followed by Wheat 8% (9% area). Pulses production contributed 7% in 12 % area of the district and other major crops in the Anuppur district are Maize with 6% of total production and Kodu Kutki with 3% of total production. Table 3 shows that except for paddy crop production, wheat, pulses, oil seeds, and millets are not sufficient for the fulfillment of nutrition per capita in the district population in 2000-2021.

Table 3: Crop-wise Area and Production of District Anuppur, M. P.

Crop/year	2017-18			2018-19			2020-21			Per capita Availability (Kg/P/Y)
	Area (ha)	Production (MT)	Average Yield (kg/ha)	Area (ha)	Production (MT)	Average Yield (kg/ha)	Area (ha)	Production (MT)	Average Yield (kg/ha)	
Wheat	16,680	30,140	1807	20,500	37,930	1850	18,607	29,378	1579	35.50
Pulses	13,230	7,830	592	15,470	14,850	980	25,195	17,638	700	21.31
Chana/Peas	23,520	18,700	795	37,720	22,640	934	9681	10,030	1036	12.12
Paddy	115,170	292,530	2540	115,100	391,340	3400	129,418	3,95,379	3055	477.77
Maize	14,200	24,500	1725	13,930	25,070	1800	8916	14,138	1586	17.08
Kodu/Kutki	12,520	10,770	860	12,950	11,010	850	6722	6,487	965	7.83
Oil Seeds	14,900	11,500	772	14,250	12,440	873	19,674	12,205	620	14.74

Source: mpKrishi.mp.gov.in

Irrigated Area

According to the Land Record Office District Anuppur 2019, only 16.3% of the land is irrigated. The remaining 84% is dependent on rainfall. Canals/rivers are irrigating only 5.5% of the land. Wells irrigate 5%, and around 5.2% of the land is irrigated by other sources. With the construction of dams, commercial ponds, wells, and canal-based irrigation, the district has an effective opportunity to expand its rainwater-based irrigation infrastructure.

Water Resource

Water is one of the most essential natural resources for maintaining the environment and supporting life. The hydrological cycle involves the continuous water circulation between the land, ocean, and atmosphere. It is a basic for all living organisms on the Earth, so it's called "Water is the elixir of life". Water is essential for various purposes like drinking, domestic, fishing, animal husbandry, shipping, power generation, sanitation, irrigation, industries, and environmental circulation. Water is the essential element for the progress of civilization in the world and determines society's biological cycles and socio-economic prosperity.

(A) Surface Water Resource

The sources of surface water are Rainfall, Rivers, Nalas, Ponds, Dams, Wells and Lakes. In the district, average rainfall varies from 100 to 120 cm yearly, but after 2014, rainfall has decreased. The Narmada River rises from the hilltop of Amarkantak hill (1,057m) with a spring in a small bowl called the Narmada Kund. The total length of the river Narmada in the district of Anuppur is 65 km. The Samrar River is only one of the significant tributaries of the

Narmada River in the study area. The Son River is the originating perennial spring of Son Kund, Sonmuda, at Amarkantak in the district of Anuppur. The Kewai, Katana, Kaser, Kunuk, and Chandi Rivers joined on the right bank and the Tipan, Murna, and Johila Rivers joined from the left side in the Son River in the district Anuppur. The total length of the Son River in the district is 48 km. The Johila River originates from a perennial spring at Jaleshwar near Amarkantak and flows in a northwest direction in the district of Anuppur. The total length of the Johila River in the district is 120 km. Small rivers in the district of Anuppur are called Nala. Some are perennial, and some are seasonal, namely Kachaha Nala, Koylar Nala, Hansiya Nala, Pandri Nala, Gobri Nala, Kantoor Nala, Alan Nala, Ghattan Nala, Nargadha Nala, Tanki Nala, Gaibuda Nala, and Baigha Nala etc. The total number of ponds in the Anuppur district was 133 in 2017-18. Out of the total ponds in the district, 36 are in Pushprajgarh block, 35 in Anuppur block, 29 in Jaithari block, and 33 in Kotma block. The district has 16 water dams with a 2 to 22 km² catchment area based on river and rainwater.

(B) Ground Water Resource

Groundwater exists in the soil pores and the fractures of rocks below the Earth. A place of unconsolidated rocks or soil where the water reserve is called an aquifer, which can produce a sufficient amount of usable water. Groundwater is a vital natural resource for millions of people all around life, i.e., extracted for the utilization of drinking, agriculture, husbandry, construction, transportation, and municipal and industrial purposes by Tube wells and wells.

Table 4: Ground Water Utilization and Projected Demand in District Anuppur (in Ham)

Year	Net Annual Ground-Water Availability	Current Annual Ground Water Extraction						Net Ground Water Availability for Future Use
		Irrigation	%	Industrial & Domestic	%	Total	%	
2003-04	44,207	1,029	2.34	1,016	2.28	2,045	4.62	42,162.00
2008-09	37,730	1,021	2.70	1,111	2.95	2,132	5.65	35,598.00
2010-11	38,155	1,017	2.66	1,172	3.07	2,189	5.73	35,966.00
2012-13	37,523	1,122	2.99	1,209	3.22	2,331	6.21	35,192.00
2014-15	34,051	1,267	3.72	1,412	4.15	2,679	7.87	31,372.00
2016-17	34,549.47	1,307	3.78	1446.95	4.19	2,753.95	7.97	31,795.52

Source: <https://igntuelibrary.informaticsglobal.com:2055/madhyapradesh/anuppur/agriculture/waterresources/groundwater/index.aspx> and Groundwater survey report of the water resource department, Madhya Pradesh 2015-2017

If we talk about net groundwater availability for future use, then we find that there has been a continuous decrease since 2003-04 (Table 4). According to 2016-17, the net groundwater availability for future utilization is 31,795.52 ham while it was 42,162 hams in 2003-04, 35,598 ham in 2008-09, 35,966 ham in 2010-11, 35,192 ham in 2012-13, and 31,372 ham in 2014-15. In 2003-04, 4.62% of the total groundwater was used for domestic, industrial, and irrigation purposes in the study area. Similarly, 5.65% in 2008-09, 5.73% in 2010-11, 6.21% in 2012-13, and 7.87% in 2014-15 were used, while in the year 2016-17, utilization of groundwater increased with 7.97% of the total groundwater, where 3.78% was used in irrigation, 4.19% in industries and domestic purposes.

Sustainable Management of Agriculture

The challenges facing future food security and sustainable agricultural production are significant, multifaceted, complicated, and urgent. Rapid urbanization is displacing enormous areas of productive land from agriculture at a time when more agricultural production and food security improvements are urgently required. Young, capable, and higher educated successor farmers are leaving farms to the elderly as they migrate from rural to urban areas.

Future food security and sustainable agricultural production face formidable, multifaceted, urgent, and complex issues. For most of the year, many of these households depend on minimum wage work to provide cash income for needs like food security. Even for extremely small landholdings, there is a great deal of opportunity to boost agricultural output and the profits from activities involving collecting, purchasing and processing forest products. A percentage of households should be able to establish small-scale enterprises. However, this process can be significantly influenced by an absence of market prospects, entrepreneurial skills, and business support infrastructures. Although there are numerous opportunities for improving crop production, it's crucial to do it in a sustainable way that supports the promotion of eco-efficient use of input resources to maximize economic outputs and minimize negative environmental externalities. To ensure sustainable growth and shared prosperity, the district will need to explore a combination of institutional, technological, and policy reforms.

Effective Policy Implementation: As they are essential to achieving inclusive and socially sustainable development, effective policies should be prioritized to provide agricultural employment and income prospects in rural areas and small-scale agricultural product processing in rural areas. Policies that provide women with the information, abilities, and resources they need to be more productive are

of great importance since they are anticipated to have a major positive impact on both people and society as a whole. An effective assessment system should be there because the government continuously implements various programs at different levels to enhance of livelihoods of society, but unfortunately, they have not properly impacted the beneficiaries.

Management of Land Resources for Agriculture:

Various strategies should be needed for the sustainable use of land resources for the increasing crop production in the district i.e., the development of the village in a planned manner for the protection of agricultural land, use of barren land for social forestry, dry farming or millet production, use of fallow land and cultivable land with increasing irrigation facilities, provide training to farmers on suitable cropping patterns according to land and weather, prevention of soil erosion with preventive and constructive methods, i.e., boundary demarcation, dams, bandh, rainwater harvesting, etc., maintain the fertility of land with green manuring, vermicompost, bio-fertilizers, enhancing the commercial crops and horticultural crops.

Management of Water Resources for Agriculture:

There is sufficient scope for enhancing rainwater utilization in different crop seasons to increase crop production and farmers' income in the district because the district gets a good amount of rainfall in the monsoon season. Protecting streams and springs, creating strategies for the construction of rainwater harvesting structures, and expanding irrigation facilities with new technology, i.e., sprinkle, shower, drip irrigation, except for flow irrigation, and people's participation is essential for the sustainable use of water in the village area for numerous daily and economic needs. The ability of the rural poor to enhance their livelihoods is controlled by a range of interrelated structural, social, economic and institutional barriers. Marginal and under-productive landholdings, periodic droughts, insecure land tenure and dependence on seasonal agricultural and forest labour characterize the situation of people with low incomes. The rural poor in forested areas, particularly tribal populations, depend on forest resources for their subsistence, income and employment. Policymakers should focus on the development of the different agro-based and local forest and other resources-based industries, warehousing, agriculture & allied marketing, banks and financial institutions, research and development centers, and capacity-building programs can solve the problems of the livelihood security of the human society in the district. Institutional cooperation is required for the sustainable utilization of different resources to enhance people's incomes, alleviate poverty and ensure the security of livelihoods of society.

Thus, a two-track strategy is needed to address the livelihood issue in rural areas in the district. The first track seeks to enhance livelihoods through improved productivity of land, water and forest resources for poor people through Integrated Watershed and Community Forest Management. The second track aims to promote enterprises that lead to the value addition of agricultural and forest produce and other micro-enterprises, providing employment and income opportunities to the rural poor. After the analysis of data, we should adopt sustainable agriculture planning. Various components should be planned for the sustainable development of agriculture in the district of Anuppur.

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