

**DOCUMENTATION OF NON TIMBER FOREST
PRODUCT COLLECTION, PROCESSING AND VALUE
ADDITION OF DHAMTARI FOREST AREA OF
CHHATTISGARH**

M.Sc. (Forestry) Thesis

by

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**DEPARTMENT OF FORESTRY
COLLEGE OF AGRICULTURE
FACULTY OF AGRICULTURE
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
RAIPUR (C.G.)
2017**

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CHHATTISGARH**

Thesis

Submitted to the

Indira Gandhi Krishi Vishwavidyalaya, Raipur

by

Pankaj Kumar Chandel

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF**

Master of Science

In

Forestry

ID No. 120115174

Uni. ID No. 20151622588

JULY, 2017

CERTIFICATE - I

This is to certify that the thesis entitled "Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh" submitted in partial fulfillment of the requirements for the degree of "Master of Science in Forestry" of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by Pankaj Kumar Chandel under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.


No part of the thesis has been submitted for any other degree or diploma or (certificate awarded etc.) has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him.


21/07/17
Chairman

Date: 21/07/2017

THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE


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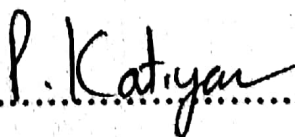
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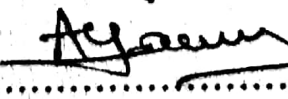
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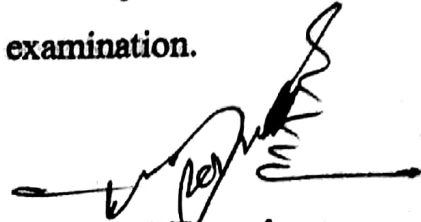


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CERTIFICATE - II

This is to certify that the thesis entitled "Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh" submitted by Pankaj Kumar Chandel to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfillment of the requirements for the degree of Master of Science in the Department of Forestry has been approved by the examiner Student's Advisory Committee after oral examination.

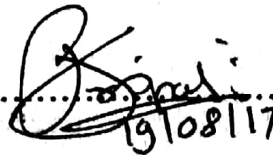


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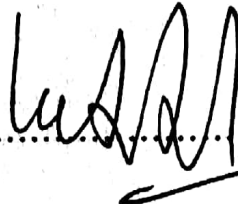
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Approved/Not approved

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Date

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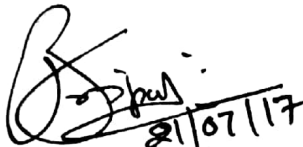
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LIST OF ABBREVIATIONS/NOTATIONS

%	Percentage
<i>et al.</i>	And others
⁰ C	Degree Celsius
@	At the rate of
NWFP	Non Wood Forest Products
MFP	Minor Forest Products
FAO	Food and Agriculture Organization
No.	Number
q. ha ⁻¹	Quintals per hectare
Ha	Hectare
Kg	Kilogram (s)
Kg/yr	Kilogram per year
Fig.	Figure
i.e.	That is
Viz.	Namely
M	Male
F	Female
ST	Schedule tribe
SC	Schedule cast
&	and
cm	Centimeter
Mm	Millimeter
P	Population
H	Household
LIT	Literate
IL	Illiterate
IVI	Importance Value Index
BA	Basal Area
RF	Relative Frequency
RD	Relative Density
RBA	Relative Basal Area

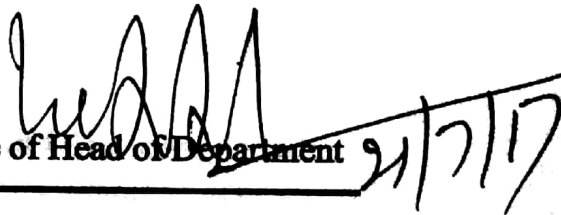
THESIS ABSTRACT

- a. Title of the Thesis : "Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh"
- b. Full Name of the Student : Pankaj Kumar Chandel
- c. Major Subject : Forestry
- d. Name and Address of the Major Advisor : Dr. R. K. Prajapati, Professor
Department of Forestry, COA,
IGKV, Raipur
- e. Degree to be awarded : M.Sc. Forestry


Signature of Major Advisor

Date: 21/07/17


Signature of student


Signature of Head of Department

ABSTRACT

Study entitled "Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh." The study was carried out in three study sites Dugli, Nagri and Sihawa range Dhamtari, district of Chhattisgarh.

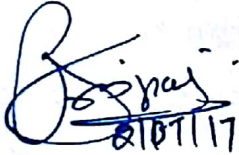
The study reveals that the Gond, Kamar and Halba are the three major tribes dominating in the study area. The social and economic status of the people was very poor. The overall literacy percentage was 65.56% was found in the study area. The livelihood of tribes totally depends on forest in which NTFPs and agriculture are the main source of their income. They also engaged in different occupation viz. Bani, Mazdoori and Rozgar Guaranty Yozna. The production of

agriculture crops was also low due to traditional cropping practice and lack of irrigation facilities. The majority of landless labour was found than marginal farmer and small farmer. The marginal farmer had 3.32 acre in the study area. A total of 32 NTFPs were marketed and catalogued from three different markets Dugli, Nargri and Sihawa. The honey fetches highest market rate Rs. 340-360/kg. The contribution of NTFPs in household economy varied from Rs 13917-25150. Women play major role in the NTFPs collection. The percentage of women in NTFPs was recorded 51.86 % in all the study sites. The 52 NTFPs species were documented belongs to 26 trees, 10 shrubs, 7 herbs and 9 climber species. A variety of NTFPs viz, seeds, leaves used for plate making, Tans and Dyes, Gum and Resin, edible products, Oil yielding, Bamboo, Fiber, and Broom making, Medicinal plants and Biocides (fungicidal, insecticidal and nematicidal) were identified. The collection, processing and value addition of NTFPs were carried out by traditional crude method. The villagers collected NTFPs like leaves, flowers, seeds, fruits, bark, stem, and rhizomes for their livelihood in unsustainable methods because of this the regeneration of species badly affected.

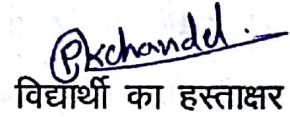
The phytosociological studies of the sites were conducted for tree, shrubs, climber and herbs species, using random sampling method through laying quadrats $10 \times 10 \text{ m}^2$ (tree), $5 \times 5 \text{ m}^2$ (shrub) and $1 \times 1 \text{ m}^2$ (herb) calculated their the Density, Frequency, Basal Area and Importance Value Index of the study sites. *Andrographis paniculata* and (herb) have high importance value index (207.28) Sihawa range and *Schleichera oleosa* (herbs) have lowest importance value index (2.26) Dugli range. Total frequency maximum (880%) for tree in Dugli range. *Cleistanthus collinus* (tree) have maximum density (770 stem/ha) Dugli range. Total basal area high were (36.23 m^2/ha) Sihawa range.

शोध सारांश

- क. शोध का शीर्षक : "छत्तीसगढ़ के धमतरी वन क्षेत्र में अकाष्ठकीय वन उत्पादों का संग्रहण, प्रसंस्करण तथा मूल्य संवर्धन का दस्तावेजीकरण।"
- ख. छात्र का नाम : पंकज कुमार चंदेल
- ग. प्रमुख विषय : वानिकी
- घ. प्रमुख सलाहकार का नाम एवं पता : डॉ. आर. के. प्रजापति, प्राध्यापक, वानिकी विभाग, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर, (छ.ग.)
- ङ. प्रदान की जाने वाली उपाधि : एम.एस.सी. वानिकी

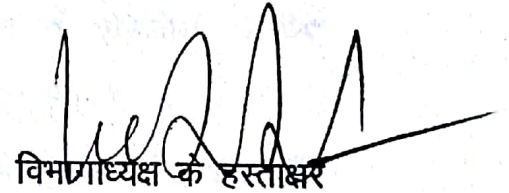


प्रमुख सलाहकार के हस्ताक्षर



विद्यार्थी का हस्ताक्षर

दिनांक: 21/07/17



विभागाध्यक्ष के हस्ताक्षर

सारांश

"छत्तीसगढ़ धमतरी वन क्षेत्र के अकाष्ठकीय वन उत्पादों का संग्रहण, प्रसंस्करण तथा मूल्य संवर्धन के दस्तावेजीकरण का अध्ययन किया गया। यह अध्ययन "छत्तीसगढ़ धमतरी जिला तीन अध्ययन स्थलों दुगली, नगरी और सिहावा परिक्षेत्र में हुआ।

अध्ययन से पता चलता है कि गोंड, कमार और हल्बा तीन प्रमुख जनजाति हैं जो अध्ययन क्षेत्र में हावी हैं। लोगों की सामाजिक और आर्थिक स्थिति बहुत खराब थी। अध्ययन क्षेत्र में साक्षरता का प्रतिशत 65.56 था। जनजातियों की आजीविका पूरी तरह वन पर निर्भर करती है जिसमें एनटीएफपी और कृषि उनकी आय का मुख्य स्रोत हैं। वे विभिन्न व्यवसायों

जैसे – बनी, मजदूरी और रोजगार गारंटी योजना में भी संलग्न थे। पारंपरिक भास्य क्रियाओं और सिंचाई सुविधाओं की कमी के कारण कृषि फसलों का उत्पादन भी कम था। अध्ययन क्षेत्र में अधिकांशता भूमिहीन मजदूर, सीमांत और छोटे किसान पाये गये थे। अध्ययन क्षेत्र में सीमान्त किसान की कुल रकबा 3.32 एकड़ था। कुल 32 एनटीएफपी को तीन अलग-अलग बाजारों दुगली, नगरी और सिहावा बाजार से सूचीबद्ध किया गया था। उस क्षेत्र में सर्वाधिक बाजार दर शहद 340–360 रु.प्रति किग्रा रहा। घरेलू अर्थव्यवस्था में एनटीएफपी का योगदान 13,917 से 25,150 रूपये था। एनटीएफपी संग्रह में महिलाएं प्रमुख भूमिका निभाती हैं। सभी अध्ययन क्षेत्रों में एनटीएफपी में महिलाओं का प्रतिशत 51.86: दर्ज किया गया था। 52 एनटीएफपी प्रजातियों का दस्तावेजीकरण जिसमें 26 पेड़ों, 10 झाड़ियों, 7 जड़ी-बूटियों और 9 बेल प्रजातियों के हैं। विभिन्न प्रकार के एनटीएफपी जैसे अर्थात् दोना-पत्तल बनाने, तान और रंजक, गोंद और राल, खाद्य उत्पादों, तेल उपज, बांस, रेशा और झाड़ू बनाने, औषधीय पौधों और जीवनाशक (फफुंद संबंधी, कीटनाशक और कृमि आघात) के लिए इस्तेमाल की जाने वाली पत्तियों की पहचान की गई। एनटीएफपी का संग्रह, प्रसंस्करण और मूल्य संवर्धन पारंपरिक अपरिष्कृत विधि द्वारा किया गया था। ग्रामीणों ने अवैधानिक विधियों के प्रयोग द्वारा पौध पुनरुत्पादन को बुरी तरह से प्रभावित करते हुए अपनी आजीविका के लिए एनटीएफपी जैसे पत्ते, फूल, बीज, फलों, छाल, तना और प्रकंद को एकत्र किया।

पौध समुहों का अध्ययन पेड़ों, झाड़ियों, बेल और जड़ी-बूटियों की प्रजातियों के लिए चौकोर पद्धति 10 x 10 (पेड़), 5x5 (झाड़ी) और 1x1 (जड़ी बूटी) बिछाने के माध्यम से यादृच्छिक नमूना का उपयोग करके घनत्व, आवृत्ति, अध्ययन स्थलों के आधारीय क्षेत्र और महत्व मूल्य सूचकांक की गणना की गई। एंड्रोग्राफीस पैनिकुलताण्ड (जड़ी बूटी) में उच्च महत्व मूल्य सूचकांक (207.28) सिहावा परिक्षेत्र और श्लेलेच्यरा ओलोसा (जड़ीबूटी) के सबसे कम मूल्य मान सूचकांक (2.26) दुगली परिक्षेत्र है। दुगली परिक्षेत्र में वृक्ष के लिए कुल आवृत्ति अधिकतम (880 प्रति 100 मीटर) क्लीस्टैथस कॉलीनस (वृक्ष) में अधिकतम घनत्व (770 तना/हेक्टेयर) दुगली परिक्षेत्र है। कुल आधारीय क्षेत्र उच्च थे (36.23 वर्ग मीटर/हेक्टेयर) सिहावा परिक्षेत्र में प्राप्त हुआ।

CHAPTER-I

INTRODUCTION

The forests provide timber and non timber forest products besides invaluable environmental services. Traditionally Non Timber Forest Products (NTFPs) refer to all biological materials other than timber extracted from natural forests for human and animal use and have both consumptive and exchange value. Globally NTFP / NWFP are defined as “forest products consisting of goods of biological origin other than wood, derived from forest, other wood land and trees outside forests”. Different terms like secondary, minor or non-timber forest products (NTFP) are also being used by governments, institutions and academics.

Non-timber Forest Products (NTFPs) are important tools for addressing poverty issues for the marginalized, forest dependent communities, by contributing to livelihoods, including food security, income, health and sustainable human development. Globally, an estimate 350 million people mostly in developing countries depend on NTFPs as their primary source of income, food, nutrition, and medicine (FAO, 2005).

NWFP may be gathered from the wild, or produced in forest plantations, agro-forestry systems and from trees outside forests. Examples of NWFP include products used as food and additives (edible nuts, mushrooms, fruits, herbs, spices and condiments, aromatic plants, gums), fibres (used in construction, furniture, clothing or utensils), resins, plant and animal products used for medicinal, cosmetic or cultural purposes.

The Indian trade in NTFPs from Himalayas to industrialised nations and neighbouring countries is growing at a tremendous rate, for use as pharmaceutical compounds and also as cosmetics and other household products. India's Ayurvedic industry and China's vast market in medicinal plants, rooted in ancient medical systems, use hundreds of tons of raw materials from the Himalayas each year. There are international commercial markets for at least 116 NTFPs, and global international trade is valued at US\$7.5-9 billion per year, with another \$108 billion in processed medicines and medicinal plants. Several million households world-

wide depend heavily on NWFP for subsistence and/or income. Some 80 percent of the population of the developing world use NWFP for health and nutritional needs.

In India, there are about 15,000 plant species out of which nearly 3000 species (20%) yield NTFPs. However, only about 126 species (0.8%) have been commercially developed. NTFP activities hold prospects for integrated forms of development that yield higher rural incomes and conserve biodiversity while not competing with agriculture.

Rural population especially forest dwellers in India depend on the forests not only to supplement their domestic requirements for foods, fodder, fibre and medicines but also to supplement their income by selling part or all of their collection in local markets. In India, more than 41 million tribals and forest dwellers derive their earnings from these products after consuming about 60% of collected NTFPs for personal use. Contemporary multidimensional forest management has led to a much broader concept of non-wood products and services include landscape amenity, clean air, water storage, biodiversity, providing a space for recreation and tranquillity. NTFP collection, an important source of income for forest dwellers and rural poor, varies from state to state ranging from 5.4 to 55 percent. Moreover, 60% of NTFP is consumed as food or as a dietary supplement especially during lean season by forest dwellers. In Manipur, India alone, nearly 90% of the population depends on forest products as a major source and some 250000 women are employed in collecting forest products (FAO, 1992). In Bastar area of Chhattisgarh, about 75 % of forest dependent people supplement their food by tubers, flowers and fruits all round the year. In a household based survey at Midnapur forests, it was observed that of the 122 uses of plants or their parts listed by the people, the maximum were for food (44), followed by fuel (39) and medicinal purposes (18). NTFPs are estimated to generate 70% of all employment in the Indian forestry sector. Commercial NTFPs alone are estimated to generate Rs.3 billion annually. One study estimated that NTFP collection generates over 2 million person years of work annually. In addition, millions of individuals are employed in NTFP processing and marketing. It is estimated that 275 million poor rural people in India—27 percent of the total population—depend on NTFPs for at least part of

their subsistence and cash livelihoods (Malhotra & Bhattacharya, 2010.). This dependency is particularly intense for half of India's 89 million tribal people, the most disadvantaged section of society, who live in forest fringe areas. According to an estimate the NTFP sector alone is able to create about 10 million workdays annually in the country. About 4,000 to 6,000 NTFPs are used worldwide. In India, 90% of the plants supplied to the international market are from wild stock. NTFPs indeed play a very significant role in rural economy in terms of providing employment, income potential and life sustenance.

Chhattisgarh is third largest state of India in terms of forest cover which is 5.6 million hectares which is 44.39% of state and 8.06% of the country. Madhya Pradesh and Arunachal Pradesh being at first and second in terms of forest cover. NTFPs have a tremendous potential to involve local collectors for establishing micro-, small and medium enterprises through clear tenured rights, better collection methods, financial support, capacity development, infrastructure and institutional support in near future.

With these efforts there is a potential to create large scale employment opportunity thereby, helping in reducing poverty and increasing empowerment of particularly women, tribal and poor people of the poorest and backward districts of the country. Among the NTFPs items, Tendu leaf share forms the major contribution. For the states like Madhya Pradesh, Chhattisgarh and West Bengal, the share of Tendu leaf is over 90 percent of the total NTFPs contribution. In Chhattisgarh there is urgent need to document the major NTFPs on district basis what is the status how we conserve and regenerate the disappearing the valuable species. There is urgent need to develop the sustainable harvesting techniques and destructive harvesting methods will be stopped to create awareness among collectors. Looking to the above aims the present study is designed to find out the solution for sustainable harvesting and value addition possibilities in important NTFPs of Chhattisgarh. Chhattisgarh State has dense forest cover with all the three canopies in the forest area. The forest ecosystems can be broadly classified into following three types depending upon species composition (Table 1.1).

Table 1.1 forest ecosystems classification

S.No.	Forest Type	Area (Sq. kms.)	% of G.Area	Biodiversity status
1.	Mixed Forests	34230	25.32	Very Rich
2.	Sal Forests	19682	14.56	Rich
3.	Teak Forests	5858	4.33	Fairly Rich
	Total	59772	44.21	

Table 1.2 Status of Trade Volume of NFPs in Chhattisgarh (2016-17)

S. No.	Category of MFP	Species/Produce	Estimated Trade (in Rs. Crores)
1.	Specified	Tendu leaves (<i>Diospyros melanoxylon roxb</i>), Gums-Kullu (<i>Sterculia urens</i>) Dhawda (<i>Anogeissus latifolia</i>), Khair (<i>Acacia catachu</i>), Babul (<i>Acacia nilotica</i>) Sal seed (<i>Shorea robusta</i>), Harra (<i>Terminalia chebula</i>), Bahera (<i>Terminalia belerica</i>), Imli (<i>Tamarindus indica</i>), Mahua (<i>Madhuca latifolia</i>), Lac (<i>Lacifer lacca</i>), Kosa (<i>Erythroxylum coca</i>), Mahul Leaves (<i>Bauhinia vahalii</i>), Chironjee (<i>Buchanania lanzan</i>), Baibidang (<i>Emblia ribes</i>), Vanjeera (<i>Vernonia anthelmintica</i>), Kalmegh (<i>Andrographis paniculata</i>), Aonla (<i>Phyllanthus emblica</i>) etc.	720
2.	Non Specified		780
	Total		1500

Objectives of the Study:

1. Documentation of NTFPs and medicinal plants available in Dhamtari forest area.
2. Documentation of traditional collection methods of different NTFPs in different seasons.
3. Documentation of Post harvest methods and value addition if any.
4. The role of NTFPs in livelihood of tribes and local residents in relation to their income.

CHAPTER-II

REVIEW OF LITERATURE

In this chapter an attempt has been made to review the work on “**Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh**”. The literature is broadly reviewed under the following aspects

1. **Documentation of NTFPs and medicinal plants availability.**
2. **Documentation of traditional collection methods of different NTFPs in different seasons.**
3. **Documentation of Post harvest methods and value addition if any.**
4. **The role of NTFPs in livelihood of tribes and local residents in relation to their income.**

2.1 Documentation of NTFPs and medicinal plants availability

Pandit *et al.* (2004) carried out research work in Juldapara Wildlife sanctuary to enlist the NTFPs their types and amount of NTFPs. A total of 132 species has been recognized as NTFPs produce which includes plants of different habit groups, occupying different strata and types of vegetation.

Rajasekaran and Prasad (2005) conducted a survey to collect information on Medicinal plants sold in local market at Velliyangiri Hills, Boluvamputti Reserve Forest by the Irula Tribes. There are Twenty-five medicinal plant species, which includes 9 shrubs, 3 herbs, 3 epiphytes and 2 climbers, were recorded from the local market place without entering major market places and tribal cooperative societies,

Bansode (2005) observed that the major problem faced by farmers for collection of medicinal plants was low rate to the produce, which they have collected from forest it was (85.55%) and lack of knowledge regarding species (68.89%). The availability of medicinal plants was far away from residence (63.33%). However, no other employment generation was found throughout the year (63.33%) while, from collection of medicinal plants (48.88%). Among the species of

medicinal plants studied maximum collection was observed for Gurvel (*Tinospora cordifolia*), followed by Harra (*Terminalia chebula*).

Kumari et al. (2012) reported that the NTFP utilized for the health care of mother and child in Himanchal Pradesh. They found that in case cut wounds three species are only used, while similar number of species used for muscular pain and reported two species to kill the lice and one for small pox, chicken pox and urine problems of the infants. It was also observed in the study area the local Vaid/Amchis and elder women practices many medicinal herbs in combination for the treatments of various ailments of women and children as mentioned.

Sinha et al. (2012) studied that total of 29 species of plants belonging to 20 families widely used as antidote in northern part of Bastar. The plants species were documented on the basis of their phytochemicals and use in Antidote. Maximum of (03) species were belong to the family Asclepiadaceae and (02) each to family Fabaceae , Acanthaceae and Liliaceae. 75.86 % of the observed plants were found to be propagated by their seeds while, 6.89 % by rhizome, 10.34% by stem cutting and 3.44 % each by other plant parts like tuber and bulb.

Jha (2015) studied that the Apatani, non-nomadic tribe, have evolved an ecologically sustainable system of rural forestry in Ziro Valley, a proposed heritage site of UNESCO. The Apatani used 112 priority NTFPs for food supplement, herbal medicine, house building material and other purposes. However, on the basis of ecological importance such NTFPs were categorized as very low, low, moderate, high, and very high vulnerable species. Twenty vulnerable species like Antiitari ayi (*Actinidia callosa*), Biiling (*Choerospondias axillaris*), Henchi (*Rubus niveus*), Jojuru ayi (*Coccinia grandis*), Ngiilyang Khiiko (*Centella asiatica*) etc. should be conserved and seventeen not vulnerable species at this stage like, Padii hamang (*Cardamine hirsute*), Sankhe (*Quercus griffithii*), Bije (*Phyllostachys manii*), Hiigu hamang (*Oenanthe javanica*), Kiira (*Quercus dealbata*), etc. could be commercialized.

Ahirwar (2015) reported that total 41 plants species belonging to 26 families and 37 plant genera were identified. A field survey was conducted at three different study sites in Boridand forest, district Korea, Chhattisgarh.

Singh and Bharti (2015) study was conducted in different area of Raigarh district of CG. (India). They documented of ethnobotanical use of 89 plant species are described in which different parts of plants are used for different purposes by people for example medicine ,food ,fodder, furniture, fibre, cosmetics etc.

Islam & Quli (2016) documented the diversity, distribution, and pattern of utilization of edible non-timber forest products (NTFPs) among the tribes of Bundu block in Ranchi district of Jharkhand, India. The results reveal that the sample population consumes 59 edible NTFPs belonging to 39 genera and 45 species under 29 families. Of the edible NTFPs, fruit represents the highest (26) followed by leaf (10), seed (7), flower (6), tuber (3), gum (2), mushroom (2), entire plant (2) and rhizome (1). The growth form of the species includes trees (30) followed by herbs (5), shrubs (4), climbers (3), fungi (2) and bamboo (1).

Kumhar *et al.* (2017) studied that the state of Madhya Pradesh 6 plants in Umaria and 11 plants in Sidhi district were observed and described the name of plant, common name, family, habit plant parts used and formulation.

2.2 Documentation of traditional collection methods of different NTFPs in different seasons

Malhotra *et al.* (1991) conducted a study in Jemboni Range Midanapore, district, West Bengal and reported that Sal leaves stood as the single largest (16.45%) contributor to the Non -Timber Forest Products (NTFPs) biomass Among the food items gatherers Tendu leaves constituted the largest proportion (48.93%) followed by Mushrooms (27.14%), Mahua flower and fruit (17.34%), tuber (5.36%) and leafy vegetables (1.21%).

Marshall *et al.* (2003) studied that the importance of non-timber forest products (NTFPs) to rural income was examined in a highland community in the Sierra de Manantla'n Biosphere Reserve, Jalisco-Colima, Mexico. Rapid Rural

Appraisal (RRA) techniques were used to interview 70% of households in the community of El Terrero. Of the nine plant species identified as NTFP sources, the two principal species traded by the community were tila (derived from the flowers and fruits of the tree *Ternstroemia lineate*), and blackberry (*Rubus species*) collecting and selling of NTFPs was almost exclusively undertaken by women, with 80% of respondents participating. NTFP sale ranked as the most important source of cash income for 30% of women interviewed, and either second- or third-most important for the remainder. The research examined harvesting impact on populations of *T. lineata*, an understory tree species characteristic of cloud forest, which this was assessed in the four most-frequented collecting sites.

Hasaker and Jadhav (2004) reported that women play a most prominent role in collection, processing and sale of NTFPs. Women involved in collection of NTFPs such as Tendu patta, Char, Sal seed, Palas, Bamboo, Chhind, Mahua /Dori, Harra, Kusum, Jamun etc. In West African Humid Region, women dominants in collection of NTFPs it is estimated that women constituted 51 percent of the total work force involved in forest based small-scale enterprises. Hence the women living in and near the forest are the major contributors of the family economy.

Giri et al. (2005) evaluated the major NTFPs items & their marketing potentials at Hazaribagh forest area in Jharkhand. This study focused on the availability of the selected economically important NTFPs, their collection pattern along with the marketing status & impact on the JFM system at two separate Forest Ranges under Hazaribagh Forest Division in Jharkhand.

Ahamad et al. (2006) conducted a research work in selected areas of Isakhel, Miawali. The interviews were held in local community and documented 55 plant species belonging to 52 genera of 30 families. These hills are rich with common plant species like *Rhazya stricta* (Verin), *Reptonia buxofolia* (Ganyer), *Prosopis juliflora* (Jana), *Zizyphus jujube* (Beri), *Dalbergia sissoo* (Tali) and *Acacia nilotica* (Kiker).

Gubbi et al. (2008) studied in the Periyar Tiger Reserve, India, they examined whether NTFP collection can solve livelihood problems by analysing

revenues obtained from various NTFP species, estimating the economic returns to collectors from various social backgrounds, and exploring the attitudes of collectors towards their profession. They found that black damar resin from the tree *Canarium strictum* (61.3%) and mace from *Myristica spp.* (35.5%) were the most commonly collected NTFPs, and the most valuable NTFPs were honey from *Apis cerana indica* (USD 4.12 kg⁻¹), cardamom *Elettaria cardamomum* (USD 3.67 kg⁻¹) and *Myristica spp.* (USD 2.77 kg⁻¹). Mean daily revenue from NTFP collection was USD 3.15 – SD 4.19 day⁻¹, and the lowest daily revenues were earned by part-time collectors with low socio-economic status such as migrants, forest-dwellers or those without access to agricultural land. Most collectors (82%) did not wish to continue harvesting NTFPs if alternative livelihoods from agriculture could be provided, and none wanted their children to be NTFP collectors.

Rout and Panda (2011) reported that the NTFP are a major source of subsistence production, income, employment and great socio-economics significance especially the weaker section of the society. They reported that the 54 important NTFP species have been collected by the Gandigadha villagers for consumption. However a few new species like ‘Sal’ (*Shorea robusta*) leaves, tooth stick and seeds Mahua (*Madhuca indica*) flower and fruit char (*Buchanania lanzan*) fruits, seeds and mushroom are collected and sold to local traders. They reported 54 NTFP species from the Gandigadha villagers. 49 numbers of NTFP are sold and 5 numbers of NTFP like fruits of *Barringtonia acutangula*, *Cassia fistula*, *Catunonegam spinosa etc.* are used for self consumption.

Saha and Sundriyal (2012) recorded that total of 343 NTFPs used for diverse purposes by tribal communities. When species choice grouped as per used category, utilization for medicinal (163 species), edible fruits (75 species) and vegetables (65 species) purposes was reasonably high. Community dependence on forest resources was 100% for firewood and house construction material. 76 plant species were sold in three major local markets while an additional 22 species traded at commercial scale mainly outside the state. NTFPs contributed 19–32% of total household income for different tribal communities, which was significant. *Illicium griffithii*, *Rubia cordifolia*, *Oroxylum indicum*, *Swertia chirayita*, *Litsea sebifera*,

Taxus wallichiana, *Valeriana jatamansii*, *Thalictrum foliolosum*, *Picrorhiza kurrooa*, *Everniastrum cirrhatum*, *Cordyceps sinensis*, *Aconitum fletcherianum*, *Nardostachys jatamansi*, *Picrorhiza kurrooa*, *Gymnadenia orchidis*, *Calamus*, *Quercus* and *Pinus roxbughii* were important commercial species.

Sarmah (2012) reported that Non-timber forest products are an imperative part of the traditional life style in Arunachal Pradesh. Namdapha national park, the species-rich protected area is also effected by human interference. Similarity index indicated that there was very less similarity among the different forest stands. Least similarity among the trees (12.24%) and herbs (9.6%) were recorded between forest stand III and forest stand I. Evasion of 13 tree species of which 6 NTFP species and 10 shrub species were recorded in forest stand I in comparison to forest stand III. On the other hand, 21 herbaceous and 11 tree species were gain in forest stand II in comparison to forest stand III. However forest stand I lost 5 herb, 7 shrub and 24 trees species in comparison to forest stand II stand due to higher anthropogenic disturbance.

Sharma et al. (2015) studied that the state of Arunachal Pradesh having more than 80% of geographical area under forest cover and predominantly inhabited by tribal people. Purpose of this study was to document the status and utilization pattern and to assess the economic value of NTFPs of the state. 135 plant based and 36 animal based non-timber forest products were recorded. Among plant based NTFPs, 54 species were collected for leaves, 30 for stem and 22 for fruits. Most of the animal based NTFPs (93%) were collected/hunted for food. Average 20-40 kg of NTFPs was collected annually per household.

Bauri et al. (2015) studied to assess the diversity of non-timber forest products (NTFPs) and its resource potential in selected sites of Kanksa Forest Division of Burdwan District, West Bengal. 23 major categories of non-timber forest products were recorded during our survey work at the present investigation which includes different forms of Dyes, grass, oil, wax, honey, gum, resin, food items (leaf, fruit, seed, herb, stem), bamboo, broom, basket, cotton, brush, paper, ornamental, worship, marriage rituals, leaves (Sal, Kendu, Datepalm), Sap and Flour. The forest dwellers are progressively dependent on NTFPs for sustaining their daily

livelihood instead of utilizing it as a prospective income source and for their socio-economic development.

Zode et al. (2015) reported that Non-timber forest products (NTFPs) are much important worldwide for their significant role in livelihood, which include any forest product other than timber like medicinal plants, dyes, mushrooms, fruits, nuts, bark, leaves, flowers, seeds, honey, roots and tubers, resins, fibers such as bamboo, rattans, palm and grasses. The present investigation scrutinized the most abundant NTFPs, their use pattern and current status of NTFPs in different villages of Tirora Tehsil. 45 different plant species extracted as most abundant NTFPs, which were used for food, fodder, fuel, medicine, household and commercial purpose. The present study reveals that among the entire 45 plant species, 26 plant species (57.00%) are food products, 4 plant species (8.88%) intended for construction purpose, 15 plant species (33.33%) for commercial use, 31 plant species (68.88%) plants having medicinal importance and all the forest dwellers depend on forest product other than timber at varying degrees.

Sinha et al. (2016) reported that total 44 plants producing NTFP were noted to be collected by tribals in 20 villages of Bastar district. Plant and plant produce collected by the tribals from the plants were seeds of 11 plants, fruits of 11, roots of 3, rhizomes of 4, flowers of 4, and secretory products from 3 plants, whereas 4 whole plants. Lac and Cocoons were also collected by the tribals from the forest.

2.3 Documentation of Post harvest methods and value addition if any.

Runk et al. (2004) studied on NTFP have often been restricted to a single species, year and human user community. However, a number of recent studies are challenging these simplifications. Here, we examine a suite of artisanal NTFP that are of increasing economic importance to Wounaan and Emberá households in Panamá. Artisans make carvings from seeds of a tagua palm (*Phytelephas seemannii*) and the wood of cocobolo (*Dalbergia retusa*), and weave baskets from the fibres of the chungu palm (*Astrocaryum standleyanum*).

Sundriyal and Sundriyal (2004) reported that the data on marketing, value addition and management concerns of the wild edible plants of the Sikkim

Himalaya. A total of 44 wild edible species have been recorded. Other important species were *Machilus edulis*, *Diplazium esculentum*, *Eleagnus latifolia*, *Dendrocalamus hamiltonii*, *Agaricus* and *Baccaurea sapida*. Value addition was done to a few wild edible species, and cost-benefit analysis showed that the income from the fruits could be increased by at least 3–5 times after making pickles, squash and jam.

Joshi and Joshi (2005) conducted a survey on Non-Timber Forest Products of Nepal, 48 species have been documented as raw materials of plant origin with their indigenous uses from the study areas (Okhami, Mulkhadka, Chaubas and adjoining areas of the Bagmati watershed and Syabru of the Langtang watershed) of Nepal. The Non-Timber Forest Products are utilized as raw materials in the manufacture of household utensils. *Rhododendron arboretum* and *Symplocos theifolia* find a particular use in manufacture of such household items as wooden paddles, spoons and bowls. *Arundinaria falcata*, *Dendrocalamus hamiltonii* and *Dendrocalamus strictus* are used for mats, woven basket (doko) and open-air storage bin (baakari).

Velde et al. (2006) reported that certain key entrepreneurs are a driving force of success throughout several NTFP value chains in both Bolivia and Mexico. It include the shopkeeper/organisation in Santa Cruz, Bolivia, who sources woven palm products from and supports several producers, and the entrepreneur in Mexico who established links between mushroom pickers in rural communities and brokers and consumers in Japan. Rather than criticising the monopolistic position of individuals, it is important to understand how the activity of key entrepreneurs can be supported in spreading successful commercialisation further and where necessary control negative impacts of their role.

Kandari and Omprakash (2009) studied 12 villages of Keonjhar district of Orissa and reported that the various NTFP are collected by the local collector. The reported that capacity building in case of value addition and harvesting will be more beneficial to get more income from this trade. However marketing channels will be improved to obtain other profit to the collector of NTFP.

Jagwan *et al.* (2010) reported that NTFP especially in the Garhwal Himalayas, Uttarakhand, Garhwal Hills are an important source of wild non-timber fruit species. Many non timber fruits variety are eaten raw and used, but not yet it has been considered as a source of alternative food products. The results reported here are the outcome of extensive study of the literature on Garhwal flora, its uses and futures benefits. Information has also been gathered from local people by an ethno botanical survey in parts of some Kedar valley villages like Triyuginarayan, Guptkashi, Phata Rampur etc. district Rudraprayag, and Chamoli region of Garhwal Himalaya, Uttarakhand.

Geibler *et al.* (2010) reported that the optimization of value chains is an important process to promote sustainable development, since value chains are closely linked to the satisfaction of human needs and combine different driving forces for environmental change. Methodological approach for the participatory development of value-chain wide sustainability indicator sets and their integration into a decision support tool in the specific case study of the chain “construction and refurbishment with wood”. There are numerous indicator sets for sustainable development of forests and sustainable forestry available at different levels, ranging from local, regional and national to global scale assessments. Some efforts were also made to integrate later production stages of forest value chains (such as wood processing) in the assessment scope (*e.g.* for chain-of-custody certification).

Pandit (2011) reported the NTFP products of Jhargram in Purulia Bankura district. They observed that the knowledge regarding availability of NTFP its quantification, marketing proper utilization and sustainability is quit poor. In JFMCs formed and they have given certain rights on collection of some NTFP but no sustained control mechanism developed. However several million rupees trade of NTFP is not scientifically utilized and processed.

Morsello *et al.* (2012) studied evaluated whether processing non-timber forest products (NTFP) and establishing trade partnerships between forest communities and companies enhance the outcomes of NTFP commercialization. In particular, we evaluated whether product processing, partnerships, or their combination was associated with a number of outcomes related to the well-being of

forest inhabitants and forest conservation. We based our analyses on ethnographic and quantitative data (i.e., survey and systematic observations) gathered at seven communities from five societies of the Brazilian and Bolivian Amazon. Our results indicated that product processing and partnerships do not represent a silver bullet able to improve the results of NTFP commercialization in terms of wellbeing and conservation indicators.

Rath and Mohanty (2013) studied evaluated antifungal screening of *Curcuma longa L* and *Cassia tora L*. against two dermatophytes, rhizome and leaf of these plants were taken and extraction were made in different solvents like water, petroleum ether, chloroform and ethanol. Ethanol extract of the *Curcuma longa* rhizome and chloroform extract of *Cassia tora* leaf showed excellent antimycotic activity against *Trichophyton mentagrophytes* and *Epidermophyton floccosum*. Petroleum ether extract of *Cassia tora* showed zone of 10 mm and 20 mm against *Trichophyton mentagrophytes* and *Epidermophyton floccosum*. The antibiogram profile indicated that Terbinafine has the maximum activity as is shown by its zone of inhibition viz., 40 mm and 32 mm for *Trichophyton mentagrophytes* and *Epidermophyton floccosum*, respectively. Fluconazole was found to be ineffective against the two-test fungi. Lowest MIC in case of ethanolic extract of *Curcuma longa* against *Trichophyton mentagrophytes* and *Epidermophyton floccosum* is 6.575 µg/ml and the chloroform extract of *Cassia tora* against *Trichophyton mentagrophytes* is 13.15 µg/ml.

Shankar et al. (2014) conducted an investigation at Indira Gandhi Krishi Vishwavidyalaya, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Bastar, Chhattisgarh in Horticultural laboratory under AICRP. They concluded that the treatment or recipe combination 1:1.5:2.5 (Tikhur starch: Sugar: Water) was best for the preparation of tikhur *Barfi*. On the other hands tikhur *Barfi* prepared through the recipe 1:1.5 2.5 (Tikhur starch: Sugar: Water) had a pleasant flavour, texture, taste moisture, texture appearance and over all acceptability.

2.4 The role of NTFPs in livelihood of tribes and local residents in relation to their income

Gera and Baghel (2000) studied revealed that some NTFPs were collected for consumption within the village only and some NTFPs such as Mahua (*Madhuca indica*) flowers and oil, Tendu (*Diospyros melanoxylon*) leaves and Sal (*Shorea robusta*) leaves they sale in local market. The study concludes that the proportion of village income generated by NTFPs, about 11% could be raised much collection and marketing by women and the activity, which most villagers engaged was the collection of Tendu leaves followed by Mahua flower.

Mahapatra et al (2005) studied the contribution of NTFPs to cash income in the dry deciduous forests of Orissa and Jharkhand, India. In its focus on cash income, this study sheds light on how the sale of NTFPs and products that uses NTFPs as inputs contribute to the rural economy. From analysis of a unique data set that was collected over the course of a year, the study finds that the contribution of NTFPs to cash income varies across ecological settings, seasons, income level, and caste.

Murthy et al. (2005) conducted a study in Uttara Karnnada district, Western Ghats of Karnataka, India. The study revealed that the number of species used as food is 17 (28.8%) and 19 (32.2%) respectively in these zones. About 50% of the species available in the evergreen zone about 40% in the semi evergreen and dry deciduous zones and only 13% in the moist deciduous zones. Significant quantities of NTFPs are collected in all the four zones and the estimated value of NTFPs per household varies between Rs. 3445 per household in evergreen zone and Rs.1233 per household in dry deciduous zone.

Mahapatra and Tewari (2005) reported that the Dry deciduous forests in India is one such typical case where forest valuation is yet to integrate the NTFP stock, widely used for subsistence and cash income. The net present value of revenues from NTFP was estimated to be US\$ 1016 ha⁻¹ in the coastal area and US\$ 1348 ha⁻¹ in the inland area, which proved to be significantly higher than the returns from alternative land uses. Dry deciduous forests were estimated to have more value

than had been assumed previously and compared favourably against potential timber revenue (US\$ 268 ha⁻¹).

Acharya *et al.* (2009) observed that Non Timber Forest Products (NTFPs) as contributing resources for improving livelihoods of the rural people. Existing trend of NTFPs in Rolpa district reveals high level of its potentiality where a single Malagiri tree in the one of the VDCs of the district has yielded profit of 15, 000 NRs. in gross. The study supports idea that the quality of life can be secured through the promotion of NTFPs as an additional resource for safety net. Major outlet clusters for NTFP trade and marketing of the Rolpa district are Sulichaur and Holeri regions where mostly NTFP species were found to be traded. Malagiri, Timur, Ritha and Allo are major local species that have a high level of demand in the market. As a result, people have started cultivating a few species in their farmland too.

Surayya (2011) reported that over 80% of FD depends on Non-Timber Forest Products (NTFP) and 28 to 50% of income comes from NTFP trade, representing just 20% of end user price spread as trade is without value addition. Lack of microfinancial assistance, ineffective administration, hinders value additions. NTFP trade is seasonal, FDs need to borrow money from moneylenders at high interest rates/ NTFP distress of sale. These and non-regulated NTFP markets are contributing to poverty of this groups. Interventions like Self-Help Groups (SHG) movement, based on save and serve themselves. Creating social collateral and group Pressure are features of this approach. The emergence of microfinance is strategic option to alleviate poverty. FD now get 38% of their microcredit from SHG. Studies show that adding value by way of making leaf plates can earn 100% average incremental benefit.

Joshi and Negi (2011) conducted a study in the western Himalayan region (Uttarakhand State in India) and reported that oak (*Quercus leucotrichophora*) and pine (*Pinus roxburghii*) are the two major forest ecosystems. The study revealed that oak forests provide a greater variety of provisioning services as compared to pine forests. Provisioning services such as fuel-wood, fodder, and natural fertilizers (leaf litter) provided by oak forests (Rs. 5676/person/year) were more valuable than those provided by pine forests (Rs. 4640/person/year). Stakeholder perceptions of the

regulating services of oak forests, such as maintenance of soil fertility, soil moisture retention, prevention of soil erosion, air and water purification, was also more positive than for pine forests.

Sarmah and Arunachalam (2011) reported that the forests of Arunachal Pradesh support rich diversity of timber as well as non-timber yielding species. The non-timber forest products (NTFPs) possess imperative part of the traditional life style in Arunachal Pradesh and utilisation of these products has been contributing much to the local livelihood. NTFPs such as fuel-wood, house building materials, wild edible vegetables and medicinal plants are mostly collected from natural habit. The total contribution of NTFPs to annual household income was maximum (23% of the total income) in the villages of Miao circle followed by Diyun circle (21% of the total income) and Nampong circle and Vijaunagar circle (19% and 18% of the total income respectively). It was recorded minimum (11% of the total income) in the villages of Bordumsa circle.

Raufu *et al.* (2012) observed that the majority of the respondents (58.9%) supported non-availability of NTFPs as the significant effect of deforestation on NTFPs activities. The major problem encountered in NTFPs gathering and marketing are insufficient labour (38.9%), storage problem (23.2%), and thieves (14.4%).

Kar and Jacobson (2012) studied that the NTFPs' role in contributing to the household economy and how different socio-economic factors may influence this contribution. Field methods involved quantitative and qualitative data collection of forest-adjacent households of Chittagong Hill Tracts in Bangladesh. Results show that the contribution of different types of NTFPs to household economy varies in terms of subsistence and cash income. However, overall NTFP income is much higher than income from timber or firewood which indicates a larger dependence of the households on NTFPs. Income data analysis also finds that the poor households are relatively more dependent on NTFPs for their subsistence and cash income than the better-off households. Moreover, the study reveals that there are many other socio-economic factors at the household level such as number of members in

household and total value of household implements and furniture that are significantly correlated with the NTFP income.

Mukul *et al.* (2016) studied to explore the contribution of NTFPs in sustaining forest-based rural livelihood in and around a protected area (PA) of Bangladesh, and their potential role in enhancing households' resilience capacity. 27% households (HHs) of the area received at least some cash benefit from the collection, processing and selling of NTFPs, and NTFPs contribute as HHs primary, supplementary and emergency sources of income. NTFPs also constituted an estimated 19% of HHs net annual income, and were the primary occupation for about 18% of the HHs.

Moe and Liu (2016) reported that Non-timber forest products (NTFPs) income plays an important role in the household economy in the rural forest dwelling communities. This study used the data from 60 sample households of the three villages in Tharwady District of Myanmar to analysis the significant of NTFPs income in the rural household economy. This study found that NTFPs income contributes 44.37%, and farm income and non-farm income contribute 32.55% and 23.07% to the total household income respectively. The lower and middle income level households derived more NTFPs income than high income level households. For low income households, share of NTFPs income in the total household income is over 75%. Major NTFPs include bamboo, thatch, firewood, charcoal, bamboo shoot, broom grass, bark and root, and others. Regression analysis showed that farm income, non-farm income and agricultural land own are scientifically and negatively correlated with the NTFPs incomes.

CHAPTER – III

MATERIAL AND METHODS

The present investigation entitled “Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh”. The experimental details relating to the study site, climate, geology, soils, forest flora, fauna and other features of land along with methodologies adopted are given below

3.1 Study Site

Dhamtari district is officially formed on 6th July 1998 dividing the Raipur district currently the capital of Chhattisgarh along with Mahasamund. As a result the boundaries of the Raipur district is converted into the districts e.g Raipur, Mahasamund and Dhamtari. Dhamtari, Kurud and Nagari are included in Dhamtari district as Tehsils and Dhamtari, Kurud, Nagari and Magarlod were designated as blocks. Dhamtari is abbreviated from "Dhamma"+"Tarai" District is situated in the fertile plains of Chhattisgarh Region. The district headquarters is Dhamtari. Study sites are situated at a distance of 50-75 km away from district Head quarter of Dhamtari. Site 01 Dugli range two villages namely Dinkarpur and Monaikera. Site 02 Nagri range, villages Daldali (A) and Karraghati. Site 03 Sihawa range, Villages bhathkhar and Satbahna (Dongripara) were selected to undertake the study.

3.1.1 Geographical location and Physiography

Dhamtari area situated at 20°42' North latitude and 81°33' east longitude. The total area of the district is 2029 km² and it is 305 meters above the sea level. Study area located between 22°20'901" N latitude to 81°57'533" E longitude and 472 m. above the mean sea level. In the East, Satpura range is located. It is popularly known as Sihawa Pahad. The District is surrounded by District Raipur in North and District Kanker as well as Bastar in South, part of Orissa state in East and District Durg and Kanker in West. Mahanadi is the principal river of this district and Mahanadi is so far named as Kankannadi, Chitrotpala, Neelotpala etc.

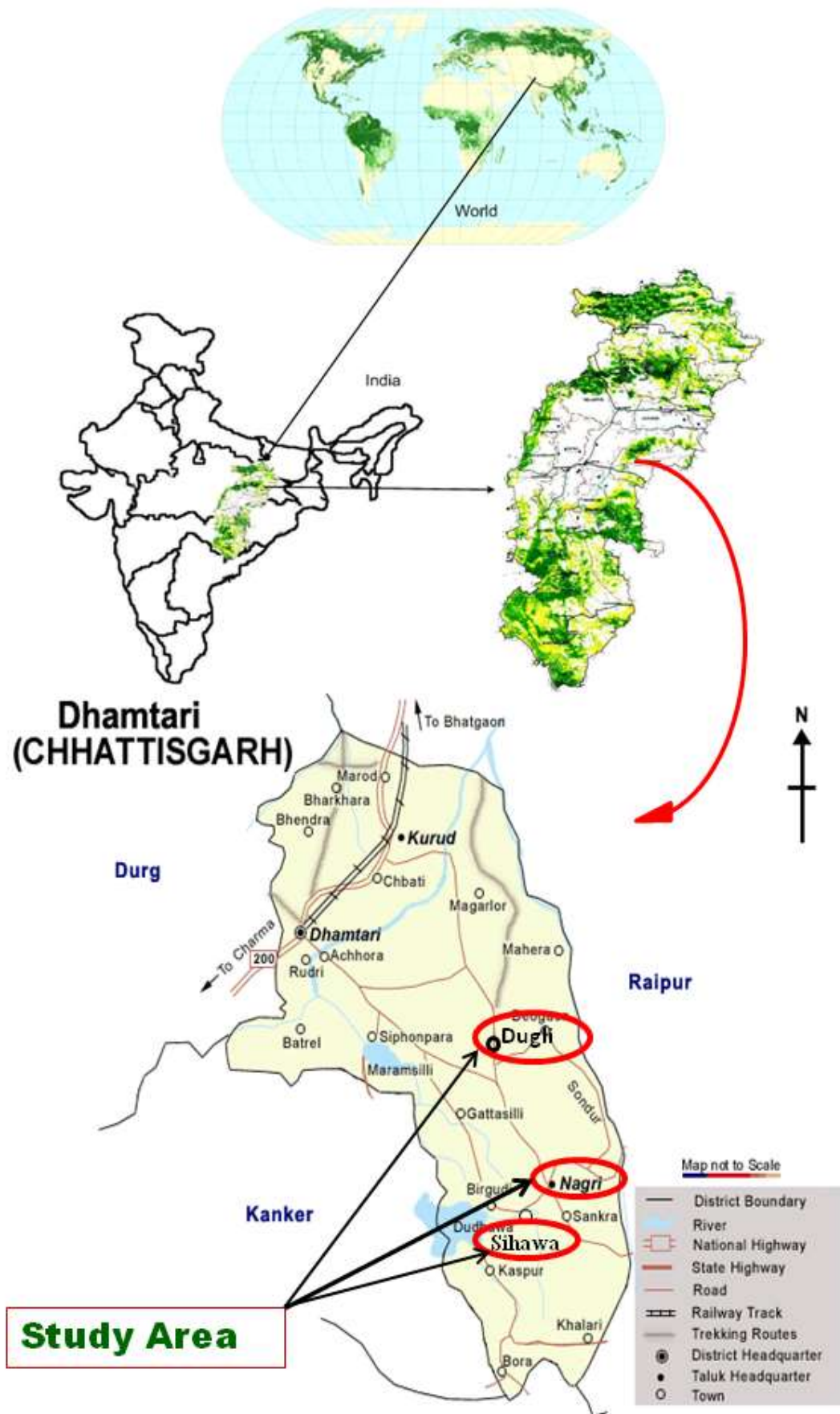


Fig. 3.1 Location map of study area

Its tributaries being Sondhur, Paury, Sondur, Joan, Kharun and Shivnath. The fertility of lands of Dhamtari district can be attributed to the presence of these rivers. The main crop of this region is Paddy. Mahanadi one of the major river in Central India originates in the hills of Sihawa flows in the direction of East into the Bay of Bengal. Dhamtari district falls between two Lok Sabha Constituencies (Kanker and Mahasamund) and three Assembly constituencies (Dhamtari, Kurud, Sihawa). The national highway No. 30 (Previously NH 43) Raipur – Vijaynagaram (Andhra Pradesh) passes through Dhamtari. Raipur is 78 Km. from Dhamtari.

3.2 Soil

The soil of the division varies at different locations. Generally soil of the area is yellowish to reddish in colour with pockets of lateritic soil. Small stretches of clay soil, shallow siliceous and less-fertile soils are also found at some places. Soil is prone to mild-erosion which covers 70 per cent area and remaining 30 per cent area experience as advance stages of erosion.

3.3 Climate

The climate of the study area is tropical consists three major seasons viz. rainy, winter and summer. Here winter season is of 3 months Dec. to Feb. and summer season commences from March and last till June from mid June to Sept. rain occurs due to South West monsoon, in between last week of Dec. to second week of Jan. there are winter rains.

3.3.1 Temperature

The average annual temperature in Dhamtari is 26.4 °C. The minimum monthly annual temperature range from 12.9°C in January to 28.2 °C in May and mean annual maximum and minimum temperature is 42.9°C in May and 27.4 °C in December. The average annual temperature of study area was 11.3 °C in December to 34.8 °C in May. During study period the highest temperature was recorded 42.9 °C in the month of May and the minimum temperature was recorded 11.3 °C in the month of December and the average temperature was recorded 26.15 °C from December to May.

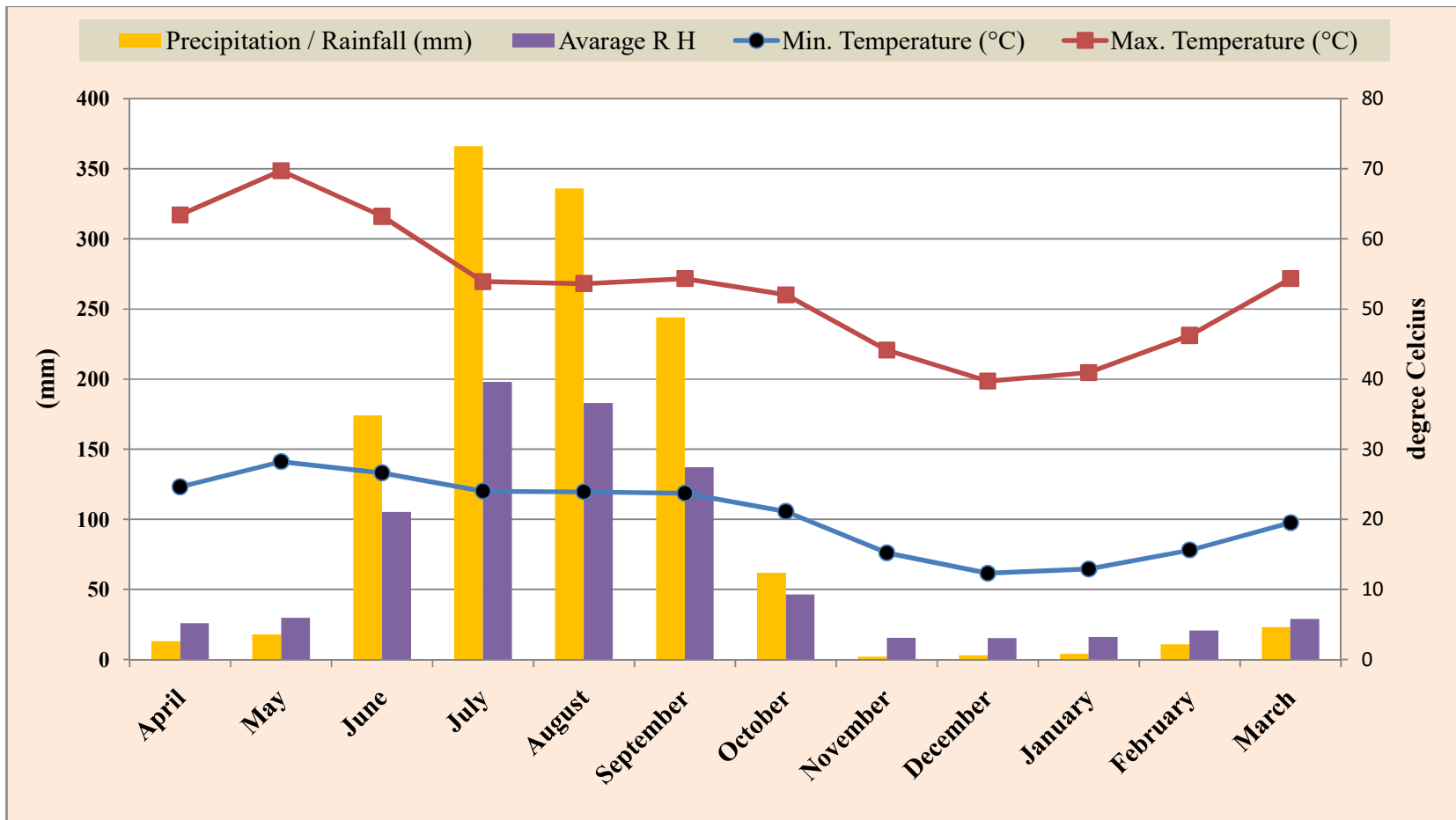


Fig. 3.2 Meteorological detail of the study area from April 2016 – March 2017

3.3.2 Rainfall

The average annual rainfall of study area ranged from 1196 to 1256 mm. The rainy season starts from mid June and remains up to mid September. The rainfall received from South- West monsoon. In winter only 6.55% rainfall received and in summer season 21.31% rainfall received. However, the rain distributed as 9.38% during winter, 21.31% as a summer and 65 % rain occurs in rainy season. During study period the maximum rainfall was recorded 23 mm in the month of March and the minimum rainfall was recorded 3 mm in the month of December and the average rainfall was recorded 12 mm from December to May.

3.3.3 Humidity

The relative humidity rapidly increases from July and August it reach maximum 95%. The month of April is dry with relative humidity 33%, in winter 62-73% in the morning (8:00 -12:00 hrs), while it varies between 41-54% in evening (12:00 to 6:00 hrs). During the study period the average relative humidity in morning was recorded 68 % and in evening it was recorded 24.33 %.

3.4 Plant world

The Dhamtari forest area mainly dry mixed deciduous forest is present. The forest are classified on the basis of dominant, co-dominant and least dominant species and therefore, divided in to two categories.

- (1) Sal forest (2) Mixed forest

3.4.1 Sal forest

In Dhamtari forest area the Sal forests are mainly found in the higher areas of the forest compartments of northern and western borders .At certain places patches of the Sal forests can be found in the vallies of the nallas.

In Sal dominated forest, the following tree species are also found - Sal (*Shorea robusta*), Karra (*Cleistanthus collinus*), Char (*Buchanania lanzan*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*), Moyan (*Lannea coromandelica*), Haldu (*Adina cordifolia*), Senha (*Cleistanthus collinus*), Bija



A View of Sal Forest at Study Area



A View of Mixed Forest at Study Area

Plate 3.1 Forest types of study area

(*Pterocarpus marsupium*), Mahua (*Madhuca indica*). Among the codominant species found Amaltas (*Cassia fistula*), Teak (*Tectona grandis*), Jamun (*Syzygium cumini*), Anola (*Emblica officinalis*), Amaltas (*Cassia fistula*), Harra (*Terminalia chebula*), Bhelwa (*Semecarpus anacardium*), Neem (*Azadirachta indica*), Kumbhi (*Careya arborea*), Khamar (*Gmelinia arborea*) Kusum (*Schleichera oleosa*), Semal (*Bombex ceiba*) etc.

In the banks of the nallas of the forest area, clums of bamboos are present which are conserved properly; they can take the form of good forest. Among the shrubs Korea (*Holarrhena antidysenterica*), Chhind (*Phoenix acaulis*), Lantana (*Lantana camara*), Kurru (*Gardenia resinifera*), Chameli (*Jasminum polyanthum*), Chikti (*Triumfetta rhomboidea*), Gotia (*Ziziphus xylopyra*), Bendrachar (*Argyrea involucrate*), species are present and among the herbs, Tikhur (*Curcuma angustifolia*), Safed musli (*Chlorophytum tuberosum*), Kalmegh (*Andrographis paniculata*), Satavar (*Asparagus racemosus*), Dashmul (*Daedalacanthus roseus*), Kakai (*Flacourtia indica*), Gengi (*Curcuma zedoaria*), Kali musli (*Curculigo orchioides*), Anantmool (*Hemidesmus indicus*), species are found. Amonge the climbers Mahul (*Bauhinia vahlii*), Baichandi (*Dioscorea hispida*), Ramdatun (*Smilax macrophylla*), Karukand (*Dioscorea bulbifera*), Keoti (*Ventilago calyculata*), Kaliyari (*Gloriosa superb*), Bodal (*Cucumis melo agrestis*), Ainthi or Marorphalli (*Helicterus isora*), species are abundantly present in the entire area.

3.4.2 Mixed forests

Mixed forests are present near about entire of plants Dhamtari forest area .The mixed forests are mainly of four category (Trees, Shrubs, Climbers and Herbs). The dominant species are Sal (*Shorea robusta*), Karra (*Cleistanthus collinus*), Char (*Buchanania lanzan*), Tendu (*Diospyros melanoxylon*), Dhawda (*Anogeissus latifolia*), Moyan (*Lannea coromandelica*), Haldu (*Adina cordifolia*), Senha (*Lagerstroemia parviflora*), Bija (*Pterocarpus marsupium*), Mahua (*Madhuca indica*), Bhirra (*Chloroxylon swietenia*), of certain places small groups of Teak (*Tectona grandis*) are also presents as scattered patch in the forest. Among the co dominant species found Amaltas (*Cassia fistula*), Teak (*Tectona grandis*), Jamun (*Syzygium cumini*), Anola (*Emblica officinalis*), Amaltas (*Cassia fistula*), Harra

(*Terminalia chebula*), Bhelwa (*Semecarpus anacardium*), Neem (*Azadirachta indica*), Kumbhi (*Careya arborea*), Khamar (*Gmelinia arborea*) Kusum (*Schleichera oleosa*), Semal (*Bombex ceiba*) etc. are present. In the entire area, Bamboo species are also present here in patches.

Among the shrubs Korea (*Holarrhena antidysenterica*), Chhind (*Phoenix acaulis*), Lantana (*Lantana camara*), Kurru (*Gardenia resinifera*), Chameli (*Jasminum polyanthum*), Chikti (*Triumfetta rhomboidea*), Gotia (*Ziziphus xylopyra*), Bendrachar (*Argyreia involucrate*), species are present and among the herbs, Tikhur (*Curcuma angustifolia*), Safed musli (*Chlorophytum tuberosum*), Kalmegh (*Andrographis paniculata*), Satavar (*Asparagus racemosus*), Dashmul (*Daedalacanthus roseus*), Kakai (*Flacourtia indica*), Gengi (*Curcuma zedoaria*), Kali musli (*Curculigo orchioides*), Anantmool (*Hemidesmus Indicus*), species are found. Amonge the climbers Mahul (*Bauhinia vahlii*), Baichandi (*Dioscorea hispida*), Ramdatun (*Smilax macrophylla*), Karukand (*Dioscorea bulbifera*), Keoti (*Ventilago calyculata*), Kaliyari (*Gloriosa superb*), Bodal (*Cucumis melo agrestis*), Ainthi or Marorphalli (*Helicterus isora*), species are the major ones.

3.5 Sample and Sampling Procedure

3.5.1 Selection of village

In Dhamtari forest area, the villages were selected on the basis of maximum collection and utilization of Non Timber Forest Products carried out by tribal communities residing in and around study area . In the study area three sites were selected and two villages in each site are selected. Site 01 Dugli, village Dinkarpur and Monaikera. Site 02 Nagri, village Daldali (A) and Karraghati. Site 03 Sihawa, Village bhathkhar and Satbahna (Dongripara) were selected in such a way to cover and represent the whole villages and surrounding areas of Dhamtari forest area to undertake the research work.

3.5.2 Selection method of respondents

Out of total tribal families residing in each selected village, a representative sample of 20 percent respondents were selected by purposive sample. The tribal

respondents, which have been incorporated in this study for collection of data are illustrated in (Table 3.1)

Table 3.1: Village wise house hold selected in different study sites of Dhamtari, (C.G.)

S. No.	Village	Total household	No of Respondents selected (20% of the total household of the village)
Site 1 Dugli Forest Range Dist. Dhamtari			
1.	Dinkarpur	127	25
2.	Monaikera	107	20
Site 2 Nagri Forest Range Dist. Dhamtari			
1.	Daldali (A)	113	22
2.	Karraghati	108	20
Site 3 Sihawa Forest Range Dist. Dhamtari			
1.	Bhathkhar	30	10
2.	Satbahna	48	10
(Dongripara)			

Table 3.2 Details of the respondents selected in Site 01 Dugli village Dinkarpur, Dhamtari, (C.G.)

S. N.	Name of Respondent	No of Family members	No of M/F	Education status	No. of Childre n	Cast
1.	Naresh Devmandal	8	4/4	B.E.	2	Gond
2.	Shivnath Netam	13	7/6	Metric	3	Gond
3.	Cheturam Mandawi	3	2/1	Primary	2	Gond
4.	Shivkumar Markam	5	1/4	Middle	3	Gond
5.	Faguram Netam	4	3/1	Primary	3	Gond
6.	Lilaram Markam	8	3/5	Primary	3	Gond
7.	Rainuram Markam	7	2/5	Primary	3	Gond
8.	Luduram Markam	5	2/3	Primary	3	Gond
9.	Devnath Netam	8	3/5	Primary	3	Gond
10.	Rajesh Markam	5	2/3	Primary	3	Gond
11.	Bhagvan Singh Netam	4	2/2	6 th	2	Gond
12.	Shivkumar Netam	5	3/2	Primary	3	Gond
13.	Rukhman Markam	5	3/2	Primary	3	Gond
14.	Vijay Netam	11	7/4	Middle	4	Gond
15.	Gautam Netam	8	4/4	Middle	3	Gond
16.	Mahesh Markam	9	5/4	12 th	4	Gond
17.	Domarsingh Markam	5	4/1	Metric	3	Gond
18.	Jethram Mandavi	6	3/3	Primary	1	Gond
19.	Sadhuram Markam	8	5/3	Middle	1	Gond
20.	Lalit Bai	2	1/1	Illiterate	1	Gond
21.	Dharamsingh Mandavi	7	3/4	Primary	4	Gond
22.	Mansingh Netam	8	2/6	Illiterate	4	Gond
23.	Itvaru Mandavi	5	2/3	Middle	2	Gond
24.	Sunder Markam	6	2/4	Primary	3	Gond
25.	Gokul Markam	3	1/2	Primary	1	Gond

M – Male, **F** – Female



Plate 3.2 Respondents selected in Dugli site, village – Dinkarpur

Table 3.3 Details of the respondents selected in Site 01 Dugli village Monaikera, Dhamtari, (C.G.)

S. N.	Name of Respondent	No of Family members	No of M/F	Education status	No. of Children	Cast
1	Dharamsingh Netam	6	2/4	Illiterate	4	Gond
2	Girdhar Markam	3	1/2	Illiterate	1	Gond
3.	Sukhram Netam	4	2/2	Primary	2	Gond
4.	Dhiraj Markam	4	2/2	3 rd	2	Gond
5.	Gajaram Netam	7	4/3	Metric	3	Gond
6.	Nathela Cedaiya	7	3/4	4 th	1	Gond
7.	Ravindra Nag	4	2/2	7 th	2	Gond
8.	Bisruram Netam	5	2/3	9 th	6	Gond
9.	Chainsingh Netam	6	1/5	B.A.	4	Gond
10.	Mohit Netam	4	2/2	B.A.	-	Gond
11.	Parshottam Nag	6	3/3	Middle	4	Gond
12.	Parmeshwar Nag	5	1/4	Middle	2	Gond
13.	Bhagiram Netam	6	4/2	Illiterate	4	Gond
14.	Hirau Netam	5	2/3	Primary	2	Gond
15.	Dukalu Netam	6	1/5	Middle	4	Gond
16.	Dhiraj Markam	4	2/2	Illiterate	2	Gond
17.	Punit Netam	7	4/3	Illiterate	3	Gond
18.	Amrotin Netam	4	2/2	Illiterate	1	Gond
19.	Kriparam Netam	6	3/3	12 th	4	Gond
20.	Rajendra Netam	5	3/2	Primary	3	Gond

M – Male, **F** – Female



Plate 3.3 Respondents selected in Dugli site, village – Monaikera

Table 3.4 Details of the respondents selected in Site 02 Nagri, Village Daldali (A), Dhamtari, (C.G.)

S. N.	Name of Respondent	No of Family members	No of M/F	Education status	No. of Children	Cast
1	Devnath Kunjam	07	2/5	Metric	5	Gond
2	Chhattar Singh Taram	10	4/6	9 th	3	Gond
3.	Mannu Mandavi	5	2/3	Metric	3	Gond
4.	Nirmal Netam	5	2/3	Metric	3	Gond
5.	Jaini Bai Dhruw	4	1/3	Middle	1	Gond
6.	Naresh Dhruw	3	1/2	Middle	1	Gond
7.	Radheshyam Markam	6	4/2	Middle	4	Gond
8.	Yashwant Darro	5	3/2	B.A.	3	Gond
9.	Devlal Kunjam	5	2/3	Middle	3	Gond
10.	Shivnarayan Chandrawanshi	16	6/10	Primary	3	Gond
11.	Shravan Darro	4	2/2	Metric	2	Gond
12.	Parasram Dhruw	5	1/4	Middle	4	Gond
13.	Ramdayal Chakradhari	4	2/2	Metric	2	Kamar
14.	Lilambar Singh Sori	8	4/4	Primary	3	Gond
15.	Ramsingh Netam	8	4/4	Middle	1	Gond
16.	Bartia Netam	3	1/2	Primary	1	Kamar
17.	Ramji Dhruw	8	3/5	Middle	4	Gond
18.	Somnath Dhruw	6	3/3	Metric	2	Gond
19.	Shyamlal Chakradhari	6	2/4	Illiterate	1	Kamar
20.	Paras Netam	6	1/5	Primary	3	Gond
21.	Ghasia Dhruw	7	3/4	Illiterate	2	Gond
22.	Vishnu Netam	3	1/2	Middle	1	Gond

M – Male, F - Female



Plate 3.4 Respondents selected in Nagri site, village – Daldali (A)

Table 3.5 Details of the respondents selected in Site 02 Nagri, Village Karraghati, Dhamtari, (C.G.)

S. N.	Name of Respondent	No of Family members	No of M/F	Education status	No. of Children	Cast
1.	Suresh Markam	6	2/4		3	Gond
2.	Kailash Markam	10	5/5	Middle	2	Gond
3.	Dhanwar Netam	8	3/5	Middle	3	Gond
4.	Premlal Kunjam	5	2/3	12 th	1	Gond
5.	Baldev Yadav	6	3/3	4 th	1	Yadav
6.	Hiralal Netam	2	1/1	Primary	-	Gond
7.	Sarjuram Kunjam	3	2/1	Metric	1	Gond
8.	Asaram Markam	4	2/2	Middle	2	Gond
9.	Ramlal Markam	3	2/1	Primary	1	Gond
10.	Rohit Netam	7	3/4	12 th	1	Gond
11.	Patiram Netam	5	3/2	Metric	3	Gond
12.	Phaguaram Netam	7	4/3	Primary	3	Gond
13.	Jhammallal Netam	7	5/2	6 th	4	Gond
14.	Abhayram Kunjam	5	2/3	Metric	3	Gond
15.	Prabhuram Kunjam	6	2/4	Illiterate	-	Gond
16.	Somru Netam	7	3/4	Primary	1	Gond
17.	Bihari Kunjam	11	4/7	Middle	2	Gond
18.	Hirday Yadav	5	3/2	Primary	3	Yadav
19.	Jhaglu Netam	7	3/4	Middle	3	Gond
20.	Kanta Markam	5	2/3	Primary	3	Gond

M – Male, F - Female



Plate 3.5 Respondents selected in Nagri site, village – Karraghati

Table 3.6 Details of the respondents selected in Site 03 Sihawa, Village-Bhhathkhar, Dhamtari, (C.G.)

S. No	Name of Respondent	No of Family members	No of M/F	Education status	No. of Children	Cast
1.	Kashiram Yadav	7	5/2	Middle	3	Yadav
2.	Saman Lal Netam	5	2/3	Metric	2	Kamar
3.	Varun Sahu	12	3/9	B.A.	8	Teli
4.	Sukhru Ram Netam	8	4/4	9 th	4	Kamar
5.	Gopi Ram Sahu	6	4/2	B.A.	4	Teli
6.	Shivnath Netam	6	3/3	Middle	2	Gond
7.	Gajju Ram Netam	3	2/1	Illiterate	1	Kamar
8.	Sukhlal Netam	5	2/3	Middle	3	Kamar
9.	Mehtar Markam	8	3/5	9 th	2	Gond
10.	Sunaram Netam	6	2/4	Metric	2	Kamar

M – Male, **F** – Female

Table 3.7 Details of the respondents selected in Site 03 Sihawa, Village Satbahna (Dongripara), Dhamtari, (C.G.)

S. N.	Name of Respondent	No of Family members	No of M/F	Education status	No. of Children	Cast
1.	Bhishmapitamha Som	4	2/2	Primary	1	Halba
2.	Subhash Pareshwar	4	2/2	12 th	2	Gond
3.	Daulal Markam	6	3/3	Primary	4	Gond
4.	Dhruwkumar Rana	4	2/2	Primary	2	Halba
5.	Ashwani Pareshwar	3	1/2	Middle	1	Gond
6.	Daulat Dhruw	5	3/2	Middle	3	Gond
7.	Tijau Markam	4	2/2	12 th	2	Gond
8.	Gajruram Pareshwar	7	5/2	Metric	2	Gond
9.	Motiram Chandravanshi	6	1/5	B.A.	4	Gond
10	Arjun Dhruw	4	2/2	Primary	-	Gond

M – Male, **F** - Female



Plate 3.6 Respondents selected in Sihawa site, village - Bhatkhar and Satbahna (Dongripara)

3.5.3 Method of data collection

Socio-economic survey was carried out from all three sites and 6 villages of study area Dhamtari. A total of 107 respondents were selected for collection of information. The primary data was collected from the sampled respondents through intensive personal interviews with the help of pre-tasted semi structured schedule for which the questionier develop to undertake data for this study. The schedule is given in Appendix- 1. The schedules contains information on collection, utilization and post harvest techniques of tribal and villagers, infrastructure facilities are available at villages. The hierarchy of village also recorded to understand the development phase of the villages.

3.5.4 Data collection

Data was collected on winter and summer season when the NTFPs are extracted from forests and sold in the market. The data was collected on the basis of questionnaire developed for this experiment regarding, processing of the harvested NTFP before storage and marketing of the produce. The collection method of different NTFPs also documented. The income obtain from different enterprises, like Agriculture, labour work, Job and any other business and contribution of different enterprises for their livelihood were recorded with the help of questionnaire developed.

3.5.5 Data collection of phytosociology

The phytosociological study was carried out in the month of January after the full vegetation is available in the forest stand to record the Density, Frequency, Basal Area and Importance Value Index of the study sites.

Quadrata sampling:

- 10X10 Meter quadrata size will be used for tree layer, in which DBH and Height of trees.
- 5X5 Meter quadrata size will be used for shrub layer, in which collar diameter & height.

- 1X1 Meter size of quadrat will be taken for herb layer, in which collar diameter will be taken.

Vegetation composition was evaluated by analyzing the frequency, density, abundance and importance value index (IVI) according to Curtis & McIntosh (1951) and Mishra (1968) and as given below:

Basal Area It is the area occupied by the base of a tree, is considered as a good indicator of the size, volume or weight of a tree. It provides information on the proportion or dominance of the larger and smaller trees in an ecosystem and is one of the most important parameters in estimating the standing biomass in an area.

$$\text{Basal area} = Cbh^2/4\pi$$

Where

Cbh = Circumference of the tree at breast height.

Usually after the quantitative estimation of relative values of density, frequency and dominance, the species are listed in order of decreasing importance.

$$\text{Density} = \frac{\text{Total number of Individuals in all sampling units} \times 100}{\text{Total number of sampling units studied}}$$

$$\text{Frequency} = \frac{\text{Number of sampling units in which species occur} \times 100}{\text{Total number of sampling units}}$$

$$\text{IVI} = \text{Relative Density} + \text{Relative Frequency} + \text{Relative Dominance}$$

$$\text{Relative density} = \frac{\text{Density value of species} \times 100}{\text{Sum of density value of all species}}$$

$$\text{Relative frequency} = \frac{\text{Frequency value of species} \times 100}{\text{Sum of frequency value of all species}}$$

$$\text{Relative dominance} = \frac{\text{Total basal area of the species} \times 100}{\text{Total basal area of all species}}$$

3.6 Important features of Ethnic Groups in the study areas

There are mainly three dominated tribes namely Gond, Kamar and Halba are living in and around Dugli, Nagri and Sihawa areas. The social cultural activity of these major tribes who are the main stake holder of NTFPs collection are given below

Gond Tribes

The Gonds are one of the most famous and important tribes in India, known for their unique customs and traditions. They are mainly a nomadic tribe and call themselves as Koytoria. The term 'Gond' is derived from the Telugu word 'Konda' which means hill. Gond Tribes are primarily located in Madhya Pradesh, Chhattisgarh, eastern Maharashtra, northern Andhra Pradesh and western Orissa. With a population of over 4 millions, Gonds also form the largest tribal group in central India. In Chhattisgarh, Gonds are the largest tribal group in terms of population and are mainly concentrated in the southern part of the state. More than 20 % of Gonds in Chhattisgarh live in Bastar region only. There are 3 major sub-castes of Gonds in Bastar – Maria, Muria and Dorla. Gond men and women have strong and black skin because they always come in contact of sunlight. They live in the Geda (Forest), they worship the garia (heaps of stones worships as Gods and Goddess), pet pigs are sacrifice them that is they are Gudadharis (Guda pig shed or pig sacrifice) and thus they are called Gonda. There are more than a dozen of subgroups in Gonds living in Chhattisgarh and M.P. and its border states.

The Gonds are predominantly Hindus and like to live in groups in small villages. The main language of the Gonds is Gondi but about half of Gond populations also speak Indo-Aryan dialects including Hindi. The Gonds are traditionally agriculturalists and some practice shifting cultivation even today. Other major activities of Gonds include collecting forest produce, fishing, hunting, forging metal goods in cottage industries and other primary sector activities. Gonds also have a special skill that has been passed down every generation and that is the secrets of the medicinal plants. As there are no proper health facilities in several areas, they still follow the traditional system of medicines and use plants and herbs for curing various ailments. Gonds are also known for practicing social hierarchy



Plate 3.7 Gond Tribe of Study Sites

system like Hindus and the Gond society is regarded as highly stratified and not conforming to the usual image of egalitarianism among tribals.

Gonds have ruled successfully in a big area of Chhattisgarh. Geographically Dandkaranya, Chhattisgarh, Vindychal, Bundelkhand and Baghelkhand region are the areas in which the Gonds have ruled from 15th to 19th century. According to Hislip, Rajgonds sprinkle little amount of water on the wood before using them to cook food. Rajgonds occupy the highest position in the society.

In Mandla district four groups of Gonds are found. This subdivision of the groups as varnas is impressed by the Hindu Varna system. The four varnas are

1. Devgond - they are pure vegetarians.
2. Suryavanashi Rajgond- the Rajput khatiyas have the earlier people from Suryavanshi and Chandravanshi. They believe that they were originate from the sun.
3. Suryavanashi devghadi gond – these are Shryavanashi gond and originate from devgarh.
4. Rawanvanashi gond- they eat cow meat, drink alcohol and sacrifice pigs.

Although gonds worship hindu Gods but they also give privilege to ancient deities and souls. Among these Dulhadev, Narayadev, Surajdev, Matabhai, Khairmata, Thakurdev and Bagheshwerdev are the major ones. Bagheshwerdev is often gifted hen and goat.

Gonds live in the hills and that place, which are covered by dense forest. Their living area at 600 **mt.** above sea level covering the Narmada basin, Satpura, Mandla, Maikal and Amarkantak hills. They like teak trees and spread its ash in the fields to increase the fertility of land but do not cut Saja trees. They use nets, bows and arrows for hunting wild animals. Their food habit includes cereals, meat, roots of wild plants, fruits and fish.

Kamar Tribes:

Kamar is one of the scheduled tribes living in the hills, valleys and forests of Central India. They are primarily settled in Rewa District of Madhya Pradesh. Some of them are also found in Chhattisgarh and West Bengal.



(A) Kamar Tribe



(B) Halba Tribe

Plate 3.8 Kamar and Halba Tribe of Study Sites

They continue to speak their native language, also called Kamar, despite outside influences. According to popular legends, the Kamar are the original inhabitants of the area in which they live, south of the plains of Chhattisgarh. The Kamar are said to be related to their neighbors, the Gond, who conquered them. Traditionally, they are military servants. Farming, collecting forest produce, hunting and fishing are other areas of activity. For extra income, many also engage in basketry throughout the entire year.

Most of the Kamar earn their income by making bamboo items, which they sell and trade in the weekly markets. Many engage in basketry throughout the entire year, and they are well known for this skill. Their fine bamboo baskets can be traded for goods such as rice, tea, and liquor. Farming is the secondary occupation of the Kamar, followed closely by hunting and fishing. Recently, many Kamar have become workers in large scale industries near their homes. They may supplement their incomes by collecting forest products, especially certain types of leaves, which are sold to contractors. The women do much of the strenuous work in the fields and forests. Kamars are divided into a number of clans or gots. The members marry within the same clan (extended family). Cross cousin marriages are also permitted. The tribe members build two-roomed mud huts. One of the rooms is for storage and for the household god. Most houses have a shed for socializing and a bari (small vegetable garden), as well as a separate cattle shed. Virtually all Kamars are Hindus. Each of their homes has a family god in the form of iron chains decorated with peacock feathers. Tertali is a famous folk dance performed by these tribes.

Overview: The Kamar (Tribe) Chhattisgarh of India, numbering 27,000, are Engaged yet Unreached. They are part of the Hindi people cluster within the South Asian Peoples affinity bloc. Globally, this group totals 38,500 in 2 countries. Their primary language is Kamar. The primary religion practiced by the Kamar (Tribe) Chhattisgarh is ethnic religion. Ethnic religion is deeply rooted in a people's ethnic identity and conversion essentially equates to cultural assimilation.

Halba Tribes

Halbi or Halba is a tribal community of India. Halba They derives their name from the word hal, meaning a plough (Russell and Hiralal, 1916). The Halba were

farmers and landlords. The Halba tribe is a popular tribe who have happily settled in the bucolic lands of Chhattisgarh. The Halba Tribals are widely dispersed all over Chhattisgarh, Maharashtra, Madhya Pradesh and Odisha. One of India's predominant tribes, the Halba tribals inhabits the districts of Durg, Bastar and Raipur in Chhattisgarh. Earlier the Halba tribes were active in the politics and military of Bastar State. The goddess of the Halba tribe is Ma Danteshwari. The language of the Halba tribe is Halbi, which is a combination of Chhattisgarhi, Odia and Marathi. The Halba/Halbi tribe has no sub-castes. The unique individuality of the Halbas is evinced by their apparels, dialects and traditional customs.

CHAPTER – IV

RESULTS AND DISCUSSION

This chapter deals with results and discussion on “**Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh**” in dry mixed deciduous forest. For the sake of easy understanding and convenience the chapter is divided into six parts. The first section deals with Educational status, Social structure and division of labour in selected villages, second part deals with Identification and documentation of NTFPs and medicinal plants species, third part deals with traditional collection techniques of NTFPs, fourth part deal with Post harvest methods and value addition of NTFPs, fifth one deal with Socio-economic status of tribes, and sixth section of this chapter deals with phytosociology analysis of NTFPs vegetation. The observations recorded in the present investigation are described under the following heads.

1. Documentation of NTFPs and medicinal plants available in Dhamtari forest area.
2. Documentation of traditional collection methods of different NTFPs in different seasons.
3. Documentation of Post harvest methods and value addition if any.
4. The role of NTFPs in livelihood of tribes and local residents in relation to their income.

4.1 Educational status, Social structure and division of labour in selected villages

4.1.1 Details of Ethnic groups

The general category or forward communities were absent in all the studied villages. It is evident from the data that majority of the villagers in studied area belong to Schedule tribe followed by Schedule cast. The population of Schedule cast varies from 1.32% - 8.46%. Schedule cast residing in all six villages namely Dinkarpur, Monaikera, Daldali (A), Karraghathi, Bhathkhar and Satbahna (Dongripara). The highest population of Schedule cast was recorded in Bhathkhar

(8.46%) and lowest in Monaikera (1.32%) The Schedule tribe population range varies from 70 to 94.26%. The highest population of Schedule tribe was recorded in Mnaikera (94.26%) followed by Daldali (A) (93.20%) and lowest population of Schedule tribe was in Bhathkhar (70.00%). The percentage of male Schedule tribe was highest in Monaikera (46.79%) followed by Daldali (A) (44.36%). However, the female Schedule tribe percentage was highest in Daldali (A) (48.83) followed by Dinkarpur (48.63%).

Verma and Paul (2016) reported that in village Banalat has 217 households and a population of 1156 Village Nirasi has 282 households with a total population of 1370. 83% of the population are Scheduled Tribes in this village whereas 92% population are Scheduled Tribes in Nirasi village (according to Census 2011, GOI). Islam *et al.* (2013) also reported that Bundu block in Ranchi district of Jharkhand that the majority 75.74 to 100% of the population in the villages are dominated by schedule tribes with an average sex ratio of 1028.22. the similar result are obtained in the all three sites and six villages where the tribal population is higher as reported by the above workers confirms the female ratio Daldali (A) village of Nagri is highest followed by the Dinkarpur in Dugli and lowest workers % was recorded in Bhathkhar this can be worked out by Anthropologist. It can be said that this may be genetic reason or so on. It may be the social culture that the tribes like to reside in dense always away from urban areas.

Choudhary *et al.* (2004) reported in Bastar plateau of Chhattisgarh total population of selected respondents was 33 out of which 67% belongs to Schedule tribe category. However, in present study the population of Schedule tribe was more as reported by above worker this may be because of location specific difference or remote villages were selected where other communities cannot live. Another study carried out by Bhattacharya *et al.* (2004) reported that in Sarguja district of Chhattisgarh which is tribal majority district, the tribal population being 19.55%. Average rate of growth of tribal population in the nintes was 27.22%. The observation recorded is more or less tribal population growth rate is higher and confirms the results obtained similar in the present investigation and showed conformity. The growth rate of tribal population is observed higher in the present investigation this may be because of hot climatic condition and the boundary of

Dhamtari district is touched to Kanker Gariyaband. So the tribal residing in hot and humid area therefore fertility and child birth rate is higher as compared to cold climatic condition like Sarguja.

4.1.2 Household and population of selected villages

The household and population of studied villages varies from 30 - 127. It was highest in Dikarpur (127) household followed by Daldali (A) (113) and lowest in Bhathkhar (30) followed by Satbahna (Dongripara) (48). The total population ranges varies from 130 - 559. It was highest in Daldali (A) (559) followed by Karraghati (510) and lowest in Bhathkhar (130) followed by Satbahna (Dongripara) (281).

Islam *et al.* (2015) also reported that Bundu block in Ranchi district of Jharkhand the total population in the sample households is 881, of which 374 (42.45%) are male, 377 (42.79%) are female and rest 130 (14.76%) are children. Nath *et al.* (2006) also reported that in Dihing Patkai Wild life Sanctuary there are 9 villages with 856 household and 4837 population on Assam border and 4 villages with 102 households and 640 population of Arunachal Pradesh. The size of village related with the number of households and population related with the social structure and behavior. The households in different villages vary in the number of households and population is lowest in the present investigation as reported by above worker at Assam while in Arunachal the number of households and population is quite low as it was found in the present investigation this shows confirmation with the present study. The study sites are quite remote areas earlier.

Sumana *et al.* (2004) studied and concluded that tribal population 29.9 percent contributed in the population of Jambani block of West Bengal during they conducted survey for knowledge, attitude and practice of family planning among tribal. The population of Scheduled tribe in remote villages varies as per the social and livelihood characters. The population of Scheduled tribe was more as reported by above worker in the present study this may be because of social and livelihood of the people is forest based in the present investigation confirm the conclusion of above research. Murli *et al.* (1996) also reported that in dry deciduous forest of Kanneri the total household was 92 and population 478 a small family were found in their investigation.

4.1.3 Infrastructure facilities available in selected villages

Among studied six villages only one village Monaikera had independent Panchayat, while rest five villages Dinkarpur, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara) do not had their own Panchayat but these villages clubbed with other village to form Panchayat. The biggest Panchayat was Monaikera and it is 45 Km. away from headquarter Dhamtari. Dinkarpur village fall in Monaikera Panchayat, Daldali (A) village fall in Vilbhadra Panchayat, Karraghati village fall in Makundpur Panchayat, Bhathkhar village fall in Semra Panchayat and Satbahna (Dongripara) village fall in Bhadseona Panchayat (Table 4.2). Dinkarpur, Monaikera, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara) All studied villages have Primary school. In village Dinkarpur, Monaikera, Daldali (A) and Karraghati Middle School and high school was present. There were no Government and Private College exists. The source of water for drinking, bathing and washing people depends on handpump, well, pond and river. The villagers mostly depend on handpump and well for drinking water. Maximum 7 handpump was found in Dinkarpur, while 2 lowest each in Bhathkhar and Satbahna (Dongripara). In all six studied villages had traditional well. Maximum 7 handpump was found in Dinkarpur and lowest 2 in Bhathkhar. The Pond was present in six villages namely Dinkarpur, Monaikera, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara). The villagers used pond water for washing and bathing. There is only one river, which falls in three villages viz. Dinkarpur, Monaikera and Daldali (A). The villages viz. Monaikera, Daldali (A), Karraghati had matel road. All six villages namely Dinkarpur, Monaikera, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara) had car track and kaccha road. The electricity facility is available in all six villages namely Dinkarpur, Monaikera, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara). The data concluded that the development of infrastructure is quite high people residing in these villages get the beneficiary R.G.Y. Govt. of India. All the development work has been done after formation of new state of Chhattisgarh.

Table 4.1: Social structure, education status and division of labour gender wise in study area of Dhamtari, (C.G.)

S. No.	Village	H	P	SC			ST			Literate			Illiterate			Labour		
				M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Site 01 Dugli Range																		
1	Dinkarपुर	12 7	771	7 (0.90)	9 (1.16)	16 (2.07)	340 (44.09)	375 (48.63)	715 (92.72)	244 (31.64)	166 (21.53)	410 (53.17)	127 (16.47)	234 (30.35)	361 (46.82)	228 (29.57)	244 (31.64)	472 (61.21)
2	Monaikera	10 7	453	3 (0.66)	3 (0.66)	6 (1.32)	212 (46.79)	215 (47.46)	427 (94.26)	158 (34.87)	108 (23.81)	266 (58.71)	68 (15.01)	119 (26.26)	187 (41.28)	150 (33.11)	150 (33.11)	300 (66.22)
Site 02 Nagri Range																		
3	Daldali (A)	11 3	559	6 (1.07)	3 (0.53)	9 (1.60)	248 (44.36)	273 (48.83)	521 (93.20)	213 (38.10)	175 (31.30)	388 (69.40)	56 (10.01)	115 (20.57)	171 (30.59)	86 (15.38)	30 (5.36)	116 (20.75)
4	Karraghathi	10 8	510	8 (1.56)	9 (1.76)	17 (3.33)	190 (37.25)	204 (40.00)	394 (77.25)	191 (37.45)	140 (27.45)	331 (64.90)	165 (32.35)	137 (26.86)	302 (59.21)	165 (32.35)	129 (25.29)	294 (57.64)
Site 03 Sihawa Range																		
5	Bhathkhar	30	130	5 (3.84)	6 (4.61)	11 (8.46)	41 (31.53)	50 (38.46)	91 (70.00)	53 (40.76)	32 (24.61)	85 (65.38)	12 (9.23)	15 (11.53)	45 (34.61)	41 (31.53)	56 (43.07)	97 (74.61)
6	Satbahna (Dongripara)	48	281	4 (1.42)	5 (1.77)	9 (3.20)	123 (43.77)	134 (47.68)	257 (91.45)	129 (45.90)	101 (35.94)	230 (81.85)	15 (5.33)	19 (6.76)	51 (18.14)	101 (35.94)	112 (39.85)	213 (75.80)

Note – Values in parentheses are in percentage, **H**-House hold, **P**-Population, **SC**- Schedule cast, **ST**- Schedule tribe, **M**-Male, **F**-Female

Table 4.2: Infrastructure facilities available in study area, of Dhamtari, (C.G.)

village	Panchayat	School facility				water				Roads			Electricity
		P	M	H	1	2	3	4	A	b	C	√	
Site 01 Dugli Range													
Dinkarpur	Monaikera	√	√	√	7	30	3	1	-	√	√	√	
Monaikera	Monaikera	√	√	√	3	15	2	1	√	√	√	√	
Site 02 Nagri Range													
Daldali (A)	Vilbhadra	√	√	√	3	9	2	2	√	√	√	√	
Karraghati	Makundpur	√	√	√	4	12	3	-	√	√	√	√	
Site 03 Sihawa Range													
Bhathkhar	Semra	√	-	-	2	3	1	-	-	√	√	√	
Satbahna (Dongripara)	Bhadseona	√	-	-	2	5	1	-	-	√	√	√	

P – Primary school

M – Middle school

H – High school

1- Hand pump

2- Well

3- Pond

4-River

a- Matel road

b- Cart track road

c- Kachha road

4.1.4 Educational status

According to the results on educational status of tribal people of selected villages shown in Table 4.1 showed that educational status of people in selected villages was good. The literacy percentage ranges from 53.17 – 81.85%. . It was highest in Satbahna (Dongripara) (81.85%) followed by Daldali (A) (69.40%) and lowest in Dinkarpur (53.17%) followed by Monaikera (58.71%). The literacy percentage in men ranges from 31.64 – 45.90%. It was highest in Satbahna (Dongripara) (45.90%) followed by Bhathkhar (40.76%) and lowest in Dinkarpur (31.64%) followed by Monaikera (34.87%). However, the literacy in women ranges from 21.53 – 35.94%. It was highest in Satbahna (Dongripara) (35.94%) followed by Daldali (A) (31.30%) and lowest in Dinkarpur (21.53%) followed by Monaikera (23.81%). The average literacy percentage was recorded 65.56 in the study area.

Verma and Paul (2016) reported that in Banalat and Nirasi villages district Jharkhand the literacy rate (according to Census 2011) are 43% and 41% respectively, which is much lower than the overall literacy of Jharkhand i.e., 67.6%.

Sivakumar *et al.* (2006) reported that in Kancheepuram district of Tamilnadu majority of the Scheduled tribes (50%) and above were mostly illiterate (57.78%). Basu *et al.* (2004) reported that in Santal and Lodha tribes the female literacy rate is only 15.8% and 2.9%, respectively. Biswas *et al.* (2003) reported that Saharia tribe of Madhya Pradesh literacy rate is only 23.3% as well as their socio - economic status also below poverty line. Islam *et al.* (2013) also reported that Bundu block in Ranchi district of Jharkhand that the literacy rate is very low varying between 24.52 to 44.87%. Similar study carried out by Sharma (1997) reported that in Primitive group of tribes in Sarguja district of Chhattisgarh extremely low level of literacy below 2% has been recorded in his study. The data of literacy % is quite high as studied by the above workers this indicates that the economic condition, education facilities and opportunities are high in the study area. This may be awareness about education and good signe of economic development in the Dhamtari district of Chhattisgarh and the study area of this study area of this investigation.

4.1.5 Distribution of labour in selected villages under study area

The percentage of labour ranges from 20.75 – 75.80. It was highest population of labour was recorded in village Satbahna (Dongripara) (75.80%) followed by Bhathkhar (74.61%) and lowest in village Daldali (A) (20.75%) followed by Karraghati (57.64%). The percentage of male labours ranges from 15.38 –35.94%. It was recorded highest in village Satbahna (Dongripara) (35.94%) followed by Monaikera (33.11%) and lowest was recorded in village Daldali (A) (15.38%) followed by Dinkarpur (29.57%). The percentage of female labours ranges from 5.36–43.07%. It was recorded highest in village Bhathkhar (43.07%) followed by village Satbahna (Dongripara) (39.85%) and lowest in village Daldali (A) (5.36%) followed by Karraghati (25.29%). The average percentage of labour was 59.37% in the study area. The range of labour is 20 to 76% this indicates the poverty and illiteracy simultaneously work of Govt. agencies nearby good enterprises, agricultural field etc. It may be the 20% labour area is rich as 75-80% is well so it is depending upon the social structure and related with economic status of that particular area.

Islam *et al.* (2015) also reported that Bundu block in Ranchi district of Jharkhand the total labour force of 751 (49.81% male and 50.19% female), the work force is 413 (50.39% male and 49.61% female) and unemployment is 338 (49.11% male and 50.89% female). The percentage of work force to labour force constituted around 55.62 per cent and 54.38 per cent among male and female

Bansod *et al.* (2005) reported that about half of the family members were engaged in collection of medicinal plant products from the forest. Similar research was observed in the present investigation that in case of NTFPs collection 47.05% average people engaged in collection during lean season they go for labour work to earn money for their livelihood. The result of present investigation confirms the result of the above workers regarding role of labour work in the livelihood of the tribes.

4.2 Documentation of Medicinal and NTFPs species available in Study Area of Dhamtari (C.G.)

The results of identification and documentation are depicted in Table 4.3. The villagers mainly depend on some NTFPs species for their livelihood and subsistence. Among all these Medicinal and NTFPs species enlisted and identified some are the source of their income such as *Madhuca latifolia* (Mhaua) flower, *Bauhinia vahlii* (Mahul) leaves, *Diospyros melanoxylon* (Tendu) leaves. There are 52 NTFPs were identified and documented during present investigation. The identified 52 NTFPs species belongs to 26 trees, 10 shrubs, 7 herbs and 9 climbers species. A variety of NTFPs viz. seeds, leaves used for plate making, Tans and Dyes, Gum and Resin, edible products, Oil yielding, Bamboo, Fiber, Thatching, Broom making, Medicinal plants, Biocides (fungicidal, insecticidal and nematicidal) and Fish poison were identified. The forest of the study area has abundant different NTFPs plants species, which are used by villagers for various purpose viz. food, medicine, tans & dyes, oil, fuel, fodder, construction etc. Maximum NTFPs species are used for medicinal purpose. Among identified 52 plants species 49 species came under medicinal plant. About 12 plant species was edible. About 8 Gum yielding plant species was identified. 7 Plate, Broom and Rope

making plant species was identified. 7 fire wood plant species was identified. 8 Biocides (fungicidal, insecticidal and nematocidal) plant species was identified. The *Diospyros melanoxylon* (Tendu) leaves used for Bidi making is playing a significant role in the income of the people residing in study area. The Tans and Dyes yielding 10 plant species were identified. The oil yielding 6 tree species were identified. The 2 lac yielding plant species was identified. The Kaliyari (*Gloriosa superba*) Colchicine, obtained from all parts of the plant but particularly the seeds, inhibits cell division and is used in plant breeding to produce polyploidy. Saja (*Terminalia tomentosa*) species source tree for Cocoon (kosa) production.

Similar study carried out by Islam & Quli (2016) documented the diversity, distribution, and pattern of utilization of edible non-timber forest products (NTFPs) among the tribes of Bundu block in Ranchi district of Jharkhand, India. The results reveal that the sample population consumes 59 edible NTFPs belonging to 39 genera and 45 species under 29 families. Of the edible NTFPs, fruit represents the highest (26) followed by leaf (10), seed (7), flower (6), tuber (3), gum (2), mushroom (2), entire plant (2) and rhizome (1). The growth form of the species includes trees (30) followed by herbs (5), shrubs (4), climbers (3), fungi (2) and bamboo (1). Singh and Bharti (2015) study was also conducted study in different area of Raigarh district of CG. (India). They documented of ethnobotanical use of 89 plant species are described in which different parts of plants are used for different purposes by people for example medicine ,food ,fodder, furniture, fibre, cosmetics etc.

Ahirwar (2015) recorded that total 41 plants species belonging to 26 families and 37 plant genera were identified. A field survey was conducted at three different study sites in Boridand forest, district Korea, Chhattisgarh. Phanikumar and Chaturvedi (2006) reported that thin rope made by Ambadi (*Hibiscus cannabinus*) bark, Sumbh (*Cyprus rotundus*) and Ainthi (*Helicteres isora*). Most of the fallen branches and leaves of the forest are used as fuel and fodder. In this investigation also various uses of the plants were recorded for their day to day work in their life. So many other uses of this plants tribes are utilized as reported by above workers confirm the results obtain in the study.

Table 4.3: List the Medicinal and NTFPs Species in Study Area of Dhamtari (C.G.)**Trees**

S.no	Local Name	Botanical Name	Status	NTFPs Use	Medicinal Use	Other Use
1.	Char	<i>Buchanania lanzan</i>	Tree	Seed, bark and Gum.	Leprosy, acrid, astringent, cooling, depurative, constipating, diarrhoea, skin diseases, coughs and asthma.	firewood and for making charcoal
2.	Sal	<i>Shorea robusta</i>	Tree	Seed, leaves and Gum.	Treatment of dysentery, gonorrhoea, boils and toothaches.	The leaves are widely used for making plates, cups and for wrapping.
3.	Mango	<i>Mangifera indica</i>	Tree	Seed, stem. Flower, fruit, bark and roots.	Angina, asthma, coughs, diabetes. Skin irritations, obstinate diarrhoea, bleeding piles, treating dysentery, treat scorpion stings, astringent, homeostatic, antirheumatic, remedy stomach-ache, diuretic, aphrodisiac, antiscorbutic and antidysenteric.	The wood is suitable for light construction, turnery, flooring, interior panelling, boxes, crates, pallets and plywood manufacture. Corewood used for decorative veneer production.
4.	Anola	<i>Emblica officinalis</i>	Tree	Fruit, Bark, root, stem and leaves. Leaves may yield 22 - 28% tannin.	Fruits are traditionally used as an expectorant, antipyretic, diuretic, antidiarrhoeal and antiscorbutic. The sour fruits are one of the ingredients of 'triphala'.	Commonly used to make jams, jellies, tarts, chutneys etc.
5.	Bija	<i>Pterocarpus marsupium</i>	Tree	Leaves and bark. The tree yields a red gum known as 'kino'.	It is used in the treatment of chronic diarrhoea and the irritation caused by gastric infection and colitis. It makes a good mouthwash and gargle.	Wood used for door and window frames, posts, agricultural implements, boat building, carts, railway carriages, and railway ties etc. Source of tannins and for dyeing.
6.	Tendu	<i>Diospyros</i>	Tree	Fruits and leaves.	Mental disorders, nervous breakdowns	The leaves used for make bidi

		<i>melanoxydon</i>			diarrhoea palpitations of the heart, stringent effect, urinary, skin and blood diseases.	cigarettes. Wood used for building, shoulder poles, mine props and shafts of carriages. Fuel wood calorific value of the sapwood is 4957 kcal/kg and of the heartwood, 5030 kcal/kg.
7.	Mahua	<i>Madhuca latifolia</i>	Tree	Flower and Whole plant	Anti-bacterial, carpentry work, pain killer, wine/liquor, worship.	Timber wood.
8.	Haldu	<i>Adina cordifolia</i>	Tree	The bark contains 7 - 9% tannins. Root.	The bark is antiseptic and febrifuge. The juice of the plant is applied externally to kill worms in sores. Roots used for treatment of diarrhoea, dysentery and Pain killer.	Pulp and paper, also used for construction, window frames, furniture, bobbins, boxes, piano keys, rulers etc.
9.	Dhawra	<i>Anogeissus latifolia</i>	Tree	Leaves and bark. The gum that exudes from the trunk, known as 'ghatti gum'.	The plant is used in treating snake bites and scorpion stings in India.	Calico printing, dyes, binding agent in pharmaceuticals and wood for timber. Gum has been used in sweetmeats and as an emulsifier in the food industry.
10.	Jamun	<i>Syzygium cuminii</i>		Leaves fruits and bark.	Ailments, cough, diabetes, dysentery, inflammation and ringworm.	Timber wood.
11.	Saja	<i>Terminalia tomentosa</i>	Tree	Bark and Gum.	Blood disorder, Burns, dandruff, antioxidant, antiseptic, astringent.	Source tree for Cocoon (kosa) production.
12.	Moyan	<i>Lannea coromandelica</i>	Tree	Bark and leaves. A soluble resin, called 'Jingan gum' is obtained from the stems.	Bruises, Bursitis, heart disease, Muscle Sprains, neuralgia, analgesic, anti-inflammatory.	Wood used for spear shafts, scabbards, wheel-spokes, oil presses, grain pounders etc. Gum used for calico printing.
13.	Bhelwa	<i>Semecarpus anacardium</i>	Tree	Seed, fruit, gum and oil.	Aphrodisiac, digestive, stimulant, bronchitis, dysentery, fever, asthma, haemorrhoids, astringent, sterility in women, headaches, skin diseases and	Floor dressing; as additive substances to lacquers, dyes and insulating material; in the plastics industry; for regenerating rubber

					scabies.	materials; and to protect wood from white ants.
14.	Teak	<i>Tectona grandis</i>	Tree	Whole plant	Burning sensation, arthritis, kidney, skin disease, diabetes and ulcer.	Timber wood.
15.	Neem	<i>Azadirachta indica</i>	Tree	Seed and leaves.	Heart problems, eczema, arthritis, white discharge, ear and tooth ache, malaria, anti-toxic and anti-microbial, tooth washing, furniture making, chicken pox, blood purification.	Timber wood. Seed and leaves used for Pest and disease control and cosmetics.
16.	Kusum	<i>Schleichera oleosa</i>	Tree	Seed, Bark and lac.	Wounds and ulcers of cattle. Leprotic ruptures, skin inflammations, ulcers and malaria.	House construction, ship building and musical instruments.
17.	Senha	<i>Lagerstroemia parviflora</i>	Tree	Bark and gum. Black dye.	None known	Wood used for making furniture, interior joinery, boatbuilding, general construction, parquet flooring and panelling.
18.	Harra	<i>Terminalia chebula</i>	Tree	Flower, fruit and bark.	Digestion, skin problem prophylaxis of CMV disease in immuno-compromised patients, laxative, stomachic, expectorant, haemostatic, tonic, and alterative, nervous complaints, diarrhoea, dysentery, intestinal worms, haemorrhoids, rectal prolapse, abnormal uterine bleeding and inflammation, vaginal discharge, involuntary ejaculation, coughs and asthma. The sour fruits are a major ingredient of 'triphala'.	These are rich in tannins and are used to make dyes and ink. It is used as construction timber and for furniture, carts and implements. In ayurveda it is used for various preparation.
19.	Behra	<i>Terminalia bellirica</i>	Tree	Bark, fruit, seed, whole plant.	Ascaris, gray hair, hoarseness, weak eyesight, anemia, asthma, piles, leprosy, liver disease, diarrhea, hair fall	Natural dyes.

					and dipsia.	
20.	Amaltas	<i>Cassia fistula</i>	Tree	Flower, fruit, Bark, stem, root, Leaves and seed.	Malaria, blood poisoning, anthrax, diabetes and dysentery Ring worm, wound, fever, leprosy, cough.	Tanning and dyeing. Wood used for buildings, carts, fence posts, agricultural implements etc.
21.	Kachanar	<i>Bauhinia variegata</i>	Tree	Root, leaves, flower, buds, gum, seeds and flower.	Amoebic dysentery, diarrhoea and other stomach disorders, cuts and wounds, skin diseases, scrofula and ulcers, piles, dysentery, worms, dyspepsia	The bark is a source of tannins. It is used for dyeing in various shades of brown. Wood used making household and agricultural implements. Fuel wood The calorific value is 4 800 kcal/kg.
22.	Imli	<i>Tamarindus indica</i>	Tree	Flower, fruit, root, bark, stem, seed and leaves.	Relives sores, ulcers, boils rashes, throat infection, cough, fever, intestinal worms, conjunctivitis, swelling, relieve pain, cure fevers, control gastric acid, treat scurvy, dysentery and diarrhoea. The plant contains pyrazines and thiazoles. The seed contains polyoses. The bark yields proanthocyanidin and hordenine	Sizing textiles, seed oil - is suitable for making paints and varnishes and for burning in lamps, The bark tannins can be used in ink or for fixing dyes. Wood used for general carpentry, sugar mills, wheels, hubs, wooden utensils, agricultural tools, mortars, boat planks, toys, panels and furniture.
23.	Bel	<i>Aegle marmelos</i>	Tree	Whole plant, bark, fruits, leaves, twigs and root.	Diarrhoea, dysentery, haemorrhoids aphrodisiac laxative, diuretic astringency and peptic ulcers.	Fruit rind is used in making perfumes and soap unripe seeds are used as adhesive and household glue.
24.	Kumbhi	<i>Careya arborea</i>	Tree	Flower, fruit, bark, juice, seed and calyx.	Body swellings astringent, mucilaginous coughs and colds embrocation.	Used for general construction (house posts, planking), furniture and cabinet work, carts, mouldings, turnery, piling and agricultural implements.
25.	Kakai	<i>Flacourtia indica</i>	Tree	Bark, leaves and root.	Leaves used for asthma, pain relief, gynaecological complaints and as an anthelmintic, and treatment for	Agricultural implements such as ploughs, posts, building poles, rough beams, walking sticks and the

					hydrocele, pneumonia, intestinal worms and snake bites. bark is used as a gargle for hoarseness.	manufacture of turnery articles. Wood used for fuel and for making charcoal.
26.	Karra	<i>Cleistanthus collinus</i>	Tree	Leaves, stem and bark	Washing agent for clearing septic wound, cure fungal diseases.	Fuel wood.

Shrubs

1.	Chhind	<i>Phoenix acaulis</i>	Shrubs	Leaves, fruit and juice.	None known	The leaves are used to make mats, ropes, umbrellas, and fences as well as for thatching roofs.
2.	Chikti	<i>Triumfetta rhomboidea</i>	Shrubs	Flower, fruit, root, bark, and leaves.	Internal ulcerations, gonorrhoea, antihypertensive, astringent, diuretic, mucilaginous, emollient, diarrhoea, dysentery, internal haemorrhages, and leprosy	A soft, glossy fibre is obtained from the bark. The fibre is rather similar to Jute (<i>Corchorus</i> spp).
3.	Ber	<i>Ziziphus mauritiana</i>	Shrubs	Leaves, fruits and bark.	Indigestion, Diabetes, diarrhea, urinary disorders.	The wood is used for general construction, furniture and cabinet work, tool handles, agricultural implements, tent pegs, golf clubs, gun stocks, sandals, yokes, harrows, toys, turnery, household utensils, bowling pins, baseball bats, chisels and packaging. It is also suitable for the production of veneer and plywood.
4.	Korea	<i>Holarrhena antidysenterica</i>	Shrubs	Seed, leaves, bark and juice.	Dropsy, skin disorders, psoriasis, nonspecific dermatitis fevers, diarrhoea dysentery and intestinal worms.	None known

5.	Lantana	<i>Lantana camara</i>	Shrubs	Seed, flower, fruit, bark and root	Influenza, cough, mumps, incessant high fever, malaria, cervical lymph node tuberculosis, asthma, toothache, headache, inflammation, gonorrhoea and leucorrhoea. dermatitis, eczema, pruritus, measles and chickenpox rashes etc.	Biocides (fungicidal, insecticidal and nematicidal) firewood fencing, windrows, woodlots or natural bush.
6.	Kurru	<i>Gardenia resinifera</i>	Shrubs	Stem, buds and gum.	Cutaneous diseases.	Insecticide.
7.	Chameli	<i>Jasminum polyanthum</i>	Shrubs	Leaf, root, flower,	Ulcer, headache, mouth disease, impotency, skin disease, ear problem, worm and fever.	Oil cosmetic industry, perfume and soap.
8.	Gotia	<i>Ziziphus xylopyra</i>	Shrubs	Fruit, bark, seed and root.	Diabetes, diarrhoea, digestive, urinary disorders, abscess, acne.	Suitable for the production of veneer and plywood.
9.	Bendrachar	<i>Argyreia involucrata</i>	Shrubs	Stem.	Antifungal effect on <i>Aspergillus niger</i> and it can be used in treating diseases caused by the test organisms.	Fungicide.
10.	Ainthe	<i>Helicteris isora</i>	Shrubs	Bark, root and fruit.	Cures dysentery, stomach pain, expectorant, demulcent, astringent, galactofuge, diarrhoea and a remedy for scabies.	Bark used as cordage for making cots, tying cattle and ploughs. bark fibre is good for making ropes and clothing.

Climber

1.	Mahul	<i>Bauhinia vahlii</i>	Climber	Leaves stem and seed	Demulcent and mucilaginous tonic and aphrodisiac	Ropes, stems are used for matting, basketry and wickerwork. Leaves used as plates, cups, rough tablecloths, umbrellas, cloaks, and rain capes.
2.	Baichandi	<i>Dioscorea hispida</i>	Climber	Tuber	Diabetes	-

3.	Ramdatun	<i>Smilax macrophylla</i>	Climber	Root	Dental abscesses, edema, gingivitis, urinary tract infection. Sexually transmitted diseases.	Rope.
4.	Karukand	<i>Dioscorea bulbifera</i>	Climber	Leaves, tuber and roots.	Fever, diarrhoea, haemorrhoids, purulent ophthalmia, and for snake-bite.	Use as a vegetable.
5.	Kaliyari	<i>Gloriosa superba</i>	Climber	Leaves, seed, tuber.	Ulcers, leprosy, piles, inflammations, abdominal pains, itching, thirst, bruises, colic, haemorrhoids, cancer, arthritic conditions, swellings of the joints, sprains, dislocations, smallpox, leprosy, eczema, itch, and ringworm. Gums used to treat painful teeth.	Colchicine, obtained from all parts of the plant but particularly the seeds, inhibits cell division and is used in plant breeding to produce polyploidy. Strong nematicidal.
6.	Anantmool	<i>Hemidesmus Indicus</i>	Climber	Whole plant	The root is a valuable alterative, blood purifier, demulcent, diaphoretic, diuretic, appetite loss, dyspepsia, fever, skin diseases, syphilis, leucorrhoea, genitourinary diseases, chronic coughs and tonic.	None known
7.	Peng	<i>Celastrus paniculatus</i>	Climber	Seed, leaves, root, stem, bark, wood and fruit.	Beriberi, rheumatism, leprosy, gout, fevers, muscular pains, analgesic, aphrodisiac, diaphoretic, emetic, emmenagogue, stimulant, tonic, tuberculosis and paralysis. Oil enhances the nervous and mental system.	The seed contains 52% oil, and the fruit 30%. It is used as an illuminant in lamps and also for soap making.
8.	Keoti	<i>Ventilago calyculata</i>	Climber	Bark, root and flower	Bodyache, fever leprosy malaria feafness, toothache, dysphasia, itching scabies.	-
9.	Bodal	<i>Cucumis melo agrestis</i>	Climber	Seed, flower, root and fruit.	Expectorant and emetic burns and abrasions antitussive, digestive, febrifuge and vermifug.	-

Herbs

1	Tikhur	<i>Curcuma angustifolia</i>	Herbs	Rhizome.	Demulcent and dislocated bones.	Tikhur barfi.
2	Safed musli	<i>Chlorophytum tuberosum</i>	Herbs	Root.	Tuberculosis, male impotency and tonic.	-
3	Kali musli	<i>Curculigo orchioides</i>	Herbs	Root, juice.	Dysentery, peptic ulcers, piles, gonorrhoea, leucorrhoea, asthma, jaundice, chronic nephritis, diarrhoea, lumbago and headache.	-
4	Kalmegh	<i>Andrographis paniculata</i>	Herbs	Whole plants	Joint pain, jaundice, head ache, malaria, anti helmenthetic, febrifuge, fever, malaria and body pain.	-
5	Charota	<i>Cassia tora</i>	Herbs	Seed, leaves	Arthritis leprosy, ringworm, itching and psoriasis and also for snakebites.	Cassia tora tea is a herbal, pure, natural and non-polluted green health beverage (coffee-tea), substitute for coffee and sodas. Natural pesticide.
6	Gengi	<i>Curcuma zedoaria</i>	Herbs	Rhizome	Indigestion, nausea, flatulence, bloating, anti-cancer properties, cervical cancer, bad breath. Rhizome is used to clean, cure ulcers, wounds and other skin disorders.	An essential oil obtained from the rhizome is used in perfumery.
7	Satavar	<i>Asparagus racemosus</i>	Herbs	Whole plant	Piles, fever, wound, anti-toxic, weakness, cough, Diarrhoea, headache, asthma, urinary disorder.	The squeezed root is used for washing clothes
8	Dashmul	<i>Daedalacanthus roseus</i>	Herbs	Root	Leucorrhea and is also used to promote fetal growth during pregnancy. The decoction of Dashmularist is available as a medicine for women gaynecological problems.	



Tendu (*Diospyros meloanoxylon*)



Chhind (*Phoenix acaulis*)



Lalbel (*Ventilago madraspatnam*)



Karra (*Cleistanthus collinus*)

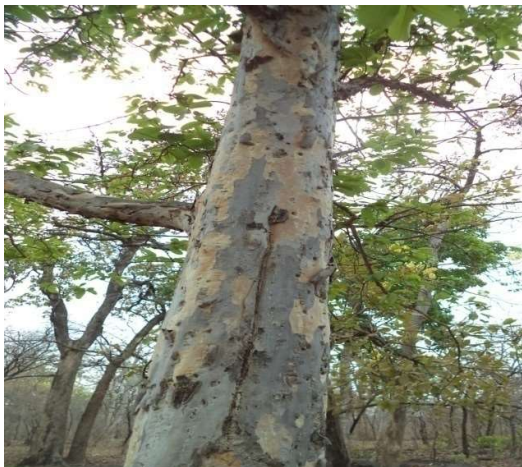


Kumbhi (*Careya arborea*)



Mahua (*Madhuca indica*)

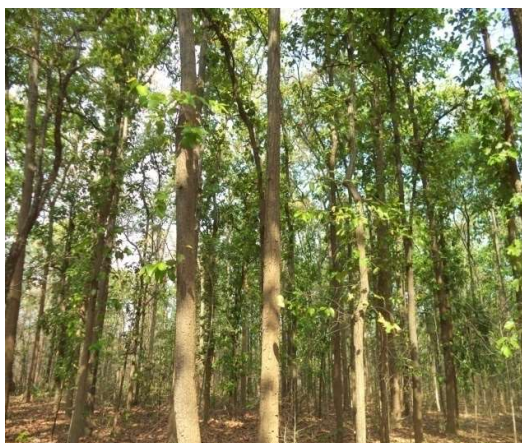
Plate 4.1 NTFPs Species of the study area



Arjun (*Terminalia arjuna*)



Bija (*Pterocarpus marsupium*)



Sal (*Shorea robusta*)



Teak (*Tectona grandis*)



Tikhur (*Curcuma angustifolia*)



Neem (*Azadirachta indica*)

Plate 4.2 NTFPs Species of the study area

Pandit *et al.* (2004) reported that diversity of NTFPs found in Jaldapara Sanctuary North Bengal. About 91 species were used as medicine. While 3 species were used for decorative articles, 24 and 22 species were used as edible and fodder purpose, respectively. Similarly Murthy *et al.* (2005) also reported that in Uttara Kannada district of Western Ghats products of medicinal value were obtained from the bark of five different species, including *Cinnamomum zeylanicum*. Buds of 3 species and roots of about 23 species, including *Rauwolfia serpentine* and *Glycyrrhiza glabra*. The fresh or dry leaves are used as manure or mulching material and grasses are extracted exclusively for fodder. The result showed that the people for their livelihood use total 38 species as NTFPs. However, other documented species are not in use or market point of view in the particular locality. The use of different species for various purposes related with the social need as well as market demand as per industries available in the area. Total documented NTFPs are 52. However only 41 are used and collected for livelihood. The results of NTFPs vary as per location and forest type. Therefore, the observations are confirmed with the observations recorded by other workers. The documented NTFPs species was less in the present investigation as reported above study the difference in plant diversity and number of species varied as it is related with climatic condition, soil and forest type. The result confirms the observations recorded in this investigation.

4.3 To study the Collection method techniques of NTFPs

Information was collected with the help of questionnaire developed for present study. Information recorded with oral interview from the respondents selected for the study. The data recorded regarding NTFPs availability and collection methods. There were total 41 plant species and their traditional collection techniques /methods documented.

Table 4.4: Collection techniques of NTFPs used by local inhabitants and scientific methods for sustainable utilization.

Trees

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Bel (<i>Aegle marmelos</i>)	<p>i) Unripe fruits were also collected which has less commercial importance.</p> <p>ii) During fruit collection they damaged the plant by cutting the branches.</p>	<p>i) Completely ripen yellow coloured fruits should be collected.</p> <p>ii) Sickled bamboo sticks should be used for collection of selected fruits so that skull of fruit may not break.</p>
2.	Char (<i>Buchanania lanzan</i>)	<p>i) People collected fruit from March-April when it is immature.</p> <p>ii) People used to cut its branches for collection of seeds.</p>	<p>i) Completely ripen black colour fruit should be collected good quality of chironjee.</p> <p>ii) Sickled bamboo stick should be used for collection of fruits.</p> <p>iii) Leader should be used for pricking the fruit from the tree.</p>
3.	Kachnar (<i>Bauhinia variegata</i>)	<p>i) Pods and leaves were collected after cutting the branches.</p>	<p>i) Collection should be done by hand plucking.</p>
4.	Bahera (<i>Terminalia bellirica</i>)	<p>i) Unripe green fruits were also collected and sometimes cut the branches for collection.</p>	<p>i) Completely ripen brown colored fruits selected for collection.</p> <p>ii) Sickled bamboo sticks should be used to collect the fruits from trees.</p>

			iii) the best method to climb on tree and good fruits will be pricked for the market.
5.	Aonla (<i>Embllica officinalis</i>)	<p>i) Immature green fruits were also collected with ripen fruits.</p> <p>ii) People used to cut branches for collecting fruits and sometimes fruits are also damaged.</p> <p>iii) The whole tree cut from the base.</p>	<p>i) Completely ripen yellow fruits should be selected for collection.</p> <p>ii) Fruits should be collected with the help of sickled bamboo stick.</p>
6.	<p>Tendu leaves (<i>Diospyros melanoxylon</i>)</p> <p>Tendu fruit</p>	<p>i) During collection of tendu leaves branches were also cut which affects the leaves production of next year.</p> <p>ii) Leaves, which are not suitable for the purpose, were also collected.</p> <p>i) Branches were cut to collect fruits from the tree or big stone thrown in the bole of the tree to damage the bark.</p>	<p>i) Only undamaged and disease free leaves should be collected.</p> <p>ii) All diseased and damaged leaves should be removed before drying.</p> <p>i) Fruits should be collected without cutting the branches with the help of sickled bamboo stick or to climber on tree and collect the ripen fruit.</p>
7.	Bhelwa (<i>Semecarpus anacardium</i>)	i) Before complete ripening the fruit people starts the collection therefore, unripe fruits were also collected.	i) Collection should be done with bamboo sticks when tree has maximum ripen fruits.
8.	Mahua Flower (<i>Madhuca latifolia</i>)	i) People put fire to clean floor below the tree, which may cause forest fire.	<p>i) Brooms should be used to clean floor. It is very easy practice.</p> <p>ii)The Tarpaulin is put in the floor so that soil will not stick with the flower or mosquito net may be used to tied in the tree.</p>
9..	Jamun (<i>Syzygium cumuni</i>)	i) During collection, unripen fruits also collected.	<p>i) Shake only selected branches to collect fruits or use bamboo stick.</p> <p>ii) Below the tree the net will be tied so that fruit may not be</p>

			damage.
10.	Kusum (<i>Schleichera oleosa</i>)	i) Collection of fruits start early even unripe fruits also collected result low oil percentage in seed. ii) During collection of fruits they also cut the branches therefore next production is affected.	i) Fruits should be collected when its colour becomes light yellowish. ii) Sickled bamboo stick should be used to collect the fruits form tree.
11.	Imli (<i>Tamarindus indica</i>)	i) Fruits are not collected properly even unripe and diseased fruits also collected and put together. The destructive fruit collection methods were used like they cut the big branches during collection of fruits.	i) Collection should be done with sickled bamboo stick and ripen fruits may be collected with care.
12.	Mango (<i>Mangifera indica</i>)	i) Fruits not collected properly people used bamboo stick for breaking the fruit. ii) During fruit collection they damaged the plant by cutting the branches.	i) Well mature fruits are collect for preparation of pickle. ii) Sickled bamboo sticks should be used for collection of selected fruits so that fruit may not damage.
13.	Sal (<i>Shorea robusta</i>)	i) Green leaves are collected directly from the trees. ii) Gums are collected by scraping it from the tree bark. The deep and wound made in the bole.	i) Sharp knife is used for collecting leaves. ii) Clean gums free from dirt are collected. Scientific methods will be applied for collection of gum from the tree.
14.	Harra (<i>Terminalia chebula</i>)	i) Unripe green fruits were also collected and sometimes cut the branches for collection.	i) Completely ripen brown colored fruits selected for collection. ii) Sickled bamboo sticks should be used to collect the fruits from trees.
15.	Neem (<i>Azadirachta indica</i>)	i) Fallen Unripe green fruits are collected from ground, leaves are collected directly from stem.	i) Ripen, sound fruits need to be collected. Leaves are collected without harming the tree.
16.	Kumbhi (<i>Careya arborea</i>)	i) Flowers are collected from ground.	i) Collected flowers should be free from unwanted material like soil particle, insect-pests etc.

Shrubs

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Ainhi (<i>Helicteres isora</i>)	i) During collection of fruit, twig and branches are also cut.	i) Leaves should be collected by hand plucking. ii) Fruit is having medicinal value will be collected fully ripen pod and properly dried.
2.	Ber (<i>Zizyphus mauritiana</i>)	i) The collection started before complete ripen the fruits. ii) They shake all branches thus unripe fruit also fall down.	i) Shake only selected branches for collection of fruits or use bamboo sticks. ii) The only ripe good quality fruit will be collected and sold in the market or sun dried fruits properly stored.
3.	Chhindi (<i>Phoenix acaulis</i>)	i) At the time of cutting leaves people also cut new or young branches ii) For their convenience they prune some branches then cut selected branches. iii) During collection of leaves the stem portion also destroyed.	i) Choose only useful mature branch before cutting. ii) Branches which has matures leaves should be selected for harvesting. iii) Selected branches should be cut without disturbing other branches with sharp knife.
4.	Karonda (<i>Carissa carandus</i>)	i) Fruit collection starts before complete maturity.	i) Only ripen fruits should be selected for collection. ii) Hand pricking is the best option for this species.
5.	Jangli chameli (<i>Jasminum arborescens</i>)	i) During collection of leaves and flowers the branches also cut.	i) Collection should be done by hand plucking and post harvest drying or oil extraction will be done with in week.

Herbs

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Charota (<i>Cassia tora</i>)	i) Before maturity leaf collection started resulted that seed production affected. ii) The whole plants were also harvested before seed maturity.	i) When plant has 70 percent leaves that time its collection should be done. ii) The seed should be collected when seed colour turns green to light brown before breaking the pod.
2.	Mushroom	i) Pepole put fire to clean forest floor for collection of mushroom, which may cause forest fire.	i) Forest floor should be clean with Bamboo sticks or Broom for collecting mushroom.
3.	Kalmegh (<i>Andrographis paniculata</i>)	i) Leaves and fruits were harvested sometimes before maturity also.	i) Harvesting should be carried out at maturity of plants and seed. ii) The whole plants will be uprooted and the root must washed with water and drying in sun.
4.	Tikhur (<i>Curcuma angustifolia</i>)	i) Immature rhizomes are collected. ii) Whole parts of rhizomes are collected by digging the soil without leaving any part of it for future regeneration.	i) Mature rhizomes are collected. ii) Some part of rhizome is left in the soil for future regeneration of the plant.
5.	Safed musli (<i>Chlorophytum tuberosum</i>)	i) Immature roots and tuber are collected. ii) Whole parts of roots and tuber are collected by digging the soil without leaving any part of it for future regeneration.	i) Mature roots and tuber are collected. ii) Some part of tuber or roots and tuber is left in the soil for future regeneration.
6.	Kali musli (<i>Curculigo orchioides</i>)	i) Immature roots and tuber are collected. ii) Whole parts of roots and tuber are collected by	i) Mature roots and tuber are collected. ii) Some part of tuber or rhizome is left in the soil for future

		digging the soil without leaving any part of it for future regeneration.	regeneration.
7.	Gengi (<i>Curcuma zedoaria</i>)	i) Immature rhizomes are collected. ii) Whole parts of rhizomes are collected by digging the soil without leaving any part of it for future regeneration.	i) Mature rhizomes are collected. ii) Some part of rhizome is left in the soil for future regeneration.

Grasses

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Munsel (<i>Iseilema nervosum</i>)	i) For collecting whole plants were dug-outs with root.	i) Some plants should be left. ii) Uprooting should be avoided.
2.	Kans (<i>Saceharum spoutaneum</i>)	i) The whole spikes of Kans cut from the base.	i) Only those spikes should be harvest, which are suitable for broom making.
3.	Sukul (<i>Heteropogon cantortus</i>)	i) Continuous grazing is used.	i) Compartment grazing should be allowed.
4.	Phulbahari (<i>Thysanolacns maxima</i>)	i) The whole spikes of Phulbahari cut from the base to obtain more material.	i) Only those spikes should be harvest, which are suitable for broom making.
5.	Bans (<i>Dendrocalamus strictus</i>)	i) During bamboo extraction young culms destroyed. ii) For their convenience in cutting of Bamboo they cut immature other culms.	i) Only mature old culms select for harvesting ii) Culms should be cut in inverted u shape (∩) so that old culms cut at first.

Climbers

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Mahul (<i>Bauhinia vahlii</i>)	<p>i) Immature leaves are also collected to obtain more material.</p> <p>ii) They cut the climbers from the base to obtain large quantity and save time.</p>	<p>i) Only mature leaves should be selected for collection</p> <p>ii) Sharp knife should be use to harvest leaves.</p> <p>iii) Branches should be cut from those places which give more new branches for further leaf collection.</p> <p>iv) Open roots should be covered with soil.</p> <p>v) The leaves should not be collected from damaged climbers at least one year.</p> <p>vi) Bukles should be used for tying mahul leaves.</p>
2.	Baichandi (<i>Dioscorea hispida</i>)	<p>i) Immature Tubers are collected.</p> <p>ii) Whole parts of Tubers are collected by digging the soil without leaving any part of it for future regeneration.</p>	<p>i) Mature Tubers are collected.</p> <p>ii) Some part of tubers is left in the soil for future regeneration.</p>
3.	Ramdatun (<i>Smilax macrophylla</i>)	<p>i) Immature climbers also collected with the mature material.</p> <p>ii) Poor quality instrument usde to cut climbers.</p>	<p>i) Only those climbers should be cut with sharp knife, which can give good fiber.</p>

4.	Karukand (<i>Dioscorea bulbifera</i>)	i) Immature leaves, tuber and roots are collected. ii) Whole parts of tuber and roots are collected by digging the soil without leaving any part of it for future regeneration.	i) Mature leaves, tuber and roots are collected. ii) Some part of tuber or roots is left in the soil for future regeneration.
5.	Anantmool (<i>Hemidesmus Indicus</i>)	i) Collect whole climbers.	ii) During collection some climbers should be left for the regeneration of plant.
6.	Bodal (<i>Cucumis melo agrestis</i>)	i) Continuous cutting of climbers for fodder purpose. ii) Immature fruits are collected.	i) Climbers should be cut in fixed interval. ii) Only mature fruits are collected.
7.	Amarbel (<i>Cuscuta reflexa</i>)	i) Collect whole climbers.	i) It is a parasite for the other plant so it should be removed as a whole.

Bio- product

S. No.	Local name	Traditional method	Scientific method
		Collection	Collection
1.	Honey	i) Smoke used for collection of honey. In the process of putting smoke to protect them -self from honeybees attack, some honeybees also die.	i) A special dress should be worn during collection honey and apply water on honeycomb. ii) All the honeybees should be carefully separated from honey comb then cut the upper portion of the comb with sharp knife. Collected honeycomb should be squeezing for honey collection.



Tendu leaves (*Diospyros meloanoxylon*)



Chhind Broom (*Phoenix acaulis*)



Bamboo shoots and Karil (*Dendrocalamus strictus*)

Plate 4.3 Collection and Processing of NTFPs in the study area

4.3.1 Traditional collection methods of NTFPs

The collected 41 plants as NTFPs in which 16 Tree, 5 Shrubs, 7 herbs, 5 Grasses, 7 Climbers and 1 Bio – products were collected and sold in the market as well as their own use. As evident from Table 4.4 mostly fruits were collected as crude method like cutting of branches or shaking of tree. The fruit collection was carried out of *Syzygium cumuni*, *Diospyros melanoxylon*, *Aegle marmelos*, *Tamarindus indica*, *Semecarpus anacardium*, *Schleichera oleosa*, *Emblica officinalis*, *Buchanania lanzan*, *Mangifera indica*, *Terminalia chebula*, *Terminalia bellirica* and *Azadirachta indica* etc. The medicinal plant Kalmegh was uprooted before maturity of seed thus next year production declines. The most of the trees, shrubs, herbs and grasses were used for medicinal purposes. Tribal people use the roots of many trees, shrubs, herbs and grasses as medicine. The fresh leaves of plants were also used as vegetable and climber medicine such as *Bauhinia variegata* (Kachanar) *Cassia tora* (Charota) leaves. The people used to cut the branches of *Bauhinia variegata* for collecting its leaves and pods. The leaves of *Cassia tora* was also collected maximum before maturity of plants for the use of vegetable purpose thus seed production affected. Lakh and Cocoons were also collected by the tribals from the forest two major source tree species *Shorea robusta* and *Terminalia tomentosa* was found in study area for rearing Cocoon (Kosa), and one major source tree species *Schleichera oleosa* was found in study area for Lac production people called Kusumi Lac. The Bio- product Honey were also collected by the people in the study area but the collection of Honey was high in rates/kg Dugli site but low price in Sihawa site this may be high production of honey.

The collection has been done by traditional crude method, which may call as destructive harvesting of NTFPs. The collected material like leaves, flowers, seeds, fruits, and rhizomes of different NTFPs for their livelihood in unscientific manner because of this the regeneration of species badly affected. The quality of produce would not good as demanded in the market therefore, the produce dose not fetch good price in the market. The collection of produce and its post harvest technique is playing a positive role to preserve quality material for longer duration and fetching good price in market.

Similar study carried out by Sinha *et al.* (2016) reported that total 44 plants producing NTFP were noted to be collected by tribals in 20 villages of Bastar district. Plant and plant produce collected by the tribals from the plants were seeds of 11 plants, fruits of 11, roots of 3, rhizomes of 4, flowers of 4, and secretory products from 3 plants, whereas 4 whole plants. Lakh and Cocoons were also collected by the tribal's from the forest. The destructive harvesting method and unscientific processing methods deteriorate the quality of price and lowering the price in market.

Rout and Panda (2011) reported that the NTFPs are a major source of subsistence production, income, employment and great socio-economic significance especially the weaker section of the society. They reported that the 54 important NTFP species have been collected by the Gandigadha villagers for consumption. However a few new species like 'Sal' (*Shorea robusta*) leaves, tooth stick and seeds Mahua (*Madhuca indica*) flower and fruit char (*Buchanania lanzan*) fruits, seeds and mushroom are collected and sold to local traders. They reported the 54 NTFP species from the Gandigadha villagers 49 numbers of NTFP are sold and 5 numbers of NTFP like fruits of *Barringtonia acutangula*, *Cassia fistula*, *Catunonegam spinosa* etc. are used for self consumption.

Gubbi *et al.* (2008) reported in the Periyar Tiger Reserve, India, they examined whether NTFP collection can solve livelihood problems by analysing revenues obtained from various NTFP species, estimating the economic returns to collectors from various social backgrounds, and exploring the attitudes of collectors towards their profession. They found that black damar resin from the tree *Canarium strictum* (61.3%) and mace from *Myristica spp.* (35.5%) were the most commonly collected NTFPs, and the most valuable NTFPs were honey from *Apis cerana indica* (USD 4.12 kg⁻¹), cardamom *Elettaria cardamomum* (USD 3.67 kg⁻¹) and *Myristica spp.* (USD 2.77 kg⁻¹). Mean daily revenue from NTFP collection was USD 3.15 – SD 4.19 day⁻¹, and the lowest daily revenues were earned by part-time collectors with low socio-economic status such as migrants, forest-dwellers or those without access to agricultural land. Most collectors (82%) did not wish to continue

harvesting NTFPs if alternative livelihoods from agriculture could be provided, and none wanted their children to be NTFP collectors.

Maikhuri (2003) also concluded that the basic causes of unsustainable harvesting are ignorance, poverty and lack of alternative livelihood support system accompanied by encroachments by outsider. Sustainable harvest with proper by back guarantee will provide better employment opportunities to the local inhabitants. The similar result regarding unscientific collection methods were recorded by the above workers should the conformation of the present investigation. NTFPs collector needs to trained and sustainable harvesting method so that the natural regeneration of these species will be promoted for conservation.

4.4 To study the Post harvest techniques and value additions of NTFPs

Information was collected with the help of questionnaire developed for present study. Information recorded with oral interview from the respondents selected for the study. The data recorded regarding NTFPs availability, collection methods, and post harvest techniques etc. There were total 41 plant species traditional post harvest techniques /methods documented.

4.4.1 Traditional methods of processing and value additions of NTFPs

The collected 41 plants as NTFPs in which 16 Tree, 5 Shrubs, 7 herbs, 4 Grasses, 7 Climbers and 2 Bio – products were collected processing technique used and sold in the market as well as their own use. As evident from Table 4.5 mostly fruits were collected and processing technique Sun dryer, Air dryer and Electric dryer are used. The fruit processing technique was carried out of *Syzygium cumuni*, *Diospyros melanoxylon*, *Aegle marmelos*, *Tamarindus indica*, *Semecarpus anacardium*, *Schleichera oleosa*, *Emblica officinalis*, *Buchanania lanzan*, *Mangifera indica*, *Terminalia chebula*, *Terminalia bellirica* and *Azadirachta indica* etc. The medicinal plant Kalmegh were kept 2-3 days in sunlight for drying. The most of the trees, shrubs, herbs and grasses were used for medicinal purposes. People used processing technique and produce value added product like preserve, candy, jam, RTS, nectar squash/leather/slab, powder by *Aegle marmelos*, Herbal Oil,

Table 4.5: Processing, Storage techniques and Value addition of NTFPs used by local inhabitants and scientific methods for sustainable utilization

Trees

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Bel (<i>Aegle marmelos</i>)	<p>i) Collected fruits kept in clean place in sunlight for 5-6 days for drying.</p> <p>ii) After drying its fruit skull automatically crack down.</p>	<p>i) After drying people sold it immediately.</p>	<p>i) Collected fruits should be kept for 3-4 days on clean cloth or tarpolean or polysheet for sun drying.</p> <p>ii) Fruits are put in extremely hot water for few minutes then remove. This process is repeated for 2-3 times for removing its hard cover.</p> <p>iii) The pulp of fruit should be cut in four parts then pulp spread on clean cloth or bamboo mats for drying. Fruits completely dry in 15-25 days.</p>	<p>i) The dry orange colour and spotless pulp should be packed in plastic bags.</p>	<p>i) After extraction of bel pulp used for the preparation of various fruit products viz., preserve, candy, jam, RTS, nectar squash/leather/slab, powder etc., which can be commercially exploited.</p>
2.	Char (<i>Buchanania lanzan</i>)	<p>i) Collected fruit kept for 2-3 days in sunlight for drying after removing its pulp from fruit.</p>	<p>i) Dried seed kept in an open room before selling.</p>	<p>i) Collected fruits should be put in a tank which is filled with fresh water than fruits rubbed under water so that pulp come out and flot, which</p>	<p>i) Well-dried seeds should be packed in jute bags for storage.</p>	<p>i) Roasted seeds are used as dry fruit. Seeds are used as condiment and to increase flavor in various sweets.</p>

				could be removed by decantation and seeds settled down on the bottom. ii) To test healthy seeds for storage seeds are put in a tank full of water, seed settled in bottom would be considered as sound seed.		
3.	Kachnar (<i>Bauhinia variegata</i>)	i) Fresh flower buds and leaves were used as vegetable. ii) Sometimes the leaves are dried for 2-3 days in sunlight to use in lean period.	i) Dried leaves were stored in any moisture proof container or plastic bag.	Not commercialized.	-	i) The product range consists of Herbal Extract, Herbal Oil, Nutraceutical Ingredients, Fruits Powder, Vegetable Powder and many more.
4.	Bahera (<i>Terminalia bellirica</i>)	i) Selected fruits spread in clean place to dry in sunlight for 4 -5 days.	i) Well-dried brown fruits were stored in simple jute bags.	i) Collected fruits should be spread on clean cloth for 10-15 days then its hard portion should be separated from mingi (seeds). ii) This separate hard cover/pulp again keeps it for 4-5 days to dry.	i) Completely dried pulp should be packed in Jute bag, which has plastic cover in inner part.	Triphala churn.

5.	Aonla (<i>Emblica officinalis</i>)	<p>i) Collected fruits were boiled 10 min. for removing seeds.</p> <p>ii) Then seeds are removed and kept for 4-5 days in sunlight for drying.</p> <p>iii) Its colour should be reddish brown after drying.</p>	<p>i) Dried fruits were kept in jute bags or clay pot.</p>	<p>i) Collected fruits washed in plenty of running water properly.</p> <p>ii) For commercial production, rotary washers, or fitted with moving conveyor belt and soft roller brushes are generally employed.</p> <p>iii) Blower fan, solar dryer or pressure less dehydration process is used for drying.</p> <p>iv) Vacuum dehydration process is used at commercial level to maintain its original value.</p>	<p>i) Completely dried reddish brown coloured fruits should be packed in plastic bags for storage.</p> <p>ii) During packing time mouth of bags should be kept little open to avoid smell.</p>	<p>i) Jams, jellies, tarts, chutneys, beverages(nectar, squash and syrup) Pickle and candy etc.</p>
6.	Tendu leaves (<i>Diospyros melanoxylon</i>) Tendu fruit	<p>i) Collected leaves were kept in sunlight for 3-4 days to dry.</p> <p>i) Fresh fruits are sold in market thus no need of any process.</p>	<p>i) For storage leaves were tied in bundles.</p> <p>No need of storage.</p>	<p>i) The collected leaves should be dried in partial shade.</p> <p>ii) 20-40⁰Ctemperature is good to dry the leaves.</p>	<p>i) Well-dried leaves of same size should be tied with soft rope in bundles then stored.</p>	<p>Bidi, cigarettes. Cigar for ecport.</p>

7.	Bhelwa (<i>Semecarpus anacardium</i>)	i) Generally people used the fruits as it is, but sometimes they dry in sunlight for storage and separates from seed.	i) Dried fruits were stored in bamboo baskets or clay pots.	Not commercialized.	-	i) Ink and medicines.
8.	Mahua Flower (<i>Madhuca latifolia</i>)	i) Collected flowers are spread in clean place evenly for 3-4 days in sunlight for drying.	i) Dried flower were kept in bamboo basket before selling.	i) Collected flowers should be spread as thin layer on polythene sheet for drying in sunlight.	i) Well-dried flowers should be packed in jute or plastic bags immediately after last drying.	i) Food material (laddu, kismis), bio diesel and wine.
10.	Jamun (<i>Syzygium cumuni</i>)	i) Fresh fruits are sold in market.	i) No need of storage.	Not commercialized	-	-
11.	Kusum (<i>Schleichera oleosa</i>)	i) Collected fruits kept as it is for 6-7 days and then it could be uncovered. ii) After collection of fruits pulp is removed and seeds were separated. iii) Seed were kept in sunlight for drying.	Dried seeds were stored openly in room.	i) First uncover the collected fruits then crushed by means of fluted wooden roller or crushers are used to remove its pulp. ii) Collected seed evenly spread on clean cloth or polythene sheet for 4-5 days for drying.	i) Dried seeds should be packed in jute bags for storage.	i) Oil is used for soap making purpose.
12.	Imli (<i>Tamarindus</i>)	i) Collected fruits were spread for 2-3 days in room then uncovered.	Uncovered fruits were kept in bamboo	i) Collected fruits were spread on polythene sheet for 2-3 days to dry then uncovered.	i) Phool Imli should be packed in plastic bags and	i) Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy etc.

	<i>indica</i>)		baskets.	ii) Uncovered fruits fiber and seed should be removed, which is called seed less Imli. iii) Imli with seeds and fiber called auti Imli.	Auti Imli packed in Jute bags for storage.	
13.	Mango (<i>Mangifera indica</i>)	i) Fresh fruit are collected and sold in the market. ii) Damaged fruit are cut into small pieces and dried in the sun light and sold in the market.	i) Seeds kernels and dry fruits are stored in small container.	i) Fresh fruit are collect for aamchur preparation. ii) Fruits are chopped, and seeds are dried in sunlight	i) Aamchur should be packed in plastic bags. ii) Dried seed and fruits packed in Jute bags for storage.	i) Aamchur, juices, nectars, concentrates, jams, jelly powders, fruit bars, flakes dried fruits pickle, candy.
14.	Sal (<i>Shorea robusta</i>)	i) Gum is collected from the cut part of the plant with plant debris. ii) Fire used then collecting the seeds and sold in the market.	i) Gum stored in bamboo basket.	i) Gum is collected from the cut part of the plant and dried in the sunlight known as dhoop.	i) Gum should be stored in aluminum and steel container.	i) Soap, sal butter which is used for cooking, sal seed cakes are used as feedstuffs. Vanaspati Ghee is prepared from sal seed.
15.	Harra (<i>Terminalia chebula</i>)	i) Selected fruits spread in clean place to dry in sunlight for 4 -5 days.	i) Fruits stored in dry place. Well-dried fruits were stored in simple jute bags.	i) Collected fruits should be spread on clean cloth for 10-15 days then its hard portion should be separated from mingi (seeds).	i) Completely dried fruit should be packed in Jute bag, which has plastic cover in inner part.	i) One main ingredient of Triphala churn.
16.	Kumbhi (<i>Careya arborea</i>)	i) Flowers are collected and dried in sun light.	i) Dried flower packed in Jute bags.	i) Flowers are collected from the forest then dried in shed and sold in market.	i) Dried flower packed in Jute bags for storage.	-

Shrubs

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Ainthe (<i>Helicteres isora</i>)	i) Fruit and twig were used for medicine purpose.	i) Fruits were dried in sunlight one week.	i) Fresh fruits are collected and dried in sunlight.	i) Dried fruits should be packed in jute bags for storage.	i) Medicine, ropes and cloth.
2.	Ber (<i>Zizyphus mauritiana</i>)	i) Fruits were kept 3-4 days in sunlight. ii) Ber fruit were generally sold fresh in market. iii) Sun dried fruits also sold in market.	i) Dried fruits were kept in jute bags or bamboo basket.	i) Undamaged and disease free fruits are selected then washed in plenty of water and spread on clean cloth or polythene sheet for drying in sunlight for 5-6 days. ii) Dried fruit pulp should be grinded to get powder form.	i) The fruit pulp powder should be packed in plastic packets for safe storage.	i) Chhuhara, jam, candy, beverages ber roti etc.
3.	Chhind (<i>Phoenix acaulis</i>)	i) Leaves were properly dried 2-3 days in sun for making broom or other items.	i) Leaves are stored in dry place.	Not commercialized.	-	Juice
4.	Karonda (<i>Carissa carandus</i>)	i) Fresh fruits and flower are used and sold in the market.	i) No need of storage.	Not commercialized.	-	Pickle, chutneys.
5.	Chameli (<i>Jasminum arborescens</i>)	i) Fresh fruits and leaves were used as medicine.	i) No need of storage.	Not commercialized.	-	Cosmetic perfume, oil, soap.

Herbs

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Charota (<i>Cassia tora</i>)	i) Its leaves were dried in sunlight for 2-3 days. ii) The collected pods of charota are kept in sun light to crack the pods for easy separation of seeds. iii) Separated seeds are again kept 1 day in sunlight for drying.	i) Dried leaves and seeds were kept separately in bamboo baskets or any other container.	i) Tray drier or electric drier should be used for drying seeds.	i) Leaves and seeds should be stored separately in plastic bags.	i) Cassia tora tea is a herbal, pure, natural and non-polluted green health beverage (coffee-tea), substitute for coffee and sodas.
2.	Mushroom	i) Fresh mushroom used as vegetable and sold in market. ii) Some types of mushroom are sun dried for storage.	i) Dried mushroom are kept in any container such as clay pot or bamboo basket.	Not commercialized.	-	i) Pickle, papad, health power powder, and use as a vegetable.
3.	Kalmegh (<i>Andrographis paniculata</i>)	i) Collected leaves, fruits or whole plant were kept 2-3 days in	i) Dried leaves, fruits and stems were placed in	i) Fresh plants are collected and cleaned with water, chopped into large pieces then	-	Medicine.

		sunlight for drying.	open room.	dried in the sunlight.		
4.	Tikhur (<i>Curcuma angustifolia</i>)	i) Rhizomes are collected and sold in market.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Rhizomes are collected and cut it into small pieces and grind, Five to Ten-time rinsed in water, then dried in sunlight white solid powder is obtained as known as Tikhur.	i) Powder should be packed in plastic bags.	i) Food material Barfi, sweets.
5.	Safed musli (<i>Chlorophytum tuberosum</i>)	i) Collected tubers are cleaned and dried.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Collected tubers are cleaned and dried.	i) Powder should be packed in plastic bags.	i) Allopathic medicines, sex tonic, Immunity-improving drug. main use to improve the vigour and vitality in men and women.
6.	Kali musli (<i>Curculigo orchioides</i>)	i) Collected tubers are cleaned and dried.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Collected tubers are cleaned and dried	i) Powder should be packed in plastic bags.	Medicines
7.	Gengi (<i>Curcuma zedoaria</i>)	i) Rhizomes are collected and sold in market.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Rhizomes are collected and cut it into small pieces and grind, Five to Ten-times rinsed in water, then dried in sunlight.	i) Powder should be packed in plastic bags.	Medicines

Grasses

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Munsel (<i>Iseilema nervosum</i>)	i) Fresh leave are use.	i) No need of storage.	Not commercialized.	-	-
2.	Kans (<i>Saceharum spoutaneum</i>)	i) Collected spikes kept 3-4 days in sunlight for drying.	i) Dried spikes tied in bundles and broom manufactured during rainy season.	Not commercialized.	-	Broom.
3.	Phulbahari (<i>Thysanolacns maxima</i>)	i) Collected spikes kept for 3-4 days in sunlight to dry.	i) Dried spikes tide in bundles and Broom manufactured.	Not commercialized.	-	Broom.
4.	Bans (<i>Dendrocalamus strictus</i>)	i) Harvested bamboo culms keep in sunlight for drying it may cause cracks.	i) Dried bamboo stored only for few days before selling.	i) Seasoning process is used for its long life and strength. Air seasoning is generally used. ii) The bans loachan is extracted from bamboo.	i) Bamboo stored in such a way that equal length and thick stem stored in grade basis for sale. Stored in container.	i) Making bamboo box, bamboo container and other bamboo product. Medicinal value to remove the calcium deficiency in human being and animal.

Climbers

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Mahul (<i>Bauhinia vahlii</i>)	i) Collected leaves tied in bundles of 100 leaves.	i) Collected leaves kept in closed room before selling.	i) Collected leaves kept in a well-closed room before making plate. ii) With the help of machine leaves are joint or stitched. iii) Molding machine is used for press the Dona and Plates.	i) Plates and Donas tied separately in bundles and packed in thin polythene bags carefully for storage	i) Making Plates, donas and rope.
2.	Ramdatoon (<i>Smilax zeylanica</i>)	i) Harvested twig beated by wooden rollers then removed its fiber and kept 2-3 days for drying.	i) Dried fiber rolled in bundles for storage.	Not commercialized.	-	Rope.
3.	Baichandi (<i>Dioscorea hispida</i>)	i) Fresh rhizomes are used for medicinal purpose.	i) No need of storage.	i) The thin slices are cut boiling the rhizome.	i) Packed in poly bag	i) Used to fry in oil as a chips with salt and peper.
4.	Karukand (<i>Dioscorea bulbifera</i>)	i) Rhizomes are collected from soil and cleaned with water and sold in market as a vegetable.	i) Rhizome stored only for few days before selling.	i) Rhizomes are collected from soil and cleaned with water then the upper surface is removed and dried in the sunlight.	i) Rhizome should be packed in jute bags for storage.	i) Use as a vegetable. and medicine.
5.	Bodal	i) Fruits are collected	i) Dried material	Not commercialized.	-	i) Food material (chips).

	<i>(Cucumis melo agrestis)</i>	and cut into small pieces and dried in the sunlight.	stored in plastic container.			
6.	Amarbel <i>(Cuscuta reflexa)</i>	i) Collected climbers kept 2-3 days in sunlight for drying. ii) Fresh climber used as medicine.	i) Dried climbers tied in bundles for storage.	Not commercialized.	-	i) Use as a medicine for skin diseases.
7.	Anantmool <i>(Hemidesmus Indicus)</i>	i) Roots are collected from soil and cleaned.	i) Dried root should be packed in jute bag for storage.	i) Roots are collected from soil and cleaned with water then dried in the sunlight and made powder.	i) Powder should be packed in plastic bags for storage.	i) Medicine tablet.

Bio- product

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Honey	i) Collected honey extracted from honeycomb.	i) Collected honey kept in container like clay pot.	i) All dirt and unwanted material removed from honey with the help of machine to clean the wax, dirt and water.	i) Well-processed honey should be stored in bottles.	i) It has attractive chemical properties for baking and a distinctive flavor when used as a sweetener.
2.	Kosa (<i>Cocoon</i>)	i) Cocoon are collected and sold in the market.	i) Should be stored in open room.	i) <i>Cocoons</i> are boiled in water; then, Kosa fibers are extracted by rupturing the cocoon.	i) After processing cocoon should be packed in jute bags for storage.	i) Silk saris, highly commercial value of kosa silk.

Nutraceutical Ingredients, Fruits Powder, and Vegetable Powder by *Bauhinia variegata*, Jams, jellies, tarts, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Emblica officinalis*, Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Tamarindus indica*, Aamchur, juices, nectars, concentrates, jams, jelly powders, fruit bars, flakes dried fruits pickle, candy by *Mangifera indica*. And many types of value added product made by people.

The collected material like leaves, flowers, seeds, fruits, and rhizomes are processed and making a plates, rope, broom, medicines and many type of value added products. The collection of produce and its post harvest technique is playing a positive role to preserve quality material for longer duration.

Similar study carried out by Sundriyal and Sundriyal (2004) reported that the data on marketing, value addition and management concerns of the wild edible plants of the Sikkim Himalaya. A total of 44 wild edible species have been recorded. Other important species were *Machilus edulis*, *Diplazium esculentum*, *Eleagnus latifolia*, *Dendrocalamus hamiltonii*, *Agaricus* and *Baccaurea sapida*. Value addition was done to a few wild edible species, and cost-benefit analysis showed that the income from the fruits could be increased by at least 3–5 times after making pickles, squash and jam. The present investigation information of post harvest also studied can compared with the scientific method can ply a significant role to increase the income of collectors it resulted the increase the income and improvement in their livelihood. Similar study carried out by above workers and confirms the finding of present study.

Shankar *et al.* (2014) concluded that the treatment or recipe combination 1:1.5:2.5 (Tikhur starch: Sugar: Water) was best for the preparation of tikhur *Barfi*. On the other hands tikhur *Barfi* prepared through the recipe 1:1.5 2.5 (Tikhur starch: Sugar: Water) had a pleasant flavour, texture, taste moisture, texture appearance and over all acceptability. The value addition technology with training can change the livelihood of the tribes after scientific training.

Pethiya and Surayya (2005) concluded that value addition to NTFPs can be carried out at three stages, pre-harvesting during harvesting and post harvesting

stages. He revealed that primary processing (FD level), secondary processing (at Traders level) and Consumer industry (Industry level) will be the best chain with the help of this system the better price can be given to the primary collector. Similar observations were recorded with this experiment where collection, post harvest and marketing are very poor this shows confirmation with finding of the above worker. *Mangifera indica* and *Emblica officinalis* could be harvested by shaking branches, hitting the fruit with stick. Plucking fruit by hand plucking, with knitted net attached at the end of a Bamboo stick. The first two methods are destructive harvesting techniques, which damage the tree and reduce the value of harvested fruit though physical damage. The fruit of *Emblica officinalis* (Aonla) can be boiled to remove the seeds and extract the pulp. The pulp dried for 4-5 days then dried pulp grinded to obtain powder form.

The present study also reveals that the sustainable harvesting and processing with small value addition the better price can be obtained by the local inhabitant in the study area confirms the result of above workers.

4.5 The role of NTFPs in livelihood of tribes and local residents in relation to their income.

4.5.1 Collection of NTFPs in study area

All NTFPs are not harvested and collected in the study area, a few NTFPs, which have commercial and domestic values in the market, are collected by local people. The products, which are collected by people, are flower, fruit, rhizome, tuber, mushroom, leaves, bamboo shoots, seed, etc. Among all these viz. fruits, seeds and leaves especially *Buchanania lanzan* (Char fruit), *Diospyros melanoxylon* (Tendu) and *Bauhinia vahlii* (Mahul) leaves are largely collected. Most of the people involved in collection of Tendu leaves during summer, when there was no scope of agriculture work. *Diospyros melanoxylon* is a nationalized product. Maximum women and childrens were involved in collection of *Diospyros melanoxylon* leaves also the *Bauhinia vahlii* (Mahul) leaves were also collected to prepare dona and plates for local sale or industrial purpose. *Madhuca latifolia* flower is also an important NTFPs for there own consumption and to get cash income.

Table 4.6: Family wise NTFPs collected in different study sites during (2016-17)

Village	Tendu leaves (<i>Diospyros melanoxyton</i>) (bundle/year)	Mahul leaves (<i>Bauhinia vahlii</i>) (bundle/year)	Mahua flower (<i>Maduca latifolia</i>) (kg/year)	Char (<i>Buchanania lanzan</i>) (kg/year)	Kumbhi flower (<i>Careya arborea</i>) (kg/year)	Imli (<i>Tamarindus indica</i>) (kg/year)	Mango dry (<i>Mangifera indica</i>) (kg/year)	Tikhur (<i>Curcuma aromatica</i>) (kg/year)	Mushroom (kg/year)	Honey (kg/year)
Site 01 Dugli range										
Dinkarpur	36750	12500	128	91	112	82	77	61	47	23
Monaikera	31300	9570	112	76	93	76	66	57	33	17
Average	34025	11035	120	83.5	102.5	79	71.5	59	40	20
Site 02 Nagri range										
Daldali (A)	33800	10150	78	60	74	57	59	22	26	13
Karraghati	32460	8590	72	66	77	52	51	18	21	12
Average	33130	9370	75	63	75.5	54.5	55	20	23.5	12.5
Site 03 Sihawa range										
Bhathkhar	12300	0	37	9	32	18	16	0	7	3
Satbahna (Dongripara)	14350	0	43	19	39	23	21	0	13	5
Average	13325	0	40	14	35.5	20.5	18.5	0	10	4
Over all Average	26826.67	6801.67	78.33	53.50	71.17	51.33	48.33	26.33	24.50	12.17

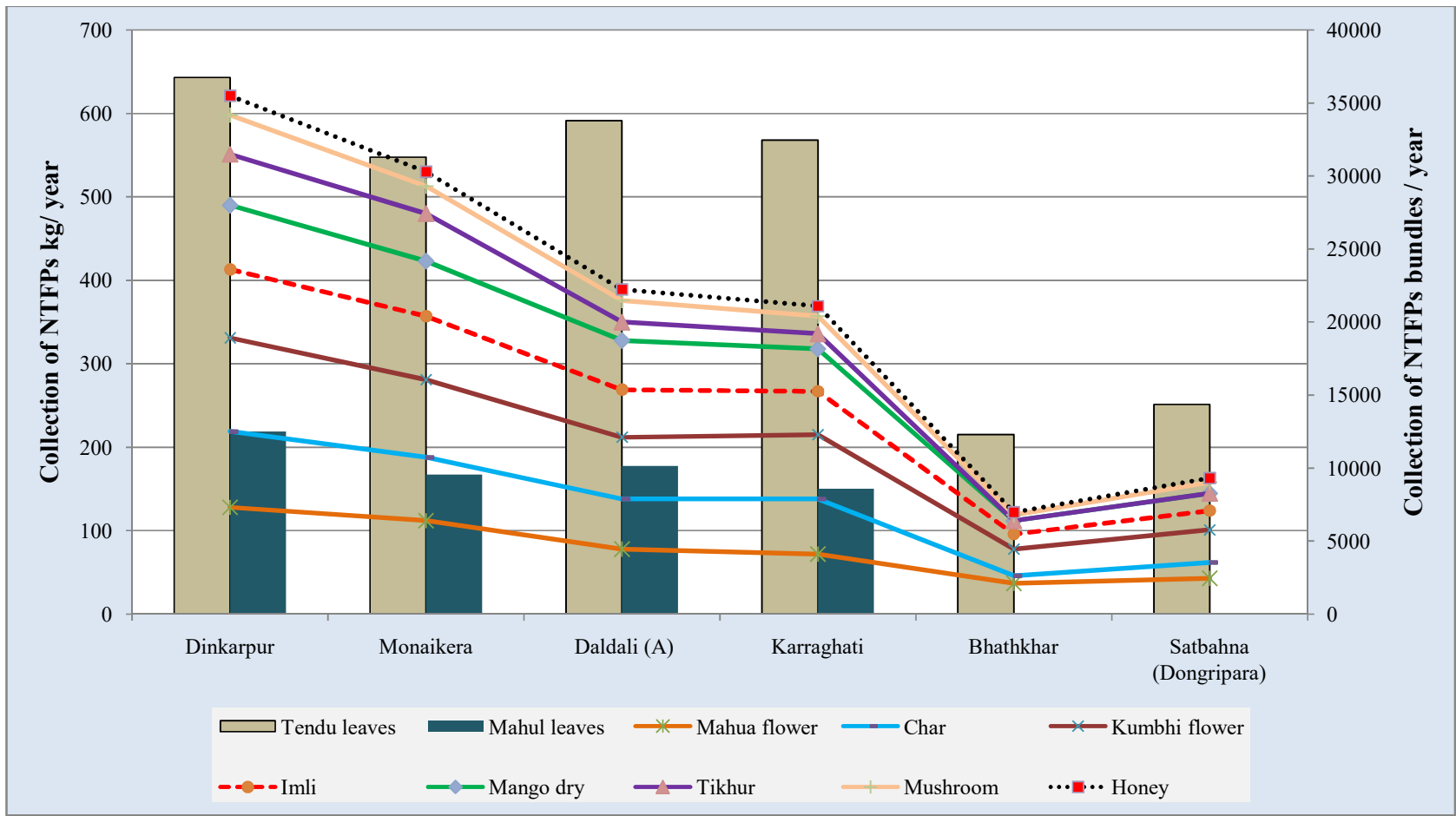


Fig. 4.1: Village wise collection of various NTFPs in Bundles/kg per year

The liquor extracted from dried flower was used in cultural functions and their ritual. The results of major NTFPs species and their average collection pattern and their quantity collected in selected villages presented in (Table 4.6) which revealed that *Diospyros melanoxylon* (Tendu) leaves (26826.67 bundle) was the main source of NTFPs income followed by *Bauhinia vahlii* (Mahul) leaves (6801.67 bundle), *Madhuca indica* (Mahua) flower (78.33 kg.), *Careya arborea* (Kumbhi) flower (71.17), *Buchanania lanzan* (Char) (53.50), *Tamarindus indica* (Imli) (51.33), *Mangifera indica* (Mango) dry (48.33), *Curcuma aromatica* (Tikhur) (26.33) and Mushroom (24.50 kg.). But Honey (12.17 kg.), is a one of the major NTFPs, collected in very small quantity by the people. The highest collection of *Diospyros melanoxylon* (Tendu) leaves was carried out in Dinkarpur (36,750 bundle) followed by Daldali (A) (33,800 bundle) and lowest in Bhathkhar (12,300 bundle) followed by Satbahna (Dongripara) (14,350 bundle). *Bauhinia vahlii* (Mahul) leaves was collected only in four villages namely Dinkarpur, Monaikera, Daldali (A) and Karraghati, the highest collection *Bauhinia vahlii* (Mahul) leaves was in Dinkarpur (12,500 bundle) followed by Daldali (A) (10,150 bundle) and lowest in Karraghati (8,590 bundle) followed by Monaikera (9,570 bundle). The highest collection of *Madhuca indica* (Mahua) flower was carried out Dinkarpur (128 kg) followed by Monaikera (112kg.) and lowest in Bhathkhar (37 kg) followed by Satbahna (Dongripara) (43 kg.). The highest collection of *Careya arborea* (Kumbhi) flower was carried out Dinkarpur (112 kg) followed by Monaikera (93kg.) and lowest in Bhathkhar (32 kg) followed by Satbahna (Dongripara) (39 kg.). The highest collection of *Buchanania lanzan* (Char) was carried out Dinkarpur (91 kg) followed by Monaikera (76 kg.) and lowest in Bhathkhar (9 kg) followed by Satbahna (Dongripara) (19 kg.). The highest collection of *Tamarindus indica* (Imli) was carried out Dinkarpur (82 kg) followed by Monaikera (76 kg.) and lowest in Bhathkhar (18 kg) followed by Satbahna (Dongripara) (23 kg.). Honey was also source of income but collected in low quantity. The highest collection of Honey was carried out Dinkarpur (23 kg) followed by Monaikera (17 kg.) and lowest in Bhathkhar (3 kg) followed by Satbahna (Dongripara) (5 kg.). The highest collection of *Mangifera indica* (Mango) dry was carried out Dinkarpur (77 kg) followed by Monaikera (66 kg.) and lowest in Bhathkhar (16 kg) followed by Satbahna



Mahua seed and flower (*Madhuca indica*)



Mango dry (*Mangifera indica*)

Imli (*Tamarindus indica*)



Char (*Buchanania lanzan*)

Harra (*Terminalia chebula*)

Plate 4.4 NTFPs found in the study area



Sal seed (*Shorea robusta*)



Tendu leaves (*Diospyros meloanoxylon*)



Sal Gum (*Shorea robusta*)



Kusum lac (*Schleichera oleosa*)



Ragi (*Eleusine corocana*)



Kumbhi flower (*Careya arborea*)

Plate 4.4 NTFPs found in the study area



Chhind Broom (*Phoenix acaulis*)



Bans Broom (*Dendrocalamus strictus*)



Kans Broom (*Saccharum spontaneum*)



Mashroom (*Termitomyces heimii*)



Peng (*Celastrus paniculata*)



Kosa (*Cocoon*)

Plate 4.4 NTFPs found in the study area

(Dongripara) (21 kg.). *Curcuma arometica* (Tikhur) was collected only in four villages namely Dinkarpur, Monaikera, Daldali (A) and Karraghati, the highest collection of *Curcuma arometica* (Tikhur) was in Dinkarpur (61 kg) followed by Monaikera (57 kg.) and lowest in Karraghati (18 kg) followed by Daldali (A) (22 kg.). The highest collection of Mushroom was carried out Dinkarpur (47 kg) followed by Monaikera (33 kg.) and lowest in Bhathkhar (7 kg) followed by Satbahna (Dongripara) (13 kg.).

Murthy *et al.* (2005) reported that in Yellapur division large quantities of *Diospyros melanoxylon* (Tendu) leaves and *A. Sinuata* are collected. The collected quantity during 1993-1994 was 3 and 8 tons respectively. Kavwar division with 1712.95 km. products gathered are *A. Sinuata*, *G. indica*, *S. Emarginatus*, *T. chebula*, Honey and Wax. The quantity of *A. Sinuata* collected during 1990-1991 was about 64 tons. The quantity of *G. Indica* gathered in same year was about 2 tons. In the present study the village wise annual collected NTFPs produce is very low because of its availability in the forest near the village is limited but overall produce is higher. There is wide variation in collection of material in different villages because of the density of the particular plants. If we compare with division wise the quantity may be high as reported by above workers confirms the result of present investigation. The people also involved in earning with other enterprises like job, traditional agriculture and labour works. It can be said that the tribal or not totally depend on NTFPs but almost 50 to 60% earning same in NTFPs and this may varied village to village in the study area of Dhamtari forest division.

Similar study was carried out by Kinhal (2006) reported that in Amadob, 816 qtl of *Bauhinia vahlii*, 1,22,050 bundles of *Diospyros melanoxylon*, and 198.61 qtl. *Madhuca indica* (Mahua) flower, 0.17 qtl *Embelica ribes* (Baibidang), 467 qtl are collected. Honey is collected in surplus quantity. *Bauhinia vahlii* and *Diospyros melanoxylon* leaves, *Madhuca indica* flower and seed are the major NTFPs. The orders of NTFPs species produce prove species wise almost same as in the present study the honey is also collected in similar manner as reported by the above worker. Choudhary *et al.* (2004) also reported that *Diospyros melanoxylon* leaves (42.60%) is the main source of forest income followed by *Dendrocalamus strictus* (12.20%),

Tamarindus indica (10.13%), *Madhuca indica* (6.97%), *Shorea robusta* (4.60%) etc. In our investigation the tendu leaves was major NTFPs among other species and collector got the higher quantity and maximum income from tendu leaves. The quantity of tendu leaves and other species varied due to the composition of species occurred in the forest stands in different study site. The result and confirmed as reported by other workers.

4.5.2 Local market rates of various NTFPs in study area

Marketing is an important part to obtain proper return of money. It connects what the consumer wants, supply the produce and profit. Analysis of collected data and marketing information indicated season wise NTFPs rates are enlisted and discussed. A total of 32 NTFPs market rate are cataloged from three different markets Dugli, Nagri and Sihawa. The market Dugli was 45 km. away from district headquarter Dhamtari and connected with Tar road, after that forest road was found. In Dugli weekly market held on Friday where people came for sale their products. In Nagri market held on Saturday and in Sihawa market held on Sunday. The market rates are quite different in all three markets for same produce. The NTFPs rates are quit high at Dugli market as compare to Nagri and Sihawa. Tendu leaf is a nationalized product and Government fixes its rate thus Tendu leaves rate are same 100 bundles @ Rs.180 purchased by Cooperative society and Tendu fruit rate was 30Rs.per kg. in Dugli and 25Rs. per kg in Nagri and Sihawa. The rate was highest for honey Rs. 340/kg in Dugli and Rs. 360/kg in Nagri and Sihawa market. In Nagri and Sihawa market the rate was below Rs. 20 for 9 NTFPs listed Kachanar, Sal seed, Bel, Kusum Brood lac, Harra, Bahera, Ber, Bhelwa seed, and kumbhi flower. The Chind broom rate was Rs.20 to 30 per piece and Phool Bahri rate was Rs. 30 per piece in all three markets. The rate of Chind (fruit) 30Rs. per kg in Dugli, 25 Rs./kg in Nagri and 20 Rs. per kg in Sihawa market. The rate of Kusum (Processed Lac) 150 Rs. per kg in all three markets. The rate of Mango dry (fruit slice) 50 Rs. per kg in Nagri and 40 Rs. per kg in Dugli and Sihawa Market. The rate of Peng (*Celetrus paniculatus*)180 Rs. per kg in Dugli and 160 Rs. per kg in Nagri market. The rate of Charota seed 26 Rs. per kg in Dugli, 25 Rs. per kg in Nagri and 20 Rs. per kg in Sihawa market. The rate of Bamboo Shoots 30-80 Rs. per kg in all three market. The

rate of Boda (*Astraeus hygromericus*) 20-100 Rs. per kg in Dugli and Nagri and 30-100 Rs. per kg in Sihawa market. The rate of Tikhur 80-100 Rs. per kg in Dugli and 80 Rs. per kg in Nagri market. The rate of Kosha (Coccon) was 5Rs. per piece in all market. The rate of mushroom was Rs. 60 per kg in Dugli market and 40Rs. per kg in Nagri and Sihawa. The rate of Mahua flower 24-35Rs. per kg in Dugli market and 25-35 Rs. per kg in Nagri and Sihawa. The rate of Sal Gum 100Rs. per kg in Nagri market and 80 Rs. per kg in Dugli and Sihawa market. The rate of Char 100Rs./kg in all three market. The rate of Imli 60Rs./kg Dugli and Nagri market and 50Rs./kg in Sihawa market. In Dugli market the rates of Kachanar, Sal seed, Bel, Kusum (Brood lac), Harra, Bahera, Ber, Bhelwa seed, and kumbhi flower were sold at Rs. 10 per kg, Rs. 10 per kg, Rs. 15-20 per kg, Rs. 5-10 per kg, Rs. 8-15 per kg, Rs. 15 per kg, Rs. 20 per kg, Rs. 5 per kg and Rs. 20 per kg. respectively. In Nagri Market the rates of Kachanar, Sal seed, Bel, Kusum (Brood lac), Harra, Bahera, Ber, Bhelwa seed, and kumbhi flower were sold at Rs. 10 per kg, Rs. 10 per kg, Rs. 20 per kg, Rs. 5-10 per kg, Rs. 8-15 per kg, Rs. 15 per kg, Rs. 10 per kg, Rs. 5 per kg and Rs. 20 per kg respectively. In Sihawa Market the rates of Kachanar, Sal seed, Bel, Kusum (Brood lac), Harra, Bahera, Ber, Bhelwa seed, and kumbhi flower were sold at Rs. 10 per kg, Rs. 10 per kg, Rs. 20 per kg, Rs. 15 per kg, Rs. 8-15 per kg, Rs. 15 per kg, Rs. 10 per kg, Rs. 5 per kg and Rs. 20 per kg respectively. (Table 4.7)

Kinhal (2006) also reported that *Bauhinia vahlii* (Mahul) leaves are sold at the rate of Rs. 5-6 per kg. Muraleedharan *et al.* reported the price of honey was Rs.25 per kg. during 1982-1983, which was enhanced to Rs. 45 per kg during 1996-1997. Similarly most of the NTFPs prices have increased over a period of time. The variation in prices definitely changed with the so many factors responsible for price hike or lowering the fluctuation price is also found in the marketing in present investigation confirms the results of above study. The present market rates are higher of all the NTFPs rates as quoted by Kinhal because it was 10 year old study. The increase in the rate of because of the time is correct and confirms that these NTFPs are still having lot of market.



Plate 4.5: A view of NTFPs village Market of study area

Table 4.7: Market rates of different NTFPs in study sites of Dhamtari, (C.G.)

S.No.	Product	Dugli (Rs./kg)		Nagri (Rs./kg)	Sihawa (Rs./kg)
1.	Mahua flower (<i>Madhuca indica</i>)	24-35		25-35	25-35
2.	Mahua Seed (<i>Madhuca indica</i>)	21		20	20
3.	Tendu leaves (<i>Diospyros meloanoxylon</i>)	100 bundle @180 Rs.(1 bundle = 100 leaves) Govt. rate		100 bundle @180 Rs.(1 bundle = 100 leaves) Govt. rate	100 bundle @180 Rs.(1 bundle = 100 leaves) Govt. rate
4.	Tendu fruit (<i>Diospyros meloanoxylon</i>)	30		25	25
5.	Mahul leaves (<i>Bahunia vihlli</i>)	100 bundle @120		100 bundle @110	100 bundle @110
6.	Honey (<i>Apis species</i>)	340		360	360
7.	Kalmegh (<i>Andrographis paniculata</i>) whole plant	100		90	90
8.	Kachanar (<i>Bauhinia variegata</i>) flower and leaf	10		10	-
9.	Anola (<i>Emblica officinalis</i>) fruits	Fruit G	25	20	20
		Fruit D	60	60	60
10.	Sal seed (<i>Shorea robusta</i>)	10		10	10
11.	Sal Gum (<i>Shorea robusta</i>)	80		100	80
12.	Chhind (<i>Phoenix acaulis</i>) broom	20-30 Rs./piece		20-30 Rs./piece	20-30 Rs./piece
13.	Char (<i>Buchanania lanzan</i>) seed	100		100	100
14.	Imli (<i>Tamarindus indica</i>) fruit	60		60	50
15.	Chhind (<i>Phoenix acaulis</i>)	Fruit	30	25	20
16.	Bel (<i>Aegle marmelos</i>) fruit	15-20		20	20
17.	Mashroom	60		40	40
18.	Kusum (<i>Schleichera oleosa</i>) seed	Brood Lac	5-10	5-10	15
		Proc. Lac	150	150	150
19.	Harra (<i>Terminalia chebula</i>) fruit	8-15		8-15	8-15
20.	Behra (<i>Terminalia bellirica</i>) fruit	15		15	15

21..	Ber (<i>Ziziphus mauritiana</i>) fruit	20	10	10
22.	Kosha (Coccon)	5Rs./piece	5Rs./piece	5Rs./piece
23.	Phool bahari (<i>Thysanolaena maxima</i>) broom	30Rs./piece	30Rs./piece	35Rs./piece
24.	Mango dry (<i>Mangifera indica</i>) fruit slice	40	50	40
25.	Peng (<i>Celastrus paniculata</i>)	180	160	-
26.	Charota seed (<i>Cassia tora</i>)	26	25	20
27.	Bamboo Shoots (<i>Dendrocalamus strictus</i>)	30-80	30-80	30-80
28.	Boda (<i>Astraeus hygromericus</i>)	20-100	20-100	30-100
29.	Bhelwa seed (<i>Semecarpus anacardium</i>)	5	5	5
30.	Jamun (<i>Syzygium cuminii</i>)	30	25	25
31.	Thikur (<i>Curcuma aungstifolia</i>)	80-100	80	-
32.	Kumbhi (<i>Careya arborea</i>)	flower	20	20

G – Green, **D** – Dry, **Proc.** – Processing.

Masih *et al.* (2001) reported that prices of various NTFPs sold in markets of Madhya Pradesh. They observed that Aonla (*Emblica officinalis*), Harra (*Terminalia chebula*), Honey, Imli (*Tamarindus indica*), Tendu (*Diospyros melanoxylon*), Mahua flower (*Madhuca indica*), Mahul leaves (*Bauhinia vahlii*), Karonda (*Carissa carandas*) were sold @ Rs. 7.41 kg, Rs. 3.29 kg, Rs. 32.22 kg, Rs.2.33 kg, Rs.3.92 kg, Rs. 6.32 kg, Rs. 3.46 kg and Rs 2.83 kg respectively. The various NTFPs prices were quite low due to lack of institutional arrangement and good market facilities. The market rates definitely vary as per the locality of the market the price is low in remote area market as compared with district market it also varies on yearly availability basis. The rates are low in the present investigation that is because of information and role of middle man in the channel of marketing so the results are almost similar. The rate of NTFPs having lot of fluctuations basically it depends on

the quantity of availability of that particular product in the market if bumper quantity came in the market the rates go down and if quantity is less the price will be higher. There is need to fix the MSP in NTFPs than only we may enhance the income of collector.

4.5.3 Land holding status of selected villages

The study showed that majority of marginal and small farmers are found in the study area. (Table 4.8). the numbers of marginal farmers are more than landless and small farmer. Marginal farmers do not possess patta lands. The population of marginal farmer was higher than landless labour. The percentage of landless labours ranges from 0 to 50%. It was highest in Satbahna (Dongripara) (50%) followed by Bhathkhar (10%) and lowest in Dinkarpur and Monaikera, (0.5%) followed by Daldali (A) (0.88%). The percentage of marginal farmer ranges from 10 - 40%. It was highest in villages namely Monaikera, Bhathkhar and Satbahna (Dongripara) (40%) followed by Daldali (A) (22.72%) and lowest in Dinkarpur (10%) followed by Karraghati (20%). The average percentage of landless labour was recorded 10.31% and for marginal farmer it was 28.79%.

Table 4.8 Land holding status of respondent selected in study sites Dhamtari, (C.G.)

S. No.	Village	Landless labour (in %)	Marginal farmer (in %)	Average size of land (in acre)
Site 01 Dugli range				
1	Dinkarpur	0.5	10	7.65
2	Monaikera	0.5	40	1.3
Site 02 Nagri range				
3	Daldali (A)	0.88	22.72	3.375
4	Karraghati	0	20	4.175
Site 03 Sihawa range				
5	Bhathkhar	10	40	2.6
6	Satbahna (Dongripara)	50	40	0.825
	Average	10.31	28.79	3.32

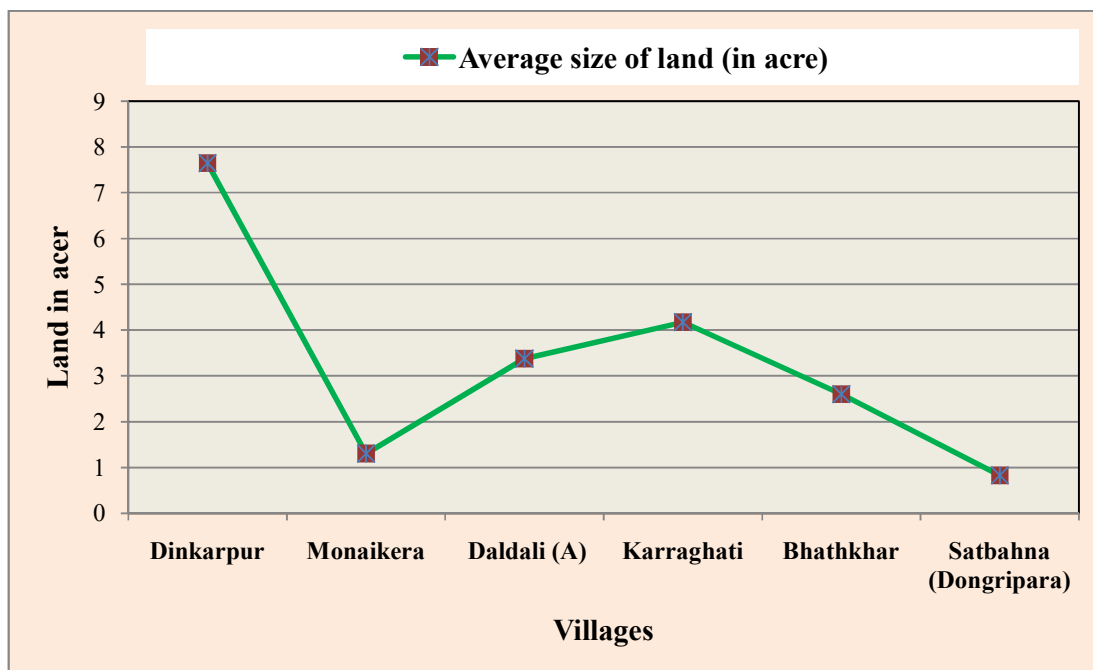


Fig. 4.2: Average Land holding status of households in different villages

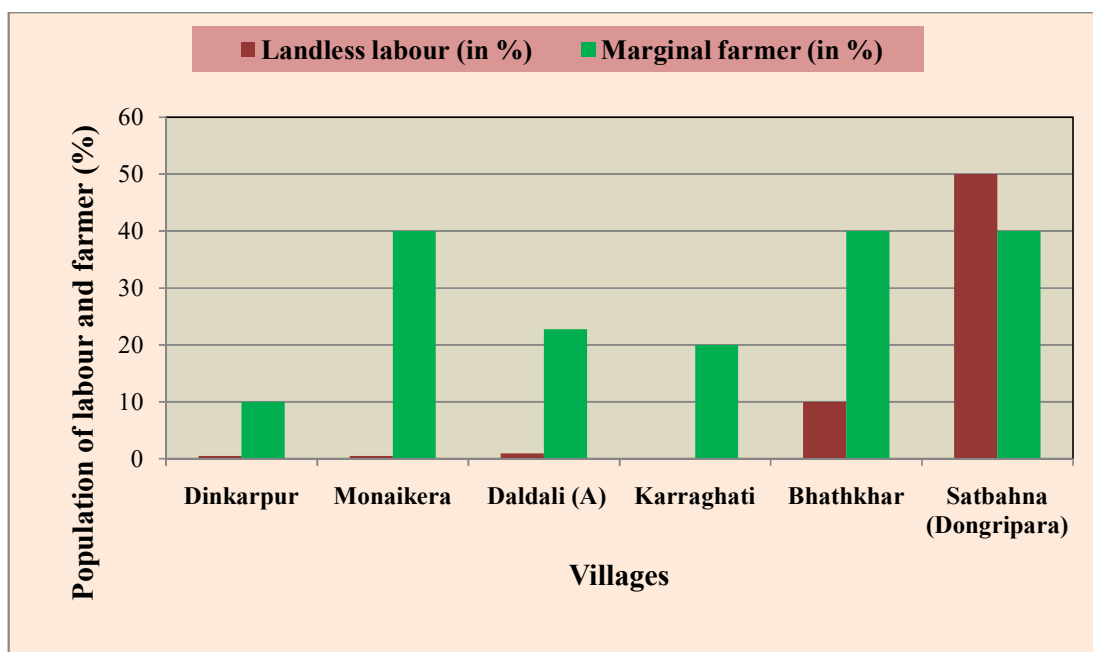


Fig. 4.3: Village wise population of landless labour and marginal farmer

The average size of land holding was ranges from 0.825 – 7.65%. It was highest in Dinkarpur (7.65) acres followed by Karraghati (4.175) acres and lowest in Satbahna (Dongripara) (0.825) acres followed by Monaikera (1.3) acres. Mono cropping practice was found in all villages and some farmers also take double cropping in the study area. Lack of irrigation facilities and traditional practices attributed to low cropping intensity and poverty.

Islam *et al.* (2015) reported that Bundu block in Ranchi district of Jharkhand A considerable percentage (46.95%) of the respondents was marginal farmers followed by small (26.22%), medium (17.68%) and large (9.15%) farmers. Islam *et al.* (2013) also reported that Bundu block in Ranchi district of Jharkhand that the average size of land holding per household was found to be 1.89 ha. The present investigation also observed that the percent of marginal farmers are 10-40 % in different villages as reported by above workers. The distribution of land between families are related with their social and economical condition the result confirms the result obtain in the study.

Bansode *et al.* (2005) reported that the land holding of farmer was very low it was 0.64 ha and the collectors were landless laboures. The total employment generation due to collection of medicinal plant products was 24.88 man days per family per year. In present investigation the land holding was recorded 0.80 ha to 0.456 ha. The land holding was higher this may be because of the social system where the number of family members may be less.

4.5.4 Production of Agricultural crops in selected villages

The people of the study area were engaged in an agriculture occupation. Depicted in Table 4.9 showed that highest production of agriculture crops in was recorded in Dinkarpur (715qtl.) followed by Karraghati (440qtl.) and lowest in Satbahna (Dongripara) (116.50qtl.) followed by Bhathkhar (176qtl.).The highest production of *Oryza sativa* was in Dinkarpur (456.) followed by Karraghati (295qtl.) and lowest in Satbahna (Dongripara) (85qtl.) followed by Bhathkhar (115qtl.). The highest production of *Zea mays* was in Dinkarpur (180.) followed by Karraghati (110qtl.) and lowest in Satbahna (Dongripara) (21qtl.) followed by Bhathkhar

Table 4.9: Crop Production pattern of study sites of Dhamtari, (C.G.)

S. No.	Crops	Dinkarpur (qtl.)	Monaikera (qtl.)	Daldali (A) (qtl.)	Karraghati (qtl.)	Bhathkhar (qtl.)	Satbahna (Dongripara) (qtl.)	Average Production (qtl.)
1	Paddy (<i>Oryza sativa</i>)	456	204	228	295	115	85	230.50
2	Maize (<i>Zea mays</i>)	180	72	84	110	42	21	84.83
3	Arhar (<i>Cajanus cajan</i>)	17	9	3	2	5	2.5	6.42
4	Gram (<i>Cicer aritinum</i>)	28	14	12	18	7	4	13.83
5	green gram (<i>Vigna radiata</i>)	8	2	2.6	5	2	1	3.43
6	black gram (<i>Vigna mungo</i>)	11	1.5	1.9	3	2	1	3.40
7	lathyrus (<i>Lathyrus sativus</i>)	15	2.5	3	7	3	2	5.42

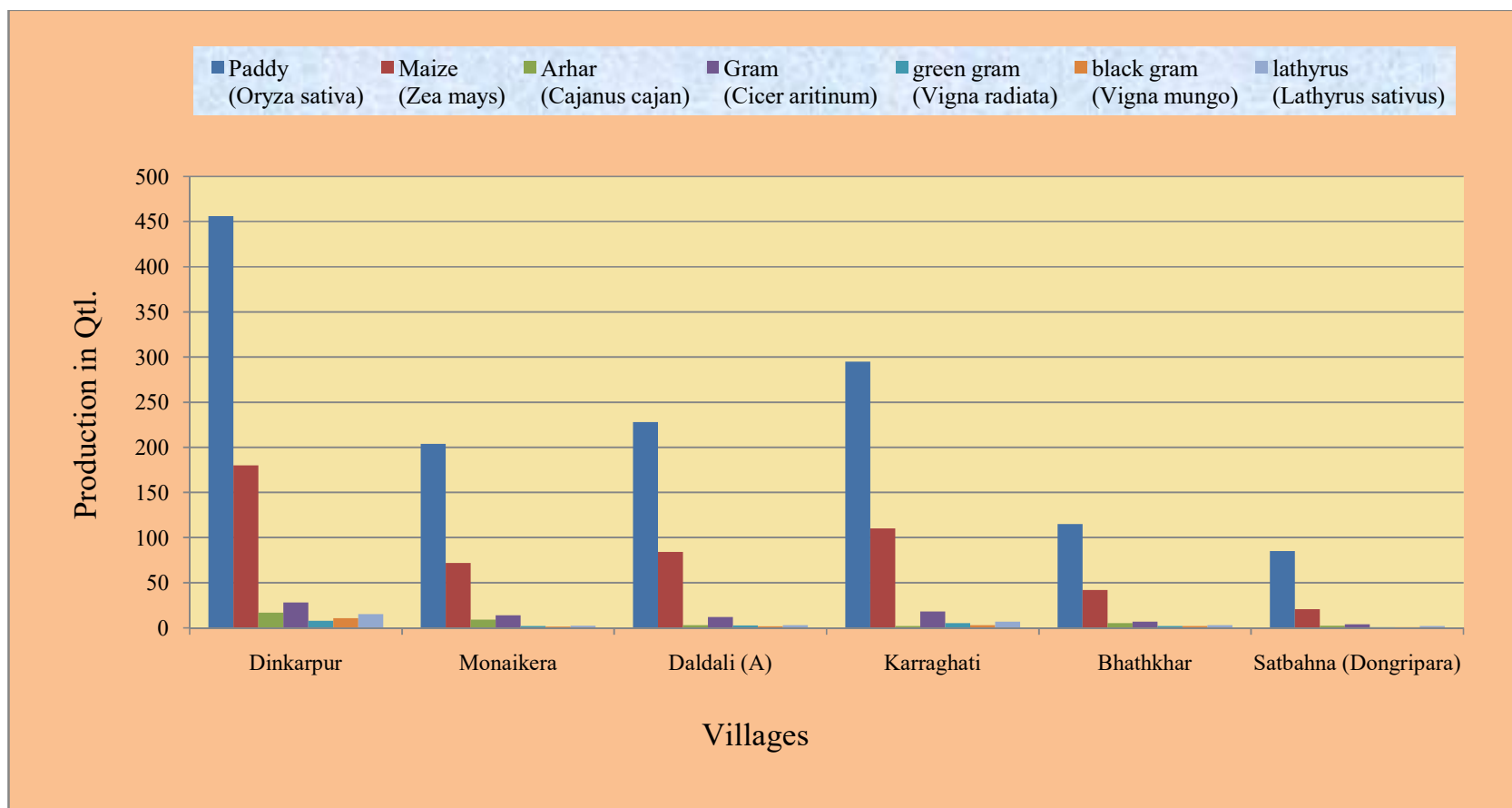


Fig. 4.4: Average food grain production in different villages at study area

(42qtl.). The highest production of *Cajanus cajan* was in Dinkarpur (17.) followed by Monaikera (9qtl.) and lowest in Karraghati (2qtl.) followed by Satbahna (Dongripara) (2.5qtl.). The highest production of *Cicer aritinum* was in Dinkarpur (28.) followed by Karraghati (18qtl.) and lowest in Satbahna (Dongripara) (4qtl.) followed by Bhathkhar (7qtl.). The highest production of *Vigna radiata* was in Dinkarpur (8.) followed by Karraghati (5qtl.) and lowest in Satbahna (Dongripara) (1qtl.) followed by Bhathkhar and Monaikera (2qtl.). The highest production of *Vigna mungo* was in Dinkarpur (11.) followed by Karraghati (3qtl.) and lowest in Satbahna (Dongripara) (1qtl.) followed by Monaikera (1.5qtl.). And the highest production of *Lathyrus sativus* was in Dinkarpur (15.) followed by Karraghati (7qtl.) and lowest in Satbahna (Dongripara) (2qtl.) followed by Monaikera (2.5qtl.). The average production of *Oryza sativa* (paddy), *Zea mays* (Maize), *Cajanus cajan* (Arhar), *Cicer aritinum* (Gram), *Vigna radiata* (Green gram), *Vigna mungo* (Black gram) and *Lathyrus sativus* (Lythyrus) was recorded 230.50qtl., 84.83qtl., 6.42 qtl., 13.83 qtl., 3.43 qtl., 3.40 qtl., and 5.42 qtl. respectively in the study area.

Choudhary *et al.* (2004) reported that in Bastar plateau of Chhattisgarh Paddy is the main crop. Besides, Nizer, Torai, Arhar, maize, Urd and Masrard. The productivity is very low of all the crops. Crop other than Paddy having negligible area. The production of Paddy, Maize, Arhar and Nizer and Urd was 216.50 qtl., 47 qtl., 2.05 qtl., 13 qtl. and 2.75 qtl. Respectively. The productivity of agriculture is also recorded quite low in the present investigation it was lower than the above worker this may be the location specific factors and social system may be responsible for the same. The lower productivity and low income because of an awareness about latest technology and variety of the crop which they are growing the crop rotation and proper fertilizer management insect pest population may be one of the reason regarding lower productivity of crop. The ignorance of information infrastructure may be the reason for lower production of agricultural crop.

Bhattacharya and Patra (2002) showed that Primitive Tribal Group dependent on agriculture for food. The total consumption from agriculture was 5313 kg./year in his study. The maximum production and intake of rice or its products

locally named '*pej*.' Similar observation were found in the present study where the production of paddy is high as compared to other crop. This is because of the food habit of the people and second the climatic conditions are responsible for the variation in production of crops. The results confirms as reported by above workers. The tribal farmers are not adopting the commercial agriculture or new technology they are happy to grow for their own consumption of crop not to earn more income.

4.5.5 Average money earning pattern in different villages per family

The average annual income earned by tribal from various enterprises is depicted in Table 4.10. The average household income for studied villages viz. Dinkarpur, Monaikera, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara) was Rs. 19,004, Rs. 18,430, Rs. 15,962, Rs. 23,000, Rs. 25,150 and Rs. 13,917 respectively. The maximum share of household income was contributed by agriculture crops followed by NTFPs and labour. The average household income was recorded maximum in Bhathkhar Rs. 25,150 followed by Karraghati Rs 23,000 and lowest in Satbahna (Dongripara) Rs. 13,917 followed by Daldali (A) Rs 15,962. The income from NTFPs was highest in Bhathkhar Rs 8,350 followed by KarraghatiRs.7575 and lowest in Satbahna (Dongripara) Rs 4,400 followed by Dinkarpur Rs. 5,620. The income from agriculture crops was highest in BhathkharRs. 9,670 followed by Dinkarpur Rs. 8,476 and lowest in Satbahna (Dongripara) Rs. 4,147 followed by Daldali (A) Rs. 5,432. The income from labour was highest in Karraghati Rs.7175 followed by Bhathkhar Rs.7,130 and lowest in Daldali (A) Rs.4,755 followed by Dinkarpur Rs.4908.

Similar study carried out by Moe and Liu (2016) reported in their study in Tharwady District of Myanmar that the NTFPs income contributes 44.37%, and farm income and non-farm income contribute 32.55% and 23.07% to the total household income respectively. Melaku et. al. (2014) reported in their study in South-western Ethiopia that the contribution of NTFPs to annual household income is 47%. 50% of the income was from agriculture and remaining 3% was from off-farm in. Islam *et al.* (2013) also reported that Bundu block in Ranchi district of Jharkhand that the agriculture contributed major share (36.23%) of total household

annual income followed by forest resources (25.05%), labour (9.74%), livestock (8.86%), business/ shop (8.72%), service (6.77%) and others (4.63%).

Maske *et al.* (2011) reported that Gondia district of Maharashtra the contribution of average income obtained from agriculture per households of villagers is Rs. 8847.57 (33.62%), Rs. 14310.20 (47.16%) and Rs. 7520.26 (19.22%) from Asalpani, Bagadband and Timezari respectively. And income generated from non timber forest produce was Rs. 917600, Rs. 917000 and Rs. 499000 which contribute 39.32 percent, 39.30 percent and 21.38 percent with Rs. 8847.57, Rs. 14310.20 and Rs. 7520.26 average income per households from Asalpani, Bagadband and Timezari.

Table4.10: Average annual income from different sources of individual families of study area Dhamtari, (C.G.)

S. No.	Village	Income from Agril. crop (in Rs.)	Income from NTFPs (in Rs.)	Income from labour (in Rs.)	Total / Year
Site 01 Dugli range					
1	Dinkarpur	8476 (44.60)	5620 (29.57)	4908 (25.82)	19004
2	Monaikera	5635 (30.57)	6925 (37.57)	5870 (31.85)	18430
	Average	7055.5	6272.5	5389	18717
Site 02 Nagri range					
3	Daldali (A)	5432 (34.03)	5775 (36.17)	4755 (29.78)	15962
4	Karraghati	8250 (35.86)	7575 (32.93)	7175 (31.19)	23000
	Average	6841	6675	5965	19481
Site 03 Sihawa range					
5	Bhathkhar	9670 (38.44)	8350 (33.20)	7130 (28.34)	25150
6	Satbahna (Dongripara)	4147 (29.79)	4400 (31.61)	5370 (38.58)	13917
	Average	6908.5	6375	6250	19533.5
	Over all Average	6935.00	6440.83	5868.00	19243.83

Note- Digits show in parentheses are in percentage of total income.

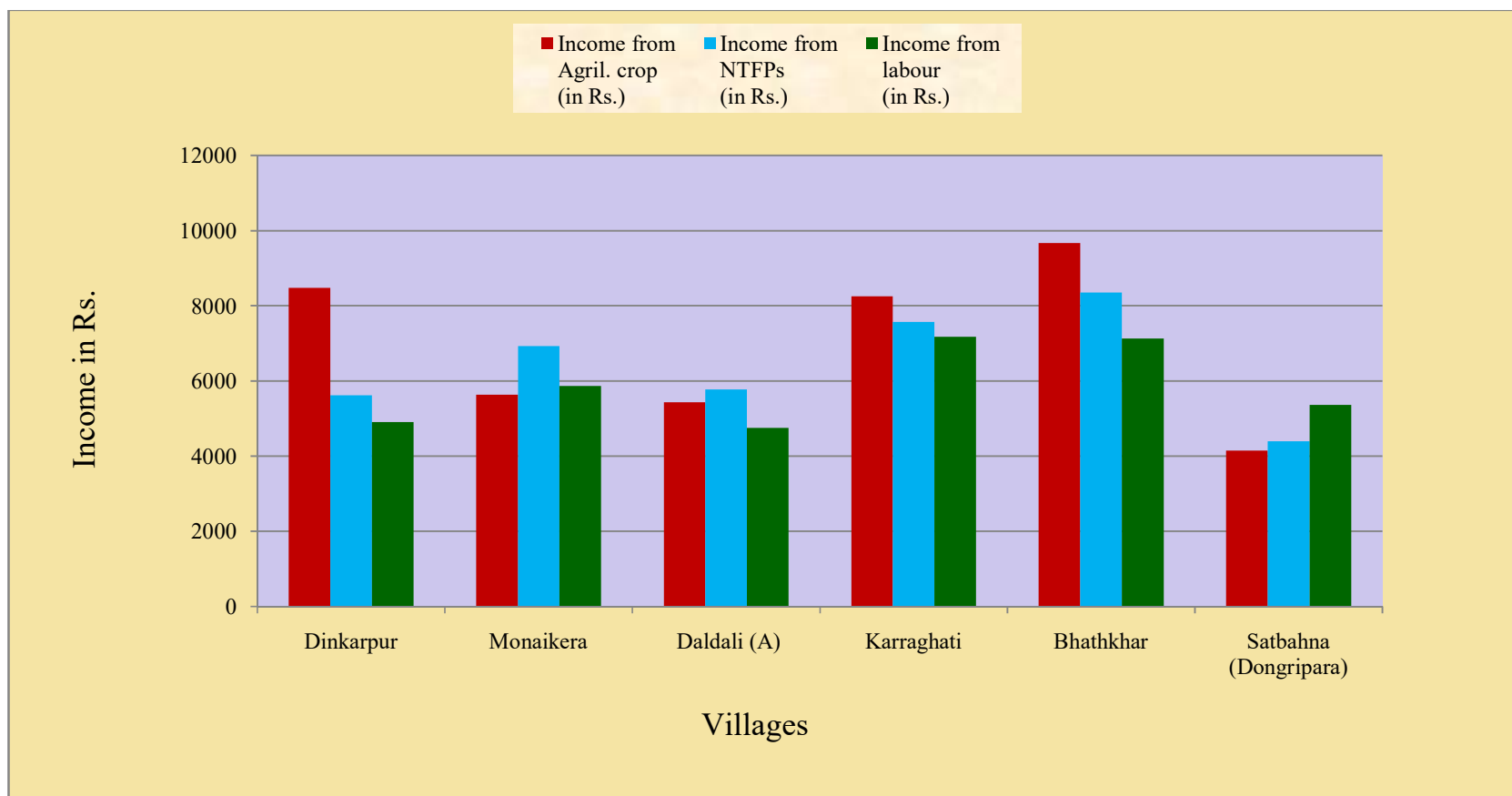


Fig. 4.5: Average annual earning pattern of income from different sources of individual family of study area

Saha and Sundriyal (2012) revealed that high dependence on wide variety of NTFPs in humid tropics of northeast India and NTFPs contributed to 19-32% of total household income for different tribal communities in northeast India. Rawat and Jishtu (2005) reported that NTFPs are significant source of subsistence products. Employment and household income in forest areas and it is estimated that these are contributing 50% to state revenue.

Bansode *et al.* (2005) reported in Sindhududutga district of Maharashtra that total annual income received from collection of medicinal plant products was about Rs. 8,681.55 (34.32%) to the total income received of Rs. 25,290 from all enterprises. The results are matches with some variation this may be because of location specific component and time span. In present investigation the Dugli range forest villages recorded almost 38% income from NTFPs followed by labour 32% and lowest 31% in agriculture and Nagri range 36% agriculture, 33% NTFPs and 31% as labour. The Sihawa range income from labour was 38% NTFPs 32% and lowest agriculture 30% reflect the social structure may be land holding and availability of NTFPs in the surrounding forest area. It can be said that all three study site income from enterprises are differ. This is very interesting that NTFPs is playing a significant role in the livelihood of the people almost it provide 1/3 income in their livelihood.

Bhattacharya and Hayat (2004) reported that in dry deciduous forest of Central India, Non- Timber Forest Products (NTFPs) are the major source of livelihood and income generation to local people. The livelihood of people is based on the NTFPs income in the current investigation confirms that the dependent and co existence of tribal with the forest vegetation.

Similar study carried out by Krishnamoorthy *et al.* (2003) reported that the average household income per household in Sathyamangalam (Tamilnadu) India Forest Range derived from NTFPs collection, which was Rs 17,088. Another similar study carried out in eight villages of Ghana, it was found that the percentage of households earning income from sale of NTFPs ranged from 49% in one village to 87% in another. The variations in village wise income mainly depends on the

population and involvement of people in particular enterprise as well the social system also responsible for income in our study the income is high this may be because of the old and current year as well the other services of income also computed in the overall income of per family. So the major share in income gathered from NTFPs as mentioned by above worker also confirms the results of present investigation. The overall share of income generate from NTFP is from 25 to 50% showed that the role of NTFPs is very important in the livelihood of these tribes. However the income from NTFPs enterprises can be increased through proper marketing value addition and MSP.

4.5.6 Men and Women participation in NTFPs collection in selected villages

The role of women in collection of NTFPs and their marketing is very important. Most of the time women engaged in gathering the forest products, processing and either sell them to support family economically or use them for own consumption. Table 4.11 showed that women are mostly engaged in collection of NTFPs. The women involvement in NTFPs collection varies from 47.83 – 56.09%. It was highest in Daldali (A) (56.09%) followed by Monaikera (55.32%) and lowest in Bhathkhar (47.83%) followed by Dinkarpur (48.54%). The participation of men in NTFPs collection varies from 13.41-21.55%. It was highest in Dinkarpur (21.55%) followed by Monaikera (19.53%) and lowest in village Bhathkhar (13.41%) followed by Karraghati (14.56%). Childrens also play an important role in collection of NTFPs. The percentage of children engaged in collection of NTFPs varies from 9.11 – 19.33%. It was highest in Dinkarpur (19.33%) followed by Monaikera (16.75%) and lowest in Bhathkhar (9.11%) followed by Satbahna (Dongripara) (11.54%). The average involvement trend was observed Women >Men > Children 51.86%, 17.10%, 14.17% in NTFPs collection respectively.

Similar study carried out by Haslkar and Jhadav (2004) reported that in West African region Women dominates in collection, trade and processing of majority of NTFPs. Women constituted 515 of total work force involved in forest based small industries. The women are playing a major role in collecting, processing and marketing in the present study also confirm results as it was concluded in above

workers investigation. The gender wise involvement is because of social structure of the tribes man are busy in hunting and drinking activity therefore, the responsibility goes on women for feeding the family it result they work hard as compared with men for the livelihood of the family.

Gera and Baghel (2000) reported that in Orissa two village studied and village income generated by NTFPs, about 11%, could be raised much collection and marketing was primarily undertaken by women. The Baiga and Gond community also responding the similar trends as observed by the above workers with the above tribes.

Vettivel (1997) concluded in his study that mostly womens are engaged in collecting different types of NTFPs and they start the collection from early morning. They form small group of ladies and work together. However, they collects the products individually like Tendu leaves, Char, Sal seed, Palas, Mahua, Bahera, Jamun and Ber etc. The rate of 100 bundles of tendu leaves they may get Rs.35. The FAO (1992) also reported in his study that nearly 90% of the population depends on NTFPs products from forest. FAO also concluded that NTFPs are the major source of livelihood in forest villages where 2,50,000 women are engaged in collection of NTFPs products. In the present investigation it was found that the women playing a major role in NTFPs collection and marketing confirms the statement given by FAO and above worker. Jadhav (2006) reported in Ratlam district of Madhya Pradesh, NTFPs are mainly collected by women and children. The traders are generally women in all the age group of 30-70 years. These traders are illiterate with no formal education. Women contributed over 90% of the traders in market. Phanikumar and Chaturvedi (2006) also reported that most of the tribal Women collected Non- Timber Forest Products to generate income. The major income generator products are leaves of *Butea monosperma* for making plates, *Diospyros melanoxylon* for Bidi making. In present investigation the Tendu leaves are the major share of overall other NTFPs because of the forest structure and womens are the major stock holder in collection and trading of NTFP produce confirms the involvement of women in this enterprise.

Table 4.11: Details of the men and women ratio in different villages of the study sites Dhamtari, (C.G.)

S. No.	Village	Men (in %)	Women (in %)	Children (in %)	Total (in %)
Site 01 Dugli Range					
1	Dinkarpur	21.55	48.54	19.33	89.42
2	Monaikera	19.53	55.32	16.75	91.6
Site 02 Nagri Range					
3	Daldali (A)	15.87	56.09	13.59	85.55
4	Karraghati	14.56	53.75	14.71	83.02
Site 03 Sihawa Range					
5	Bhathkhar	13.41	47.83	9.11	70.35
6	Satbahna (Dongripara)	17.69	49.61	11.54	78.84
	Average	17.10	51.86	14.17	83.13

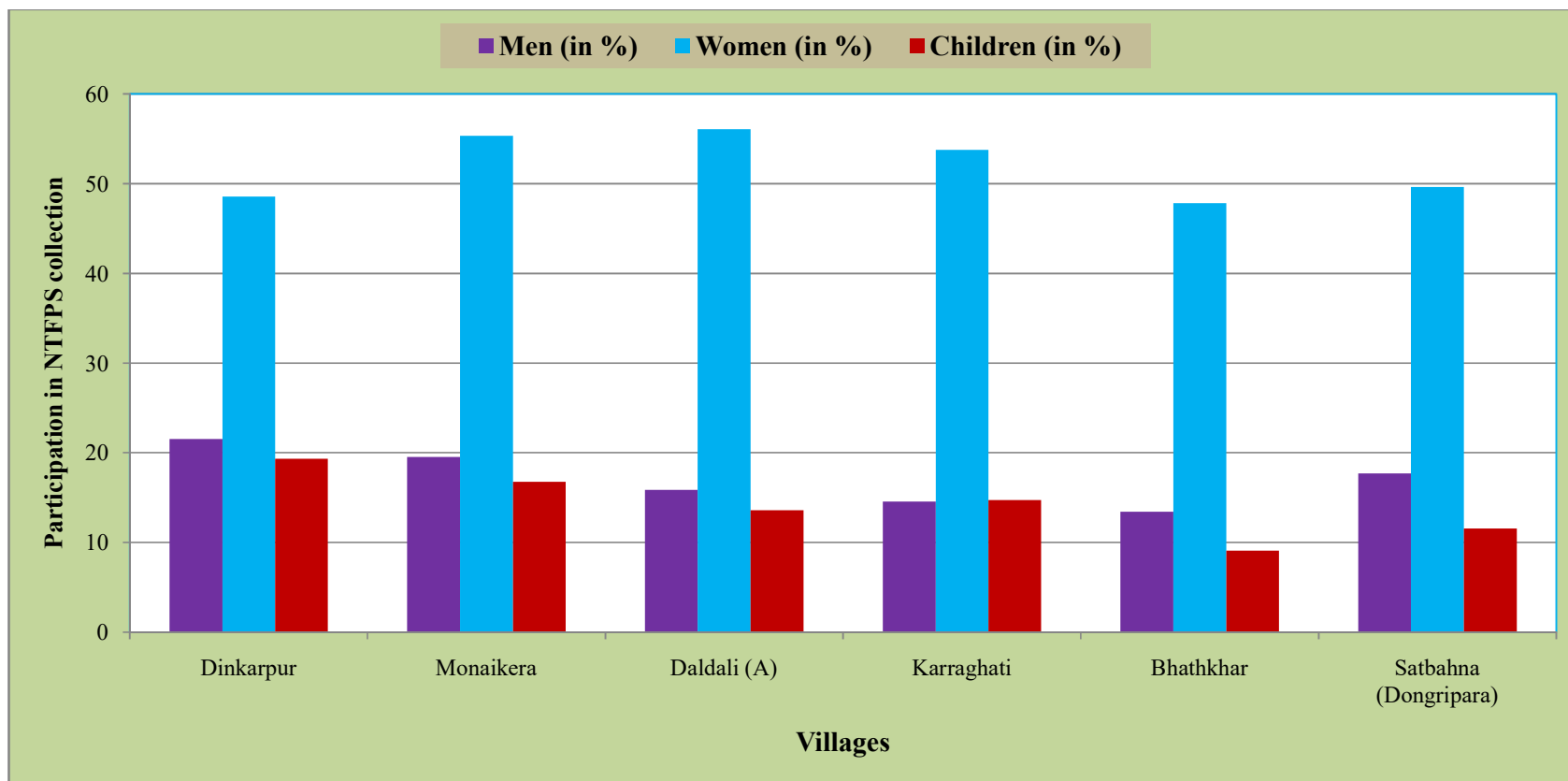


Fig. 4.6: Gender wise participation of men and women in NTFPS collection

4.5.7 Occupational status

There are three types of employment found in study area namely Bani, Mazdoori and Rozgar Guaranty Yozna. The rate of RGY was highest Rs. 172/day followed by Mazdoori Rs. 141.67/day and Bani Rs. 106.67/day. Mazdoori is a type of work in which people do any type of work like building, road, pond construction etc. it may be private or Government. The Rozgar Guaranty Yozna was a programme started by Government to provide work to rural or poor people throughout the year under 5-7 km. distance. Under this programme people first registered his name in Panchayat. Bani is a type of work in which the main aim is not to earn money but cooperate each other.

Table 4.12: The variation in wages fixed by Govt. and wages fixed by the local people in study area, Dhamtari, (C.G.)

S. No.	Village	Bani (in days) in local rate	Mazdoori (in days) in local rate	Rojgar Guaranty Yozna (in days) Govt. rate
Site 01 Dugli range				
1	Dinkarpur	100	150	172
2	Monaikera	80	100	172
	Average	90	125	172
Site 02 Nagri range				
3	Daldali (A)	100	150	172
4	Karraghati	120	150	172
	Average	110	150	172
Site 03 Sihawa range				
5	Bhathkhar	120	150	172
6	Satbahna (Dongripara)	120	150	172
	Average	120	150	172
	Over all Average	106.67	141.67	172.00

The people of selected villages involved in different work to earn money for their livelihood. In studied area nearly 3-4 months people engaged in different occupation when they free from agriculture work. Generally during summer men and women engaged in different occupation such as Bani, Mazdoori and Rozgar Guaranty Yozna.

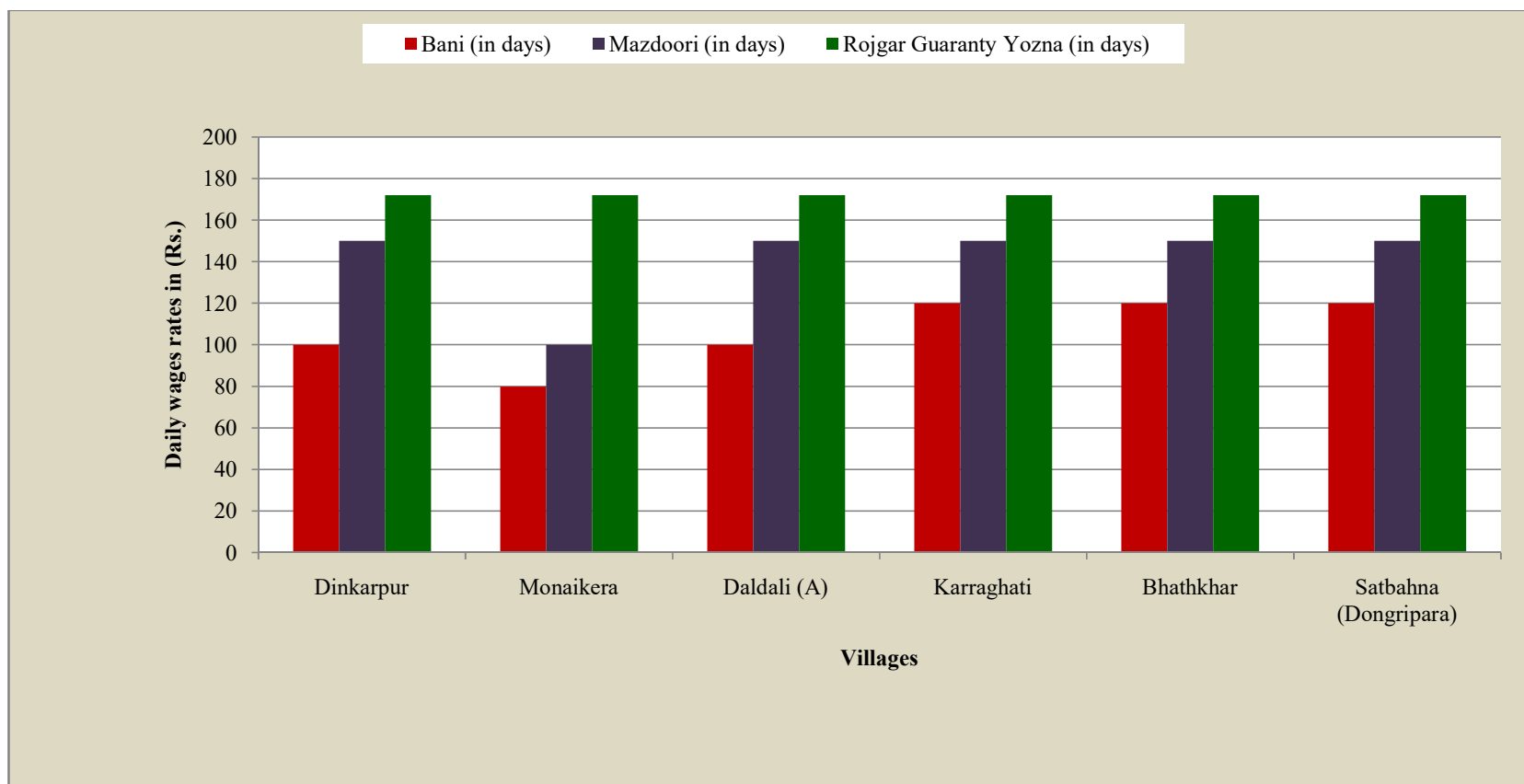


Fig. 4.7 daily wages income from different occupation of study area

The study area villagers income from Bani were ranges from 80-120Rs./day. It was highest in three villages Karraghati, Bhathkhar and Satbahna (Dongripara) (120Rs./day.) followed by Dinkarpur and Daldali (A) (100Rs./day.) and lowest income in Monaikera (80Rs./day.) In income from Mazdoori ranges from (100-150Rs./day). It was highest in five villages namely Dinkarpur, Daldali (A), Karraghati, Bhathkhar and Satbahna (Dongripara) (120Rs./day), lowest in Monaikera (100Rs./day.) Income from RGY 172Rs./day. In all villages (Table 4.12)

Basu *et al.* (2004) reported that Lodhas tribes were working as daily wages labourers and their (99.7%) household income ranged from Rs. 500-999 only. Household income of (80%) Santal was also Rs. 500-999. Only 3.6% of Santals had a monthly income of more than Rs. 2000 because they had their own land. Sivakumar *et al.* (2006) reported that in Kancheepuram district Tamilnadu 57.78% of farmers were working as laboures followed by 31.11% of the farmers involved in pig farming as cast occupation. Poffenberger (1994) reported that NTFPs generate some of lowest wages of the rural employment sector. The minimum wages in most states ranges from Rs.30 – 40 per day, most of the NTFPs collector's people earn from Rs. 5 – 15 per day. Similar trend was recorded in the present study where different type of employment is available with the season. People work in different type of employment in that area. The livelihood of tribes is better as compared to other worker reported this may be of because of the employment opportunities are higher in the present study area.

4.5.8 Utilization pattern of income in different sector

The tribal people expenditure of total income in various sector was food, medicine, clothes, festivals, education and others like festivals gift, celebration, marriages and tours etc. The Table 4.13 showed that total average expenditure was highest in Dinkarpur (Rs. 54050) followed by Monaikera (Rs. 44,350) and lowest in Daldali (A) (Rs. 33,250) followed by Satbahna (Dongripara) (Rs. 37,300). The average investment on food, medicine, clothes, festivals, education and other activities was Rs. 21,383.3, Rs.2800, Rs.3758.33, Rs.3958.33, Rs.2508.33, and Rs.7133.33 respectively.

Table 4.13: Distribution pattern of annual income utilized for different purposes of the respondents of study area Dhamtari, (C.G.)

S. No.	Village	Food	Medicine	Clothes	Festival	Education	Others	Total
Site 01 Dugli								
1	Dinkarpur	27900	3400	5100	4750	3300	9600	54050
2	Monaikera	23200	2900	3900	4100	2850	7400	44350
	Average	25550	3150	4500	4425	3075	8500	49200
Site 02 Nagri								
3	Daldali (A)	18300	2300	3150	3300	1800	4400	33250
4	Karraghati	22400	2700	3400	3800	2100	6700	41100
	Average	20350	2500	3275	3550	1950	5550	37175
Site 03 Sihawa								
5	Bhathkhar	17200	3100	3700	4100	2700	8400	39200
6	Satbahna (Dongripara)	19300	2400	3300	3700	2300	6300	37300
	Average	18250	2750	3500	3900	2500	7350	38250
	Over all Average	21383.3	2800	3758.33	3958.33	2508.33	7133.33	41541.7

Others - Festival gift, celebration, marriage and tour etc.

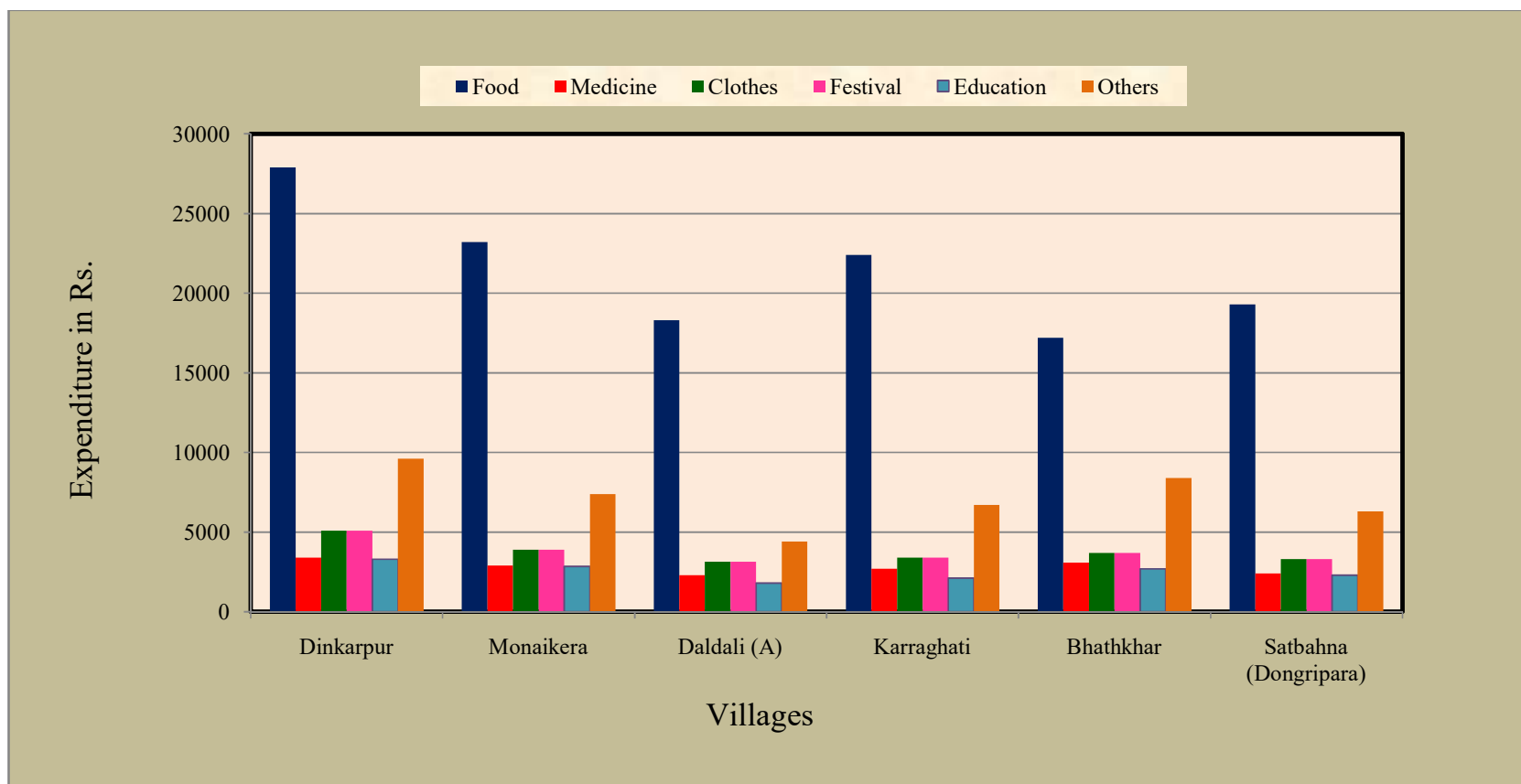


Fig. 4.8: Village wise utilization of money for different purposes

The highest expenditure on food among all studied villages was in Dinkarpur Rs. 27,900 followed by Monaikera Rs. 23,200 and lowest in Bhathkhar Rs.17,200 followed by Daldali (A) Rs. 18,300. The highest expenditure on medicine was in Dinkarpur Rs. 3400 followed by Bhathkhar Rs. 3,100 and lowest in Daldali (A) Rs. 2300 followed by Satbahna (Dongripara) Rs. 2,400. The highest expenditure on clothes was in Dinkarpur Rs. 5100 followed by Monaikera Rs. 3900 and lowest in Daldali (A) Rs.3150 followed by Satbahna (Dongripara) Rs. 3300. The highest expenditure on festival was in Dinkarpur Rs. 4750 followed by Monaikera and Bhathkhar Rs. 4100 and lowest in Daldali (A) Rs.3300 followed by Satbahna (Dongripara) Rs. 3700. The highest expenditure on education was in Dinkarpur Rs. 3300 followed by Monaikera Rs. 2850 and lowest in Daldali (A) Rs.1800 followed by Karraghathi Rs. 2100. The highest expenditure on others was in Dinkarpur Rs. 9600 followed by Bhathkhar Rs. 8400 and lowest in Daldali (A) Rs.3150 followed by Satbahna (Dongripara) Rs. 6300. The variation in expenditure of their income as village wise clearly shows the social system of that village followed by the income earned. Almost half of the total income or more is spent on food > festival>clothes >medicine>education. The one fourth is spent on the other sector. The livelihood of people may be uplifted through sustainable harvest value addition and proper marketing of their produce. The average expenditure was recorded Rs. 41,541.7 in the study area.

4.6 Phytosociological vegetation analysis of NTFPs species in study area

The tree density was highest on Dugli range (2050 stem ha¹) followed by Nagri range (700 stem ha¹) and lowest on Sihawa range (650 stem ha¹). The shrubs and climber density was highest on Dugli range (1790 stem ha¹) followed by Nagri range (960 stem ha¹) and lowest on Sihawa range (930 stem ha¹). The herbs density was highest on Dugli range (2050 stem ha¹) followed by Nagri range (1570 stem ha¹) and lowest on Sihawa range (1910 stem ha¹).

The tree frequency was highest on Dugli range (880 %) followed by Sihawa range (320%) and lowest on Nagri range (310 %). The shrubs and climber density was highest on Dugli range (540 %) followed by Nagri range (280 %) and lowest on

Sihawa (220 %). The herbs density was highest on Dugli range (380 %) followed by Nagri range (250 %) and lowest on Sihawa range (230 %).

The tree basal area was highest on Sihawa range (36.23 m²/ha) followed by Dugli range (34.65 m²/ha) and lowest on Nagri range (30.50 m²/ha). The shrubs and climber density was highest on Sihawa range (2.00 m²/ha) followed by Nagri range (1.69 m²/ha) and lowest on Dugli range (1.23 m²/ha). The herbs density was highest on Dugli range (6.82 m²/ha) followed by Nagri range (0.58 m²/ha) and lowest on Sihawa range (0.127 m²/ha).

Dominance (Importance Value Index) of trees at Dugli range

Cleistanthus collinus was the dominant species in the Dugli range, with the IVI value 84.48. The Co-dominant species are *Shorea robusta* and *Terminalia tomentosa* with IVI value 51.51 and 27.64 respectively. A total of 15 tree species are recorded from the Dugli range. 100% frequency was reported by the *Cleistanthus collinus* and 10% frequency was recorded for the only one species *Schleichera oleosa*. Highest Basal Area was recorded for the *Cleistanthus collinus* 12.39. Lowest Basal Area was observed for the *Embllica officinalis* 0.20. The minimum IVI value (2.26) was reported for the *Schleichera oleosa*. *Cleistanthus collinus* has the 28.16% share in the forest of the Dugli range. Density of 2050 tree stems ha⁻¹ was recorded in the Dugli range. The density was recorded highest (770 stems ha⁻¹) for *Cleistanthus collinus* followed by *Shorea robusta* (240 stems ha⁻¹) and lowest was recorded for *Schleichera oleosa* (10 stems ha⁻¹), (Table 4.14).

Dominance (Importance Value Index) of Shrubs and Climber at Dugli range

The maximum IVI (56.33) was for the *Phoenix acaulis*. *Bauhinia vahlii* and *Dioscorea hispida* has the IVI value of 49.56 and 43.62 respectively. 100% Frequency was recorded for the *Dioscorea hispida*. Lowest Frequency 30% was observed for the two species *Argyreia involucrate* and *Smilax macrophylla*. Highest Basal Area was recorded for the *Bauhinia vahlii* 0.42. Lowest Basal Area was observed for the *Dioscorea hispida* 0.01. A Density of (1790) Shrubs and Climber stems ha⁻¹ was recorded in the Dugli range. The density was recorded highest



Observation of tree diameter



Observation of Chhind diameter



Observation on collar diameter

Plate 4.6 Measurement of diameter at breast height tree, shrubs and herbs

Table 4.14: Vegetation analysis of Trees in Dugli study site, Dhamtari, (C.G.)

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m ² /ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Char	<i>Buchanania lanzan</i>	70	90	0.34	7.95	4.39	0.98	13.32
Sal	<i>Shorea robusta</i>	90	240	10.31	10.23	11.71	29.57	51.51
Karra	<i>Cleistanthus collinus</i>	100	770	12.39	11.36	37.56	35.55	84.48
Anola	<i>Emblica officinalis</i>	30	30	0.20	3.41	1.46	0.57	5.44
Bija	<i>Pterocarpus marsupium</i>	60	70	1.92	6.82	3.41	5.50	15.73
Tendu	<i>Diospyros melanoxylon</i>	60	150	0.85	6.82	7.32	2.44	16.57
Mahua	<i>Madhuca latifolia</i>	60	120	0.68	6.82	5.85	1.95	14.62
Haldu	<i>Adina cordifolia</i>	50	80	0.63	5.68	3.90	1.80	11.38
Dhawra	<i>Anogeissus latifolia</i>	70	80	0.61	7.95	3.90	1.74	13.60
Saja	<i>Terminalia tomentosa</i>	90	180	3.01	10.23	8.78	8.63	27.64
Moyan	<i>Lannea coromandelica</i>	80	90	1.70	9.09	4.39	4.89	18.37
Bhelwa	<i>Semecarpus anacardium</i>	40	40	0.66	4.55	1.95	1.88	8.38
Teak	<i>Tectona grandis</i>	40	60	0.60	4.55	2.93	1.71	9.18
Neem	<i>Azadirachta indica</i>	30	40	0.75	3.41	1.95	2.16	7.52
Kusum	<i>Schleichera oleosa</i>	10	10	0.22	1.14	0.49	0.64	2.26
Total		880	2050	34.85	100	100	100	300

Table 4.15: Vegetation analysis of Shrubs and Climber in Dugli study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m ² /ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Chhind	<i>Phoenix acaulis</i>	90	110	0.41	16.67	6.15	33.52	56.33
Chikti	<i>Triumfetta rhomboidea</i>	40	190	0.20	7.41	10.61	16.52	34.55
Gotia	<i>Ziziphus xylopyra</i>	70	130	0.04	12.96	7.26	3.21	23.43
Bendrachar	<i>Argyrea involucrate</i>	30	70	0.07	5.56	3.91	5.60	15.07
Mahul	<i>Bauhinia vahlii</i>	50	110	0.42	9.26	6.15	34.15	49.56
Baichandi	<i>Dioscorea hispida</i>	100	430	0.01	18.52	24.02	1.08	43.62
Ramdatun	<i>Smilax macrophylla</i>	30	50	0.02	5.56	2.79	1.25	9.60
Karukand	<i>Dioscorea bulbifera</i>	60	310	0.02	11.11	17.32	1.85	30.28
Keoti	<i>Ventilago calyculata</i>	70	390	0.03	12.96	21.79	2.82	37.57
Total		540	1790	1.23	100	100	100	300

Table 4.16 Vegetation analysis of Herbs in Dugli study site, Dhamtari, (C.G.)

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m ² /ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Tikhur	<i>Curcuma angustifolia</i>	100	670	3.89	26.32	35.08	56.99	118.38
Safed musli	<i>Chlorophytum tuberosum</i>	60	310	1.06	15.79	16.23	15.51	47.53
Kali musli	<i>Curculigo orchioides</i>	50	260	0.92	13.16	13.61	13.44	40.21
Kalmegh	<i>Andrographis paniculata</i>	60	330	0.03	15.79	17.28	0.41	33.48
Gengi	<i>Curcuma zedoaria</i>	70	270	0.93	18.42	14.14	13.58	46.14
Satavar	<i>Asparagus racemosus</i>	40	70	0.00	10.53	3.66	0.06	14.25
Total		380	1910	6.8268	100	100	100	300

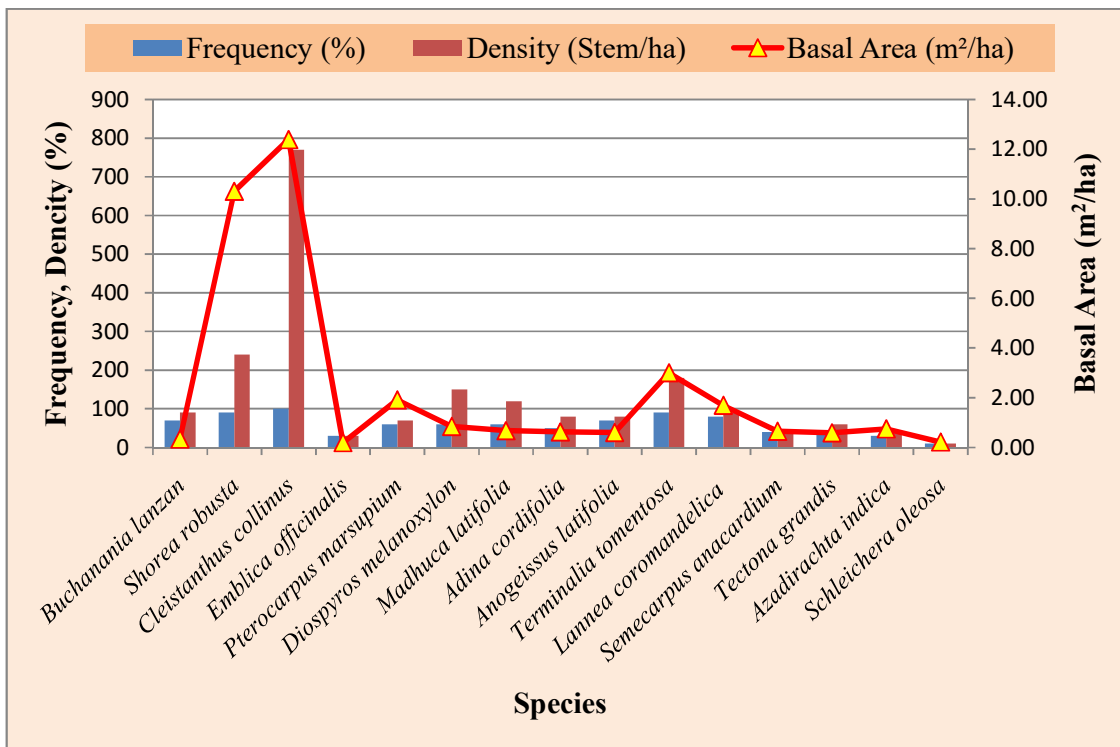


Fig. 4.9: Vegetation analysis of Trees in Dugli ranges

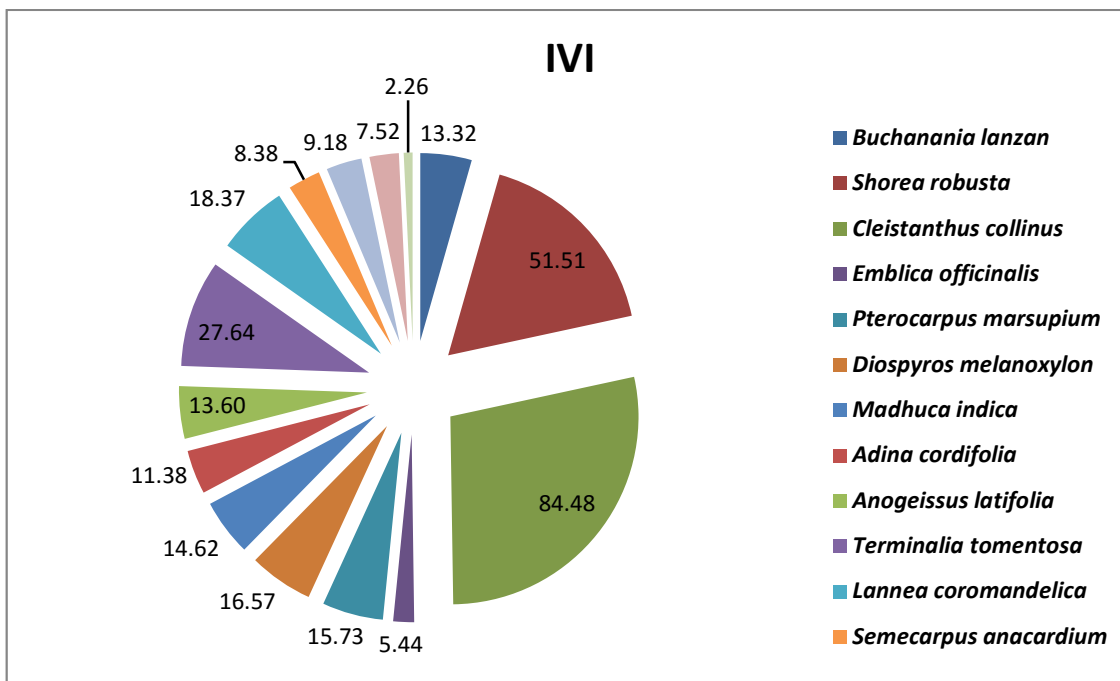


Fig. 4.10 Tree species based on IVI value in Dugli range

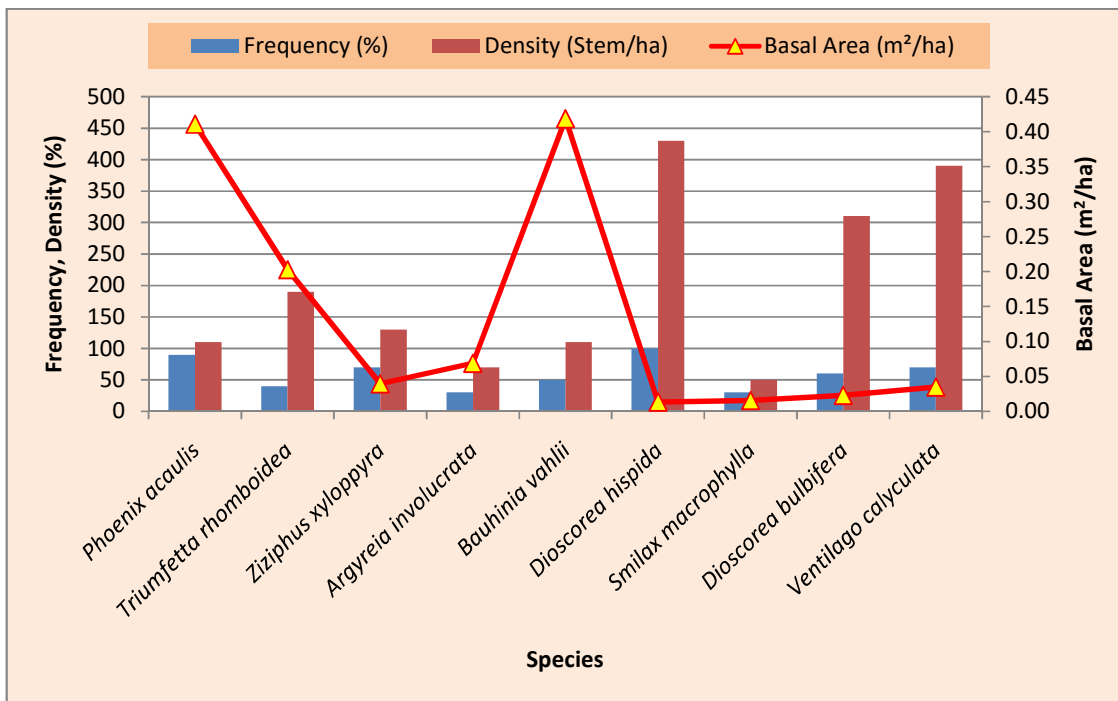


Fig. 4.11: Vegetation analysis of Shrubs and Climber in Dugli range

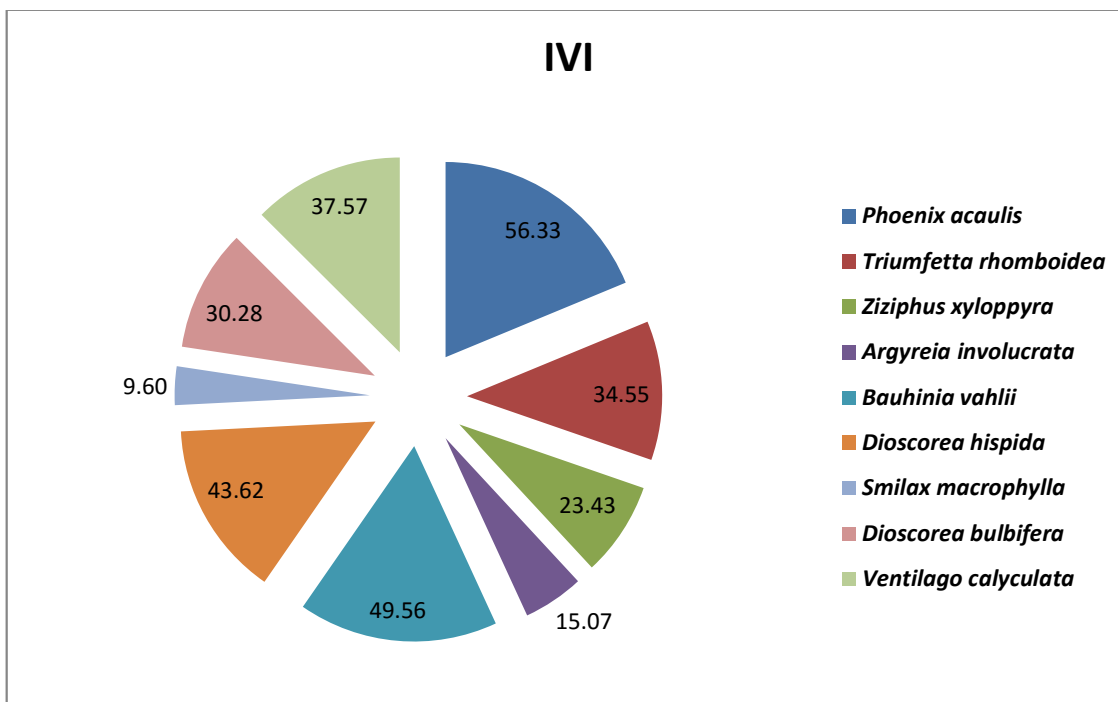


Fig. 4.12: Shrubs and Climber species based on IVI value in Dugli range

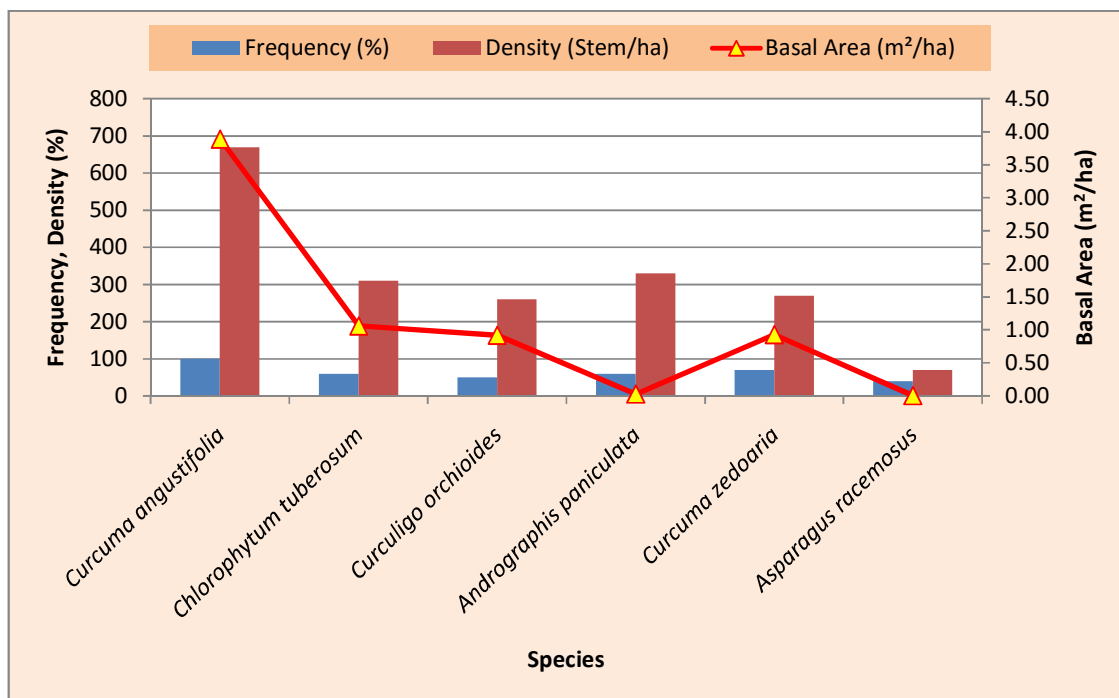


Fig. 4.13: Vegetation analysis of Herbs in Dugli range

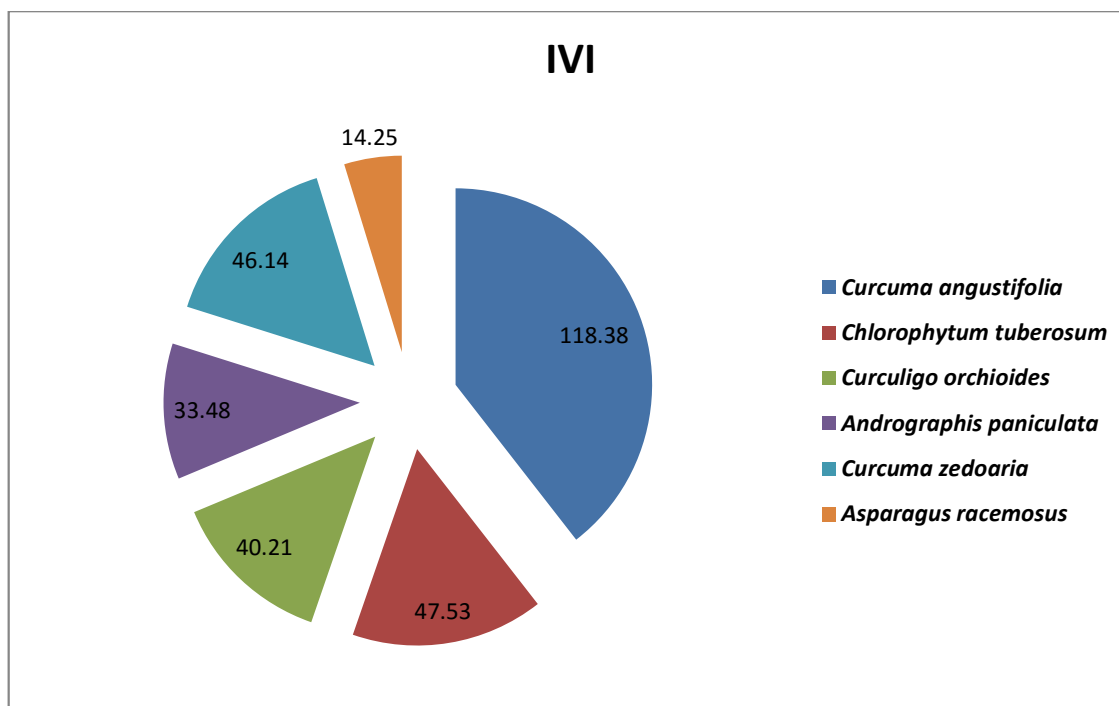


Fig. 4.14: Herbs species based on IVI value in Dugli range

(430 stems ha⁻¹) for *Dioscorea hispida* followed by *Ventilago calyculata* (390 stems ha⁻¹) and lowest was recorded for *Smilax macrophylla* (50 stems ha⁻¹). The minimum IVI Value (9.60) was recorded for the *Smilax macrophylla* (Table 4.15).

Dominance (Importance Value Index) of herbs at Dugli range

The maximum IVI (118.38) was for the *Curcuma angustifolia*. *Chlorophytum tuberosum* and *Curcuma zedoaria* has the IVI value of 47.53 and 46.14 respectively. 100% Frequency was recorded for the *Curcuma angustifolia*. Lowest Frequency 40% was observed for *Asparagus racemosus*. Highest Basal Area was recorded for the *Curcuma angustifolia* 3.89. Lowest Basal Area was observed for the *Andrographis paniculata* 0.03. A Density of (1910) herbs stems ha⁻¹ was recorded in the Dugli range. The density was recorded highest (670 stems ha⁻¹) for *Curcuma angustifolia* followed by *Andrographis paniculata* (330 stems ha⁻¹) and lowest was recorded for *Asparagus racemosus* (70 stems ha⁻¹). The minimum IVI Value (14.25) was recorded for the *Asparagus racemosus* (Table 4.16).

Dominance (Importance Value Index) of trees at Nagri range

Shorea robusta was the dominant species in the Nagri range, with the IVI value 185.71. The Co-dominant species are *Lagerstroemia parviflora* and *Lannea coromandelica* with IVI value 25.30 and 20.79 respectively. 100 % frequency was reported by the *Shorea robusta*. 10% frequency was observed by the three species *Terminalia chebula*, *Adina cordifolia* and *Pterocarpus marsupium*. Highest Basal Area was recorded for the *Shorea robusta* 26.76. Lowest Basal Area was observed for the *Terminalia chebula* 0.03. The minimum IVI value (4.75) was reported for the *Terminalia chebula*. *Shorea robusta* has the 61.90% share in the forest of the Nagri range. A density of 700 tree stems ha⁻¹ was recorded in the Nagri range. The density was recorded highest (460 stems ha⁻¹) for *Shorea robusta* followed by (50 stems ha⁻¹) two species *Lagerstroemia parviflora*, *Madhuca latifolia* and lowest was recorded (10 stems ha⁻¹) for three species *Terminalia chebula*, *Adina cordifolia* and *Pterocarpus marsupium*.(Table4.17).

Dominance (Importance Value Index) of Shrubs and Climber at Nagri range

The maximum IVI (113.42) was for the *Holarrhena antidysenterica*. *Phoenix acaulis* and *Argyreia involucrate* has the IVI value of 88.72 and 63.33 respectively. Highest Frequency 90% was recorded for the *Phoenix acaulis*. Lowest Frequency 10% was observed for the two species *Lantana camara* and *Gloriosa superb*. Highest Basal Area was recorded for the *Holarrhena antidysenterica* 0.73. Lowest Basal Area was observed for the *Cucumis melo agrestis* 0.01. A Density of (960) Shrubs and Climber stems ha⁻¹ was recorded in the Dugli range. The density was recorded highest (400 stems ha⁻¹) for *Holarrhena antidysenterica* followed by *Phoenix acaulis* (310 stems ha⁻¹) and lowest was recorded for *Gloriosa superb* (10 stems ha⁻¹). The minimum IVI Value (6.66) was recorded for the *Gloriosa superb* (Table 4.18).

Dominance (Importance Value Index) of herbs at Nagri range

The maximum IVI (185.01) was for the *Daedalacanthus roseus*. The Co-dominant species *Hemidesmus Indicus* with the IVI value 40.17. Highest Frequency 90% was recorded for the *Daedalacanthus roseus*. Lowest Frequency 40% was observed for *Andrographis paniculata*. Highest Basal Area was recorded for the *Daedalacanthus roseus* 0.52. Lowest Basal Area was observed for the *Curculigo orchioides* 0.01. A Density of (1570) herbs stems ha⁻¹ was recorded in the Nagri range. The density was recorded highest (960 stems ha⁻¹) for *Daedalacanthus roseus* followed by *Andrographis paniculata* (250 stems ha⁻¹) and lowest was recorded for *Curculigo orchioides* (160 stems ha⁻¹). The minimum IVI Value (38.71) was recorded for the *Andrographis paniculata* (Table 4.19)

Table 4.17 Vegetation analysis of Trees in Nagri study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (stem/ha)	Basal area (m ² /ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Sal	<i>Shorea robusta</i>	100	460	26.76	32.26	65.71	87.74	185.71
Moyan	<i>Lannea coromandelica</i>	40	40	0.66	12.90	5.71	2.17	20.79
Senha	<i>Lagerstroemia parviflora</i>	50	50	0.62	16.13	7.14	2.02	25.30
Bhelwa	<i>Semecarpus anacardium</i>	20	20	0.24	6.45	2.86	0.77	10.08
Chhar	<i>Buchanania lanzan</i>	20	30	0.30	6.45	4.29	0.99	11.73
Mahua	<i>Madhuca latifolia</i>	30	50	1.21	9.68	7.14	3.98	20.80
Harra	<i>Terminalia chebula</i>	10	10	0.03	3.23	1.43	0.09	4.75
Haldu	<i>Adina cordifolia</i>	10	10	0.16	3.23	1.43	0.51	5.17
Amaltas	<i>Cassia fistula</i>	20	20	0.22	6.45	2.86	0.73	10.04
Bija	<i>Pterocarpus marsupium</i>	10	10	0.30	3.23	1.43	0.99	5.65
Total		310	700	30.50	100	100	100	300

Table 4.18: Vegetation analysis of Shrubs and Climber in Nagri study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m²/ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Korea	<i>Holarrhena antidysenterica</i>	80	400	0.73	28.57	41.67	43.18	113.42
Chhind	<i>Phoenix acaulis</i>	90	310	0.41	32.14	32.29	24.28	88.72
Lantana	<i>Lantana camara</i>	10	20	0.09	3.57	2.08	5.51	11.16
Bendrchar	<i>Argyreia involucrate</i>	60	170	0.41	21.43	17.71	24.20	63.33
Kaliyari	<i>Gloriosa superb</i>	10	10	0.03	3.57	1.04	2.05	6.66
Bodal	<i>Cucumis melo agrestis</i>	30	50	0.01	10.71	5.21	0.79	16.71
Total		280	960	1.69	100	100	100	300

Table 4.19: Vegetation analysis of Herbs in Nagri study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m²/ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Kalmegh	<i>Andrographis paniculata</i>	40	250	0.04	16.00	15.92	6.79	38.71
Dashmul	<i>Daedalacanthus roseus</i>	90	960	0.52	36.00	61.15	87.86	185.01
Kali musli	<i>Curculigo orchioides</i>	60	160	0.01	24.00	10.19	1.93	36.12
Anantmool	<i>Hemidesmus Indicus</i>	60	200	0.02	24.00	12.74	3.43	40.17
Total		250	1570	0.5865	100	100	100	300

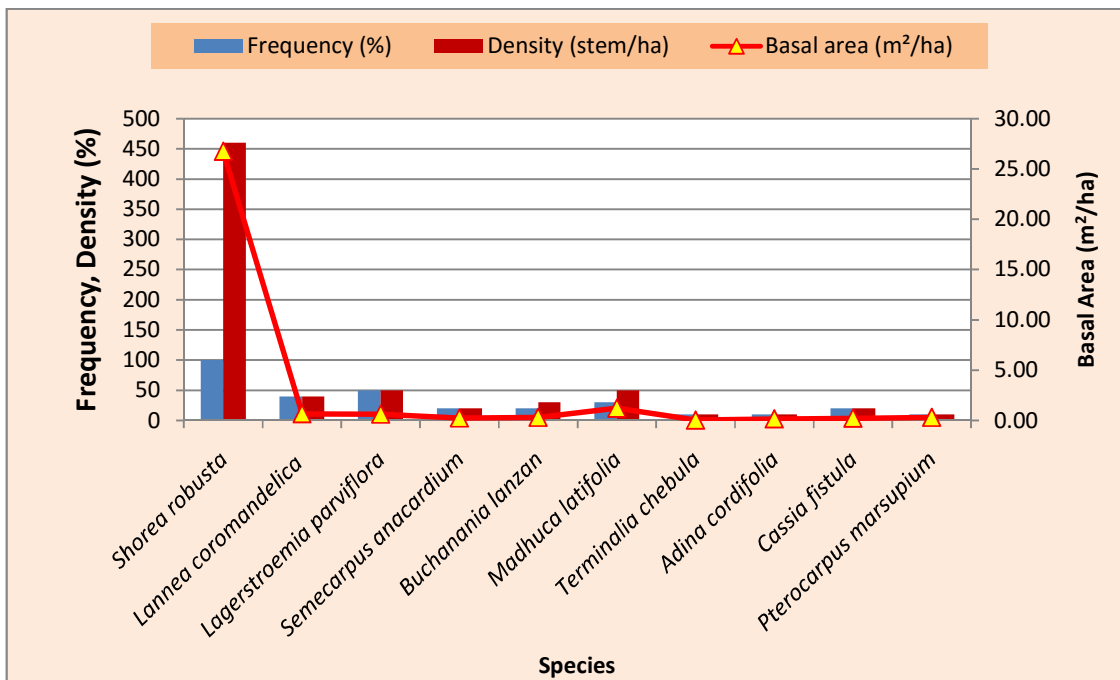


Fig. 4.15:Vegetation analysis of Trees in Nagri range

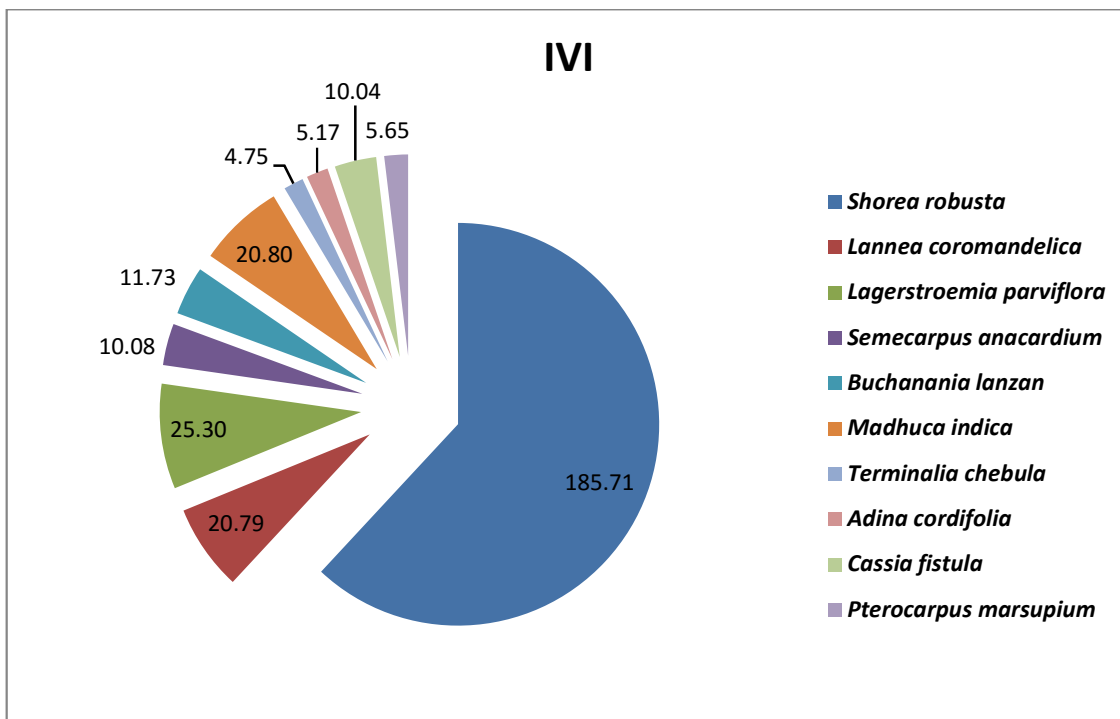


Fig. 4.16: Tree species based on IVI value in Nagri range

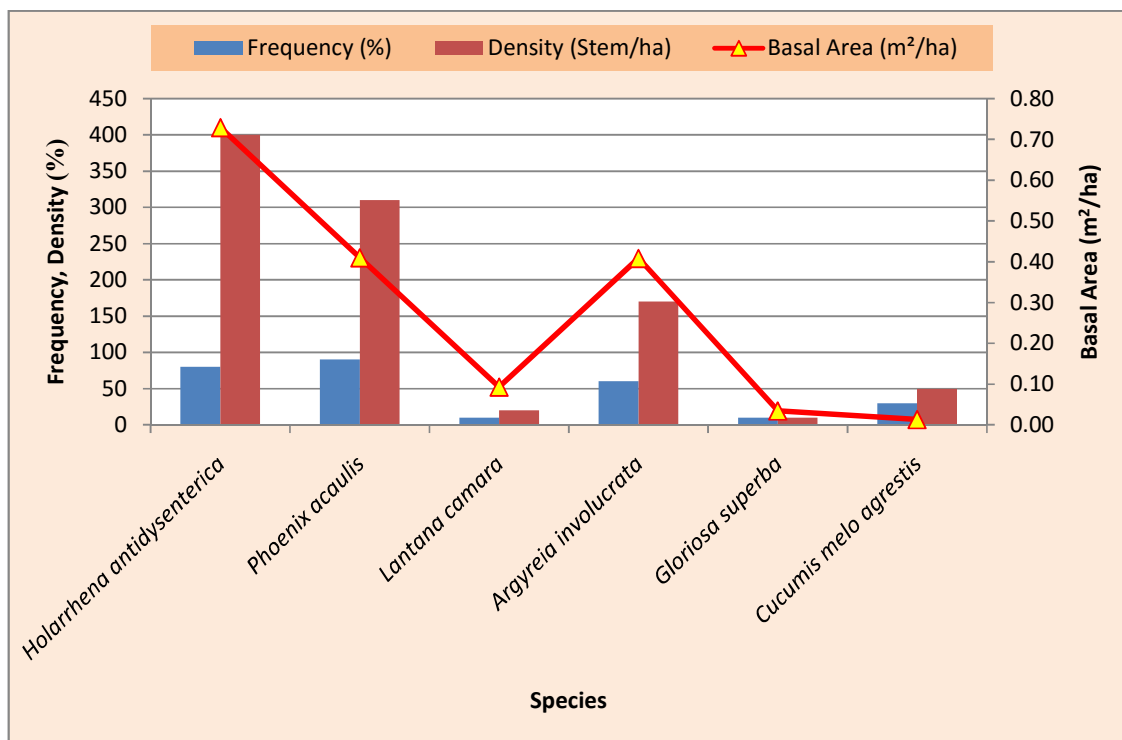


Fig. 4.17: Vegetation analysis of Shrubs and Climber in Nagri range

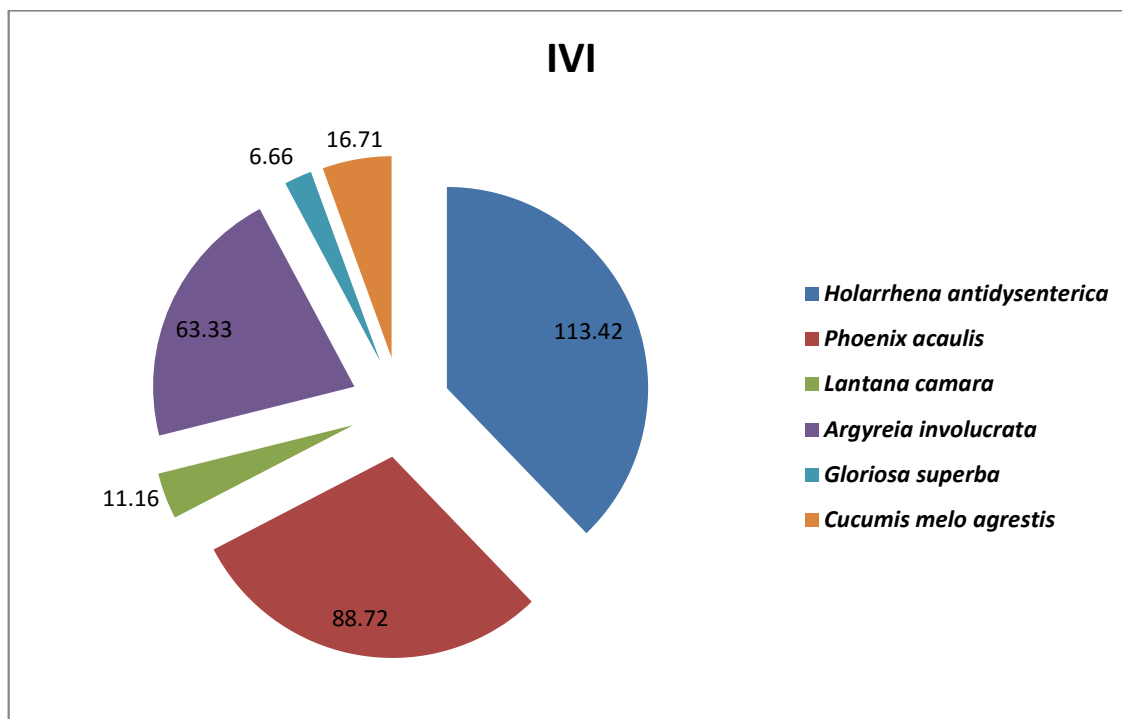


Fig. 4.18: Shrubs and Climber species based on IVI value in Nagri range

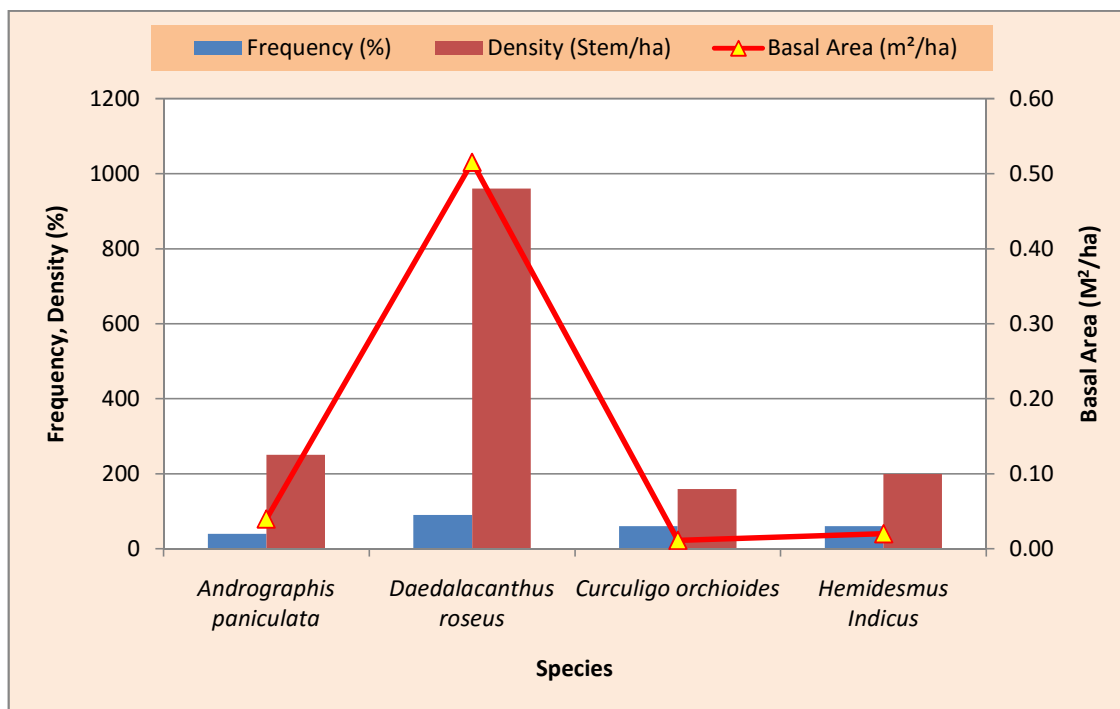


Fig. 4.19:Vegetation analysis of Herbs in Nagri range

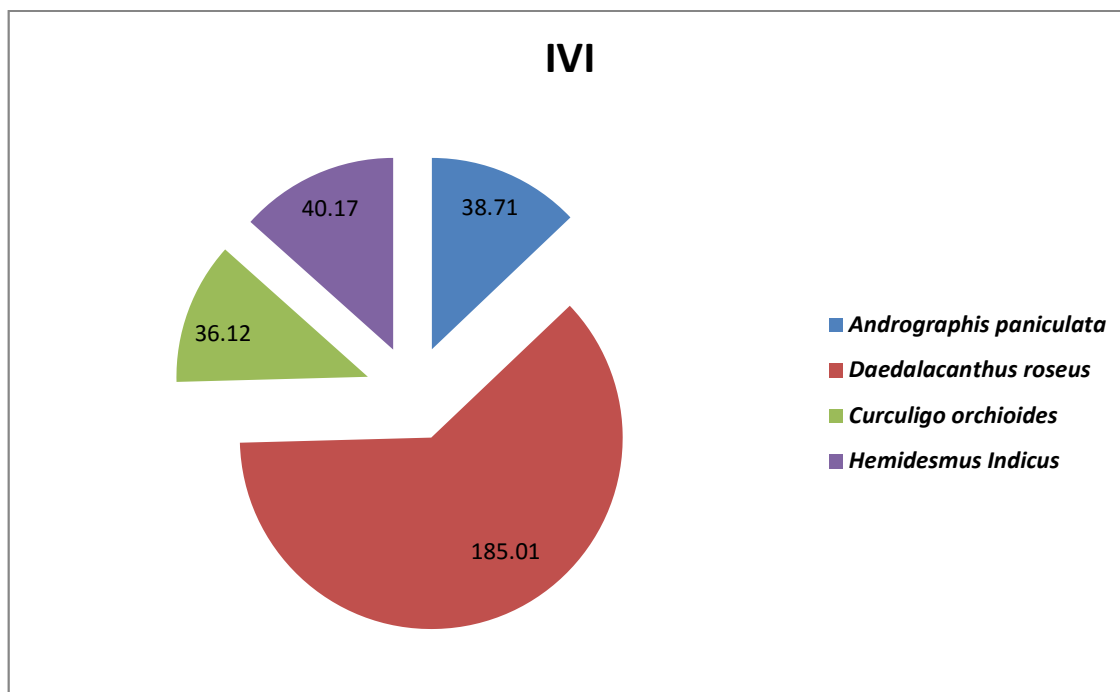


Fig. 4.20: Herbs species based on IVI value in Nagri range

Dominance (Importance Value Index) of trees at Sihawa range

Shorea robusta was the dominant species in the Sihawa range, with the IVI value 134.73. The Co-dominant species are *Pterocarpus marsupium* and *Diospyros melanoxylon* with IVI value 43.79 and 38.07 respectively. 100 % frequency was reported by the *Shorea robusta*. 10% frequency was observed by the three species *Anogeissus latifolia*, *Madhuca indica* and *Schleichera oleosa*. Highest Basal Area was recorded for the *Shorea robusta* 19.09. Lowest Basal Area was observed for the *Schleichera oleosa* 1.14. The minimum IVI value (8.97) was reported for the *Madhuca indica*. *Shorea robusta* has the 44.91% share in the forest of the Sihawa range. A density of 650 tree stems ha⁻¹ was recorded in the Sihawa range. The density was recorded highest (330 stems ha⁻¹) for *Shorea robusta* followed by *Diospyros melanoxylon* (80 stems ha⁻¹) and lowest was recorded for *Madhuca latifolia* (10 stems ha⁻¹), (Table 4.20).

Dominance (Importance Value Index) of Shrubs and Climber at Sihawa range

The maximum IVI (191.24) was for the *Holarrhena antidysenterica*. *Phoenix acaulis* and *Lantana camara* has the IVI value of 42.89 and 16.48 respectively. 100% Frequency was recorded for the *Holarrhena antidysenterica*. 10% Frequency was observed for the 5 species *Gardenia resinifera*, *Jasminum polyanthum*, *Argyrea involucre*, *Ziziphus xyloppyra* and *Helicterus isora*. Highest Basal Area was recorded for the *Holarrhena antidysenterica* 1.54. Lowest Basal Area was observed for the *Ziziphus xyloppyra* 0.01. A Density of (930) Shrubs and Climber stems ha⁻¹ was recorded in the Sihawa range. The density was recorded highest (640 stems ha⁻¹) for *Holarrhena antidysenterica* followed by *Phoenix acaulis* (130 stems ha⁻¹) and lowest was recorded (10 stems ha⁻¹) for two species *Gardenia resinifera* and *Ziziphus xyloppyra*. The minimum IVI Value (6.10) was recorded for the *Ziziphus xyloppyra* (Table 4.21).

Dominance (Importance Value Index) of herbs at Sihawa range

The maximum IVI (207.28) was for the *Andrographis paniculata*. The Co-dominant species *Daedalacanthus roseus* with the IVI value 32.45. 100% Frequency was

recorded for the *Andrographis paniculata*. Lowest Frequency 40% was observed for the 2 species *Daedalacanthus roseus* and *Asparagus racemosus*. Highest Basal Area was recorded for the *Andrographis paniculata* 0.1164. Lowest Basal Area was observed for the *Asparagus racemosus* 0.0033. A Density of (760) herbs stems ha⁻¹ was recorded in the Sihawa range. The density was recorded highest (550 stems ha⁻¹) for *Andrographis paniculata* followed by *Daedalacanthus roseus* (90 stems ha⁻¹) and lowest was recorded for *Asparagus racemosus* (60 stems ha⁻¹). The minimum IVI Value (27.88) was recorded for the *Asparagus racemosus* (Table 4.22).

Shahid & Joshi (2016) also reported that Dehra Dun forest division, Doon Valley, Uttarakhand, India. Phytosociological studies of the sites were conducted for tree species. Fifty quadrats of 10 × 10 m² size were laid on each site for studying the trees composition and structure. Diversity Indices were calculated for each site. Species richness ranged between six species in Thano to 15 species in Barkot. Two Way Indicator Species Analysis was performed and classified tree layer into eight groups depending on the eigen value. Bajpai *et al.* (2012) the mosaics of species distribution in any forest are governed by various environmental factors.

Similar study carried out by Khakhlyar & Sharma (2017) reported that the diversity of NTFPs of Garampani Wildlife Sanctuary in Karbi Anglong district, Assam, India. The data was collected by using random sampling method through laying quadrats along the transect of 5×5 m² (herbs & shrubs), 10×10 m² (tree) and calculated their diversity index and importance value index. 14 species of herbs/shrubs, 13 species of ferns/climber/epiphytes and 5 species of wild edible fruits were recorded. The average Shannon wiener index of diversity of different species were 1.96 (herbs/shrubs), 2.27 (ferns/climbers/epiphytic) and 1.50 (fruit edible) where ferns/climbers/ epiphytic species indicated higher importance value and diversity in comparison to herbs/shrubs and wild edible fruits species. *Delima sarmentosa* L. (climber) have high importance value index (115.81) and *Solanum indicum* L. (20.25) have lowest importance value index.

Criddle *et al.* (2003) have reported that vegetation of any place is the outcome interaction of many factors like meso-topographic gradients, the elevation,

Table 4.20:Vegetation analysis of trees in Sihawa study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m ² /ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Sal	<i>Shorea robusta</i>	100	330	19.09	31.25	50.77	52.71	134.73
Dhawra	<i>Anogeissus latifolia</i>	10	30	2.25	3.13	4.62	6.21	13.95
Bija	<i>Pterocarpus marsupium</i>	70	70	4.04	21.88	10.77	11.15	43.79
Tendu	<i>Diospyros melanoxylon</i>	50	80	3.67	15.63	12.31	10.14	38.07
Moyan	<i>Lannea coromandelica</i>	40	0	1.72	12.50	9.23	4.74	26.47
Saja	<i>Terminalia tomentosa</i>	30	50	2.75	9.38	7.69	7.60	24.67
Mahua	<i>Madhuca latifolia</i>	10	10	1.56	3.13	1.54	4.31	8.97
Kusum	<i>Schleichera oleosa</i>	10	20	1.14	3.13	3.08	3.15	9.36
Total		320	650	36.23	100	100	100	300

Table 4.21:Vegetation analysis of Shrubs and Climber in Sihawa study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m²/ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Korea	<i>Holarrhena antidysenterica</i>	100	640	1.54	45.45	68.82	76.97	191.24
Chhind	<i>Phoenix acaulis</i>	50	130	0.12	22.73	13.98	6.18	42.89
Lantana	<i>Lantana camara</i>	20	40	0.06	9.09	4.30	3.08	16.48
Kurru	<i>Gardenia resinifera</i>	10	10	0.10	4.55	1.08	5.10	10.72
Chameli	<i>Jasminum polyanthum</i>	10	30	0.08	4.55	3.23	3.78	11.55
Bendrchar	<i>Argyreia involucrate</i>	10	20	0.03	4.55	2.15	1.54	8.24
Gotia	<i>Ziziphus xyloppyra</i>	10	10	0.01	4.55	1.08	0.48	6.10
Altidori	<i>Helicterus isora</i>	10	50	0.06	4.55	5.38	2.87	12.79
Total		220	930	2.00	100	100	100	300

Table 4.22: Vegetation analysis of Herbs in Sihawa study site, Dhamtari, (C.G.).

Common Name	Botanical Name	Frequency (%)	Density (Stem/ha)	Basal Area (m²/ha)	Relative Frequency (RF)	Relative Density (RD)	Relative Basal Area (RBA)	IVI
Kalmegh	<i>Andrographis paniculata</i>	100	550	0.1164	43.48	72.37	91.44	207.28
Sattavar	<i>Asparagus racemosus</i>	40	60	0.0033	17.39	7.89	2.59	27.88
Dashmul	<i>Daedalacanthus roseus</i>	40	90	0.0041	17.39	11.84	3.22	32.45
Kakai	<i>Flacourtia indica</i>	50	60	0.0035	21.74	7.89	2.75	32.38
Total		230	760	0.1273	100	100	100	300

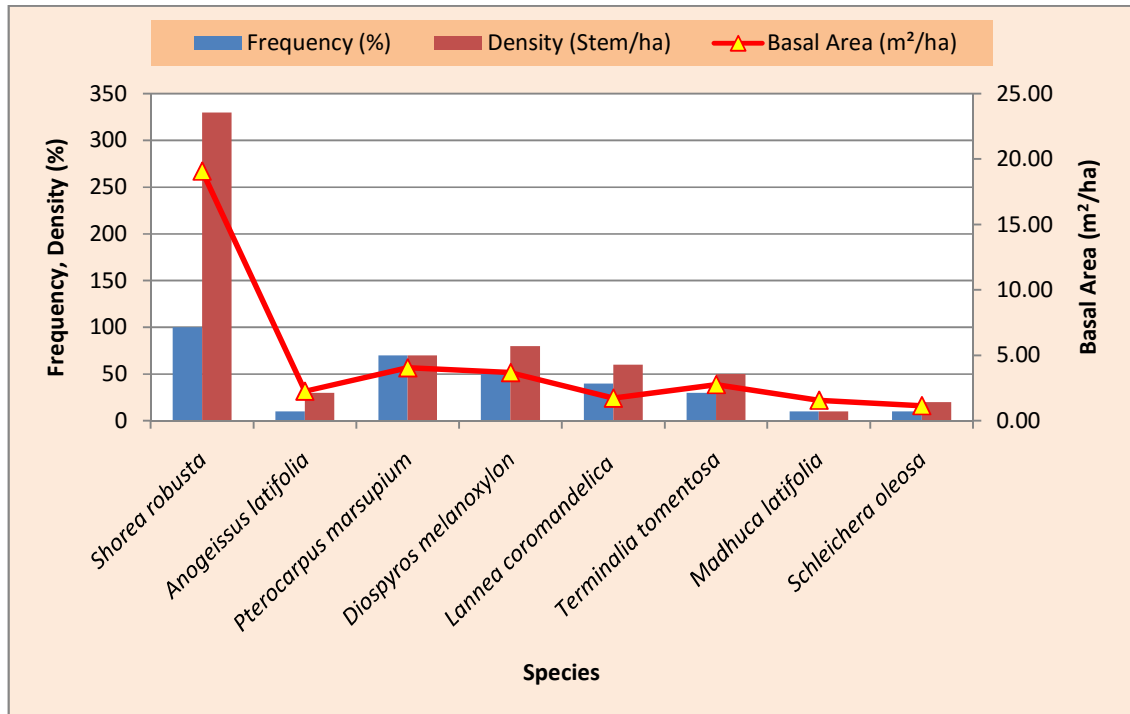


Fig. 4.21: Vegetation analysis of Trees in Sihawa range

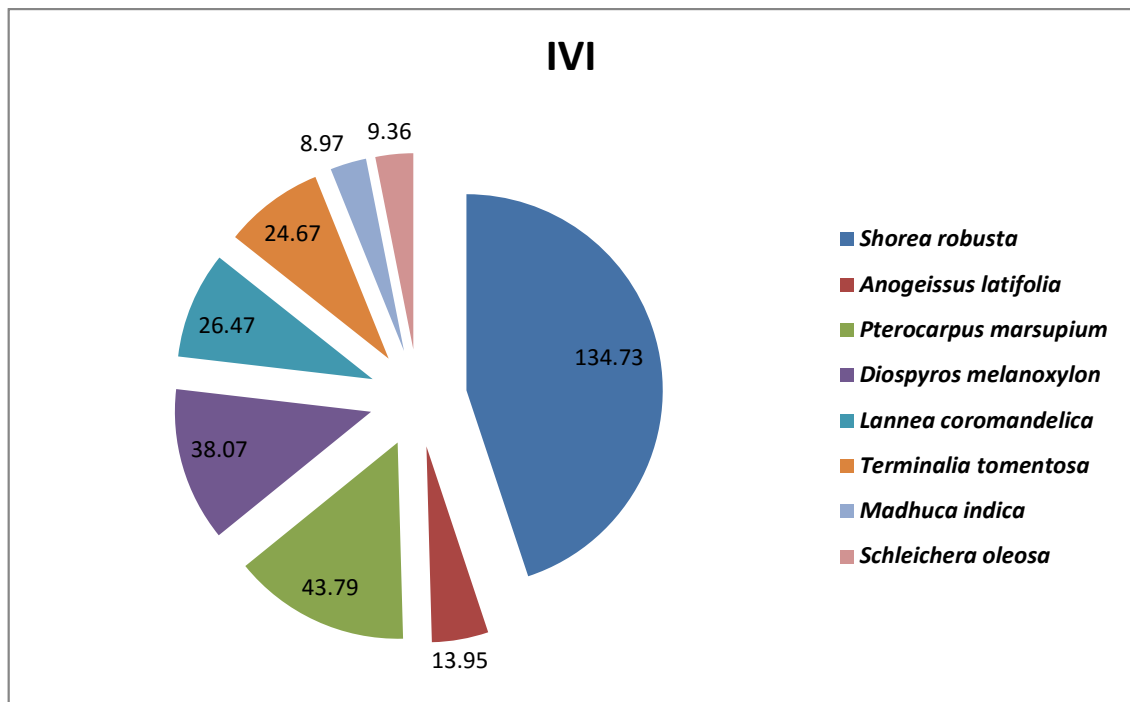


Fig. 4.22: Tree species based on IVI value in Sihawa range

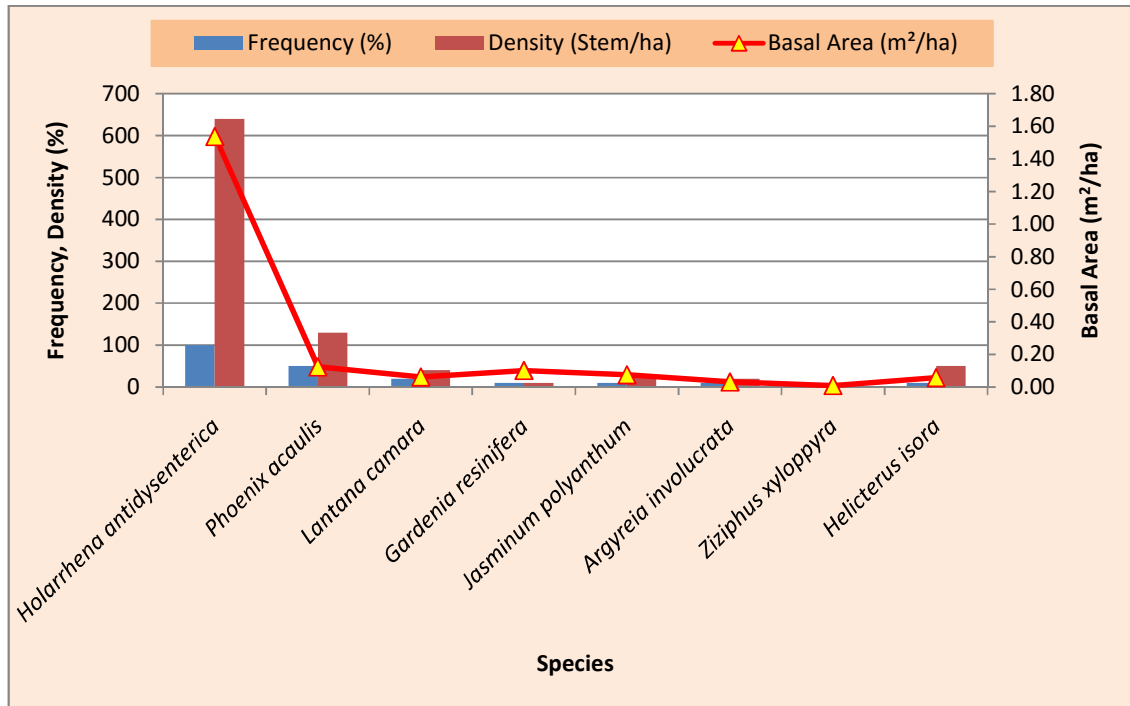


Fig. 4.23: Vegetation analysis of Shrubs and Climber in Sihawa range

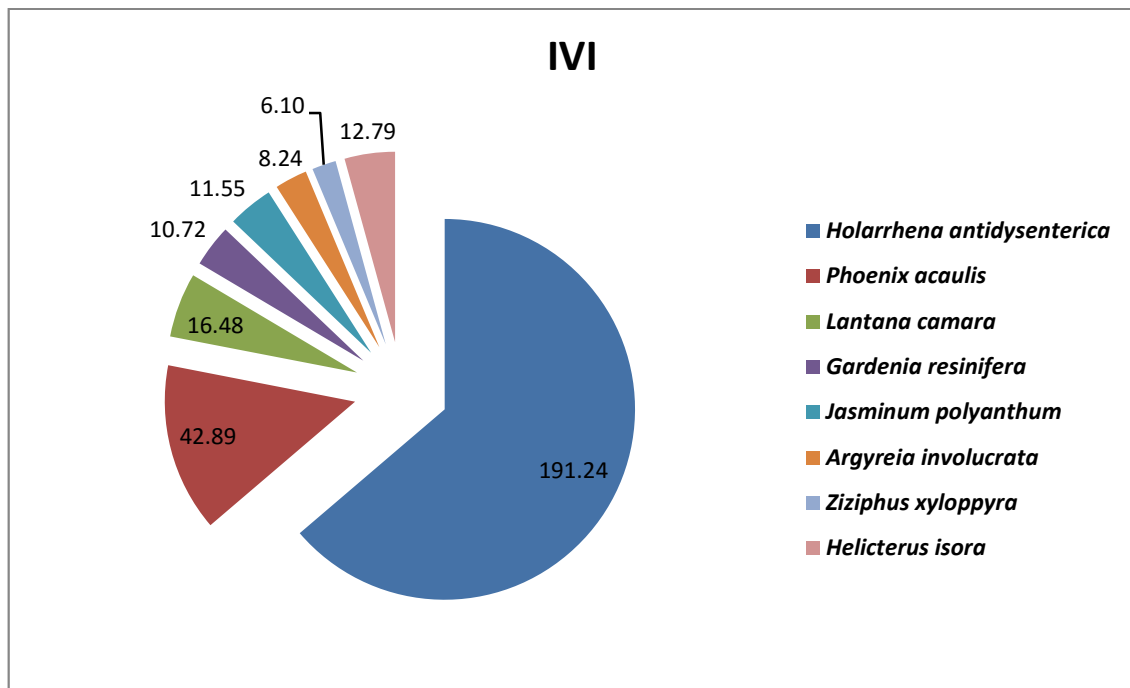


Fig. 4.24: Shrubs and Climber species based on IVI value in Sihawa range

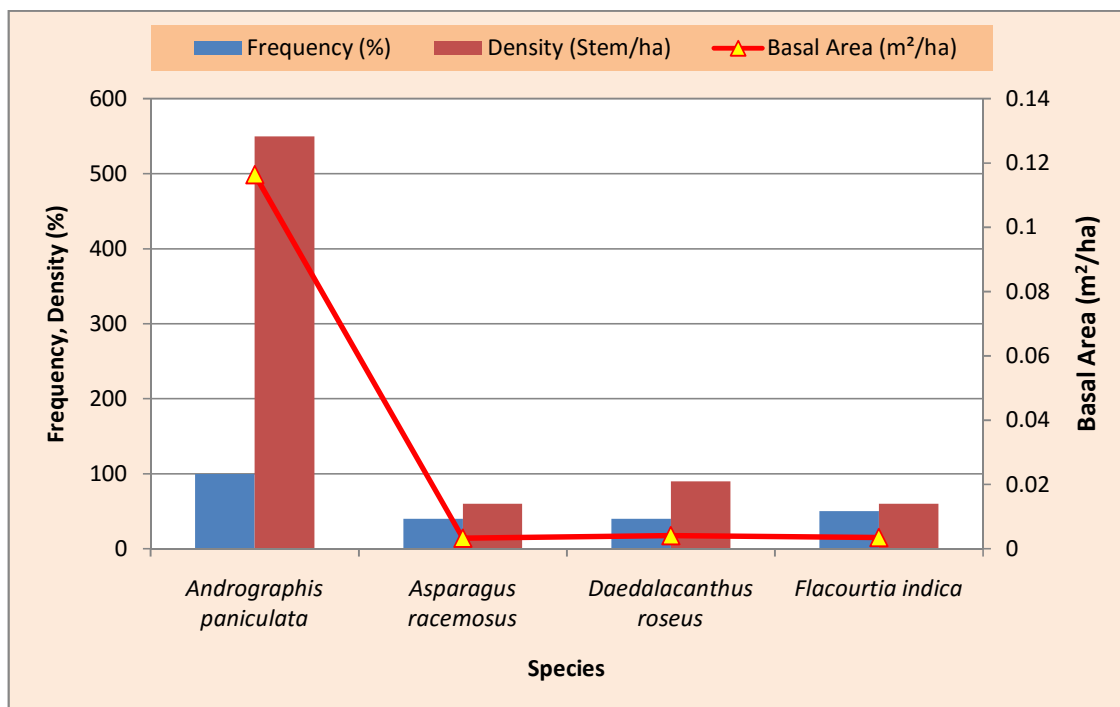


Fig. 4.25: Vegetation analysis of Herbs in Sihawa range

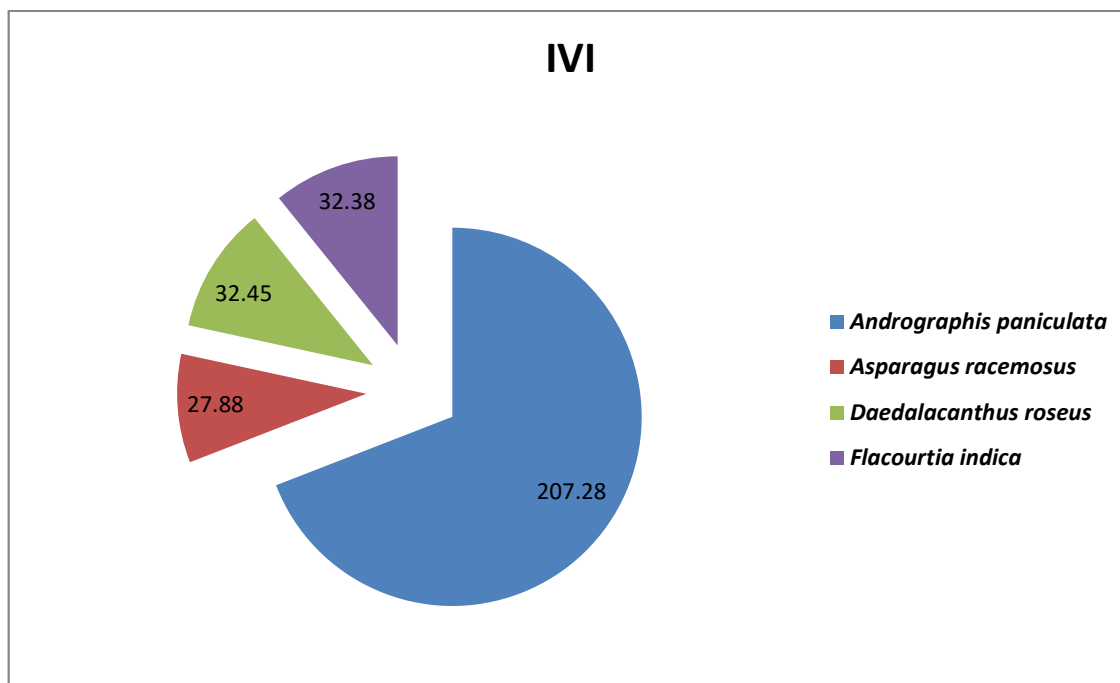


Fig. 4.26: Herbs species based on IVI value in Sihawa range

soil species composition and biotic interferences. It is also reported that the regional patterns of species richness are consequences of many interacting factors, such as plant productivity, competition, geographical area, historical or evolutionary development, regional species dynamics, regional species pool, environmental variables and human activity. In present investigation also the all the three sites the tree, shrubs, climber and herbs dominance and diversity differ because of the so many biological factors like topography, soil type, moisture availability the species occurrence is not matched with the site. The Dugli Forest area the *Cleistanthus collinus* and Nagri and Shihawa the *Shorea robusta* showed the dominating species. The variation in frequency, density and basal area depicted that the favorable condition and its natural regeneration pattern of the site, fertility suitability and favorable environmental condition. Therefore, it can be said that the plant diversity and natural regeneration of all the layer is better and suitable for insitue conservation of dirrerent medicinal and NTFP plants.

4.7 Entomophagy Study

The Gond tribe residing in Dinkarpur and Monaikera village of Dhamtari district of Chhattisgarh collected eggs and larvae of honey bees along with honey during summer season. Men and children were engaged in honey collection, while women were not involved in these activities. Children enjoy of this very much. Collection is done in the afternoon. They felt it was nutritious for body as it was available at no cost for them hence it was also economical for them.

Similar phenomenon of Entomophagy has been reported by Fastoranti and Ajiboye (1993) in Kwara State of Nigeria in which four major tribes Yoruba, Ibirra, Nupe and Baruba were present. Where seven species of insects are generally acceptable by these four groups namely Coleoptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Odonata and Orthoptera. Another study carried out by Ashru (1998) and reported that in Nigeria 69% larvae of venata are eaten by the people. In present investigation also it was observed that tribes having different food habits and they eat different insects, animal as per the availability of their population in that particular area. Some of the farmers of all the sites eat the larva of honey and red

aunt as chutney in their food. The larvae are prepared by roasting them in hot dry white sand for eating. The red ants are eaten to make chutney in the study area to fight with the lack of nutrition these eating habit came from their ancestors to fulfill the requirement of protein and other minerals from these insects. The red ant is also used as a bite to cure the fever as the ant has acid and that is effective to lower the temperature and body aches in the patient.

CHAPTER - V

SUMMARY AND CONCLUSIONS

The study entitled “**Documentation of Non Timber Forest Product Collection, Processing and Value Addition of Dhamtari Forest Area of Chhattisgarh**” was conducted at Dhamtari forest area Dhamtari district of Chhattisgarh during 2016-2017.

SUMMARY

- The maximum no of households were found in village Dikarpur (127) and maximum populations were recorded in village Daldali (A) (559) in the study area.
- The population of scheduled tribe was higher in all the three sites of study area. The Schedule tribe population range varies from (70.00% - 94.26%). The highest population of Schedule tribe was recorded in Monaikera (94.26) and lowest population of Schedule tribe was in Bhathkhar (70.00%).
- The literacy percentage ranges from 53.17 – 81.85%. It was highest in Satbahna (Dongripara) (81.85%) and lowest in Dinkarpur (53.17%). percentage of illiteracy percentage ranges recorded from 18.14 - 59.21 %.
- In village Dinkarpur, Monaikera, Daldali (A) and Karraghati Middle School and high school was present.
- Among studied six villages only one village Monaikera had independent Panchayat.
- The landless labour was recorded 10.31% and marginal farmer percentage was 28.79% only.
- During documentation and identification of NTFPs 26 trees, 10 shrubs, 7 herbs and 9 climber NTFPs species were identified in the study area. Which are utilized and collected for trade.

- Traditional collection methods and post harvest techniques which are used for NTFPs collection and processing in the study area resulted the check in the natural regeneration as well as low quality produce.
- The market rate was found highest for Honey (340-360 Rs/kg.) among other NTFPs. *Buchanania lanzan* (100 Rs. /kg.), Kusum Lac (150 Rs/kg.) and *Tamarindus indica* (50-60 Rs/kg.) also had good price, but available in low quantity.
- The maximum income was recorded from NTFPs then other sources of income. The maximum annual income was (Rs.8350) earned from NTFPs collection in Bhathkhar village.
- Average yearly collection of NTFPs among all the villages were basically comprises of Tendu leaves (26826.67 bundles), Mahul leaves (6801.67 bundles) and Mahua (78.33 kg.)
- Commercially important species like Aonla, Char, Kumbhi, and Imli etc. are over exploited. These species enlisted in the verge of extinction very soon if no control measure taken.
- The household annual income varied from Rs. 13917 - 25150. It was highest in village Bhathkhar (Rs. 25150) and lowest in Satbahna (Dongripara) (Rs.13917).
- Marginal, Small farmer and landless labour on the study area had the average land holding of 3.32 acre. The population of marginal farmer was higher than the landless labour.
- The Agriculture production also very low in study area due to lack of irrigation facilities and knowledge of advanced technique of cultivation.
- The overall role in collection of NTFPs the trend observed was Women>Men>Children.

- The women had the highest average involvement in the collection of NTFPs which was recorded 51.86 % in the study area.
- Tendu leaves and mahul leaves were collected in a good quantity. Hence income generated from these products was also high.
- IVI value for trees was recorded highest (185.71) for *Shorea robusta* in the range of Nagri, and recorded lowest (2.26) for *Schleichera oleosa* in Dugli range.
- IVI value for shrubs and climber was recorded highest (191.24) for *Holarrhena antidysenterica* and lowest (6.10) for *Ziziphus xyloppyra* in the range of Sihawa.
- IVI value for herbs was recorded highest (207.28) for *Andrographis paniculata* and lowest (32.38) for *Flacourtia indicain* in the range of Sihawa range of study area.
- Total frequency for tree was recorded highest (880%) for Dugli range, the density was recorded highest (2050 Stem/ha) for Dugli range and the basal area was recorded highest (36.23 m²/ha) for Sihawa range.
- Total frequency for shrubs and climber was recorded highest (540%) for Dugli range, the density was recorded highest (1790 Stem/ha) for Dugli range and the basal area was recorded highest (2.00 m²/ha) for Sihawa range.
- Total frequency for herbs was recorded highest (380%) for Dugli range, the density was recorded highest (1910 Stem/ha) for Dugli range and the basal area was recorded highest (6.82 m²/ha) for Dugli range.

CONCLUSIONS

- Among all these Medicinal and NTFPs species enlisted and identified some are the source of their income such as *Madhuca latifolia* (Mhaua) flower, *Bauhinia vahlii* (Mahul) leaves, *Diospyros melanoxylon* (Tendu) leaves. There are 52 NTFPs were identified and documented during present investigation. The identified 52 NTFPs species belongs to 26 trees, 10 shrubs, 7 herbs and 9 climbers species. A variety of NTFPs viz. seeds, leaves used for plate making, Tans and Dyes, Gum and Resin, edible products, Oil yielding, Bamboo, Fiber, Thatching, Broom making, Medicinal plants and Biocides (fungicidal, insecticidal and nematicidal). The forest of the study area has abundant different NTFPs plants species, which are used by villagers for various purpose viz. food, medicine, tans & dyes, oil, fuel, fodder, construction etc.
- The collected 41 plants as NTFPs in which 16 Tree, 5 Shrubs, 7 herbs, 5 Grasses, 7 Climbers and 1 Bio – products were collected and sold in the market as well as their own use. The fruit collection was carried out of *Syzygium cumuni*, *Diospyros melanoxylon*, *Aegle marmelos*, *Tamarindus indica*, *Semecarpus anacardium*, *Schleichera oleosa*, *Embllica officinalis*, *Buchanania lanzan*, *Mangifera indica*, *Terminalia chebula*, *Terminalia bellirica* and *Azadirachta indica* etc. The medicinal plant Kalmegh was uprooted before maturity of seed thus next year production declines. The most of the trees, shrubs, herbs and grasses were used for medicinal purposes. Tribal people use the roots of many trees, shrubs, herbs and grasses as medicine. Lakh and Cocoons were also collected by the tribals from the forest two major source tree species *Shorea robusta* and *Terminalia tomentosa* was found in study area for rearing Cocoon (Kosa), and one major source tree species *Schleichera oleosa* was found in study area for Lac production people called Kusumi Lac.

- The collected 41 plants as NTFPs in which 16 Tree, 5 Shrubs, 7 herbs, 4 Grasses, 7 Climbers and 2 Bio – products were collected processing technique used and sold in the market as well as their own use.
- The tree density was highest on Dugli range (2050 stem ha¹) followed by Nagri range (700 stem ha¹) and lowest on Sihawa range (650 stem ha¹). The shrubs and climber density was highest on Dugli range (1790 stem ha¹) followed by Nagri range (960 stem ha¹) and lowest on Sihawa range (930 stem ha¹). The herbs density was highest on Dugli range (2050 stem ha¹) followed by Nagri range (1570 stem ha¹) and lowest on Sihawa range (1910 stem ha¹).
- The tree frequency was highest on Dugli range (880 %) followed by Sihawa range (320%) and lowest on Nagri range (310 %). The shrubs and climber density was highest on Dugli range (540 %) followed by Nagri range (280 %) and lowest on Sihawa (220 %). The herbs density was highest on Dugli range (380 %) followed by Nagri range (250 %) and lowest on Sihawa range (230 %).
- The tree basal area was highest on Sihawa range (36.23 m²/ha) followed by Dugli range (34.65 m²/ha) and lowest on Nagri range (30.50 m²/ha). The shrubs and climber density was highest on Sihawa range (2.00 m²/ha) followed by Nagri range (1.69 m²/ha) and lowest on Dugli range (1.23 m²/ha). The herbs density was highest on Dugli range (6.82 m²/ha) followed by Nagri range (0.58 m²/ha) and lowest on Sihawa range (0.127 m²/ha).

Suggestion for future work

Documentation of Non Timber Forest Product collection, processing and value addition of Dhamtari was studied in dry mixed deciduous forest of forest Area of Chhattisgarh. The study has limited scope since it is conducted only in a small area and covering few sample villages. There is need to replicate such studies in different area of

Chhattisgarh for arriving a sound conclusion on pattern of NTFPs collection methods, processing, value addition and Socio-economic status of tribes/forest dwellers. Continuing research is needed to determine the sustainable and scientific method for collection of NTFPs and post harvest techniques to enhance the quality of raw material and obtain better price.

- The extraction methods were crude, scientific training should be imparted on proper harvesting and utilization of the valuable NTFPs. The vulnerable and commercially important NTFPs such as Char, Mushroom, Aonla, kalmegh, Honey etc. could be domesticated in the kitchen gardens and also in protected forest as in situ cultivation and conservation.
- There is a tremendous scope for developing NTFPs based cottage industries like Plate making, Lack and Sericulture, Honey extraction, Rope making in the study area.
- Traditional knowledge concerning the collection and utilization of different NTFPs needs to be documented and utilized for the benefit of local communities.
- Institutional arrangement and marketing facilities need to be improved for denationalized forest products.
- The minimum support price for each NTFPs must be declared by the state Govt. and Central Govt. so, that the livelihood of the tribes who are the stake holder will be improved.

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APPENDIX

APPENDICES - I

परिशिष्ट

आर्थिक सर्वेक्षण के लिए प्रपत्र

(अ) व्यक्तिगत जानकारी		
1.	गांव का नाम	
2.	व्यक्ति का नाम	
3.	पिता का नाम	
4.	जनजाति का नाम	
5.	बच्चों की संख्या	
6.	परिवार में सदस्यों की कुल संख्या	
7.	परिवार में NTFPs संग्रहण करने वालों की संख्या	
8.	शिक्षा की स्थिति	
9.	कुल रकबा	
10.	आय के अन्य स्रोत	
11.	विभिन्न NTFPs संग्रह की राशि	

(ब) NTFPs के संदर्भ में महत्वपूर्ण संसाधनों की पहचान व मूल्य –

NTFPs उत्पाद का नाम	वानस्पतिक नाम	एक वर्षीय व बहु वर्षीय झाड़ी	उपयोगी भाग	उपयोग	मूल्य प्रति किलो	वानिकी प्रकार
तेन्दू पत्ती						
माहूल पत्ती, रस्सी व बीज						
आँवला						
चिरोंजी						
आम						
मैदा						
बांस						
इमली						
साल पत्ती व बीज						
महुआ						

(स) अन्य NTFPs				
	Category वर्ग	Species प्रजातियाँ	Uses उपयोग	Domestic/commercial purpose उपयोग घरेलू व वाणिज्यिक उद्देश्य
1.	Dyes रंजक			
2.	Oil तेल			
3.	Gum गोंद			
4.	Fiber/floss रेशा/जंगली कपास			
5.	Beverage पेय पदार्थ			
6.	Fodder चारा			
7.	Bio-products जैव.उत्पाद			

(द) गांव स्तर की जानकारी		
1.	गांव का नाम	
2.	गांव में घरों की संख्या	
3.	गांव की आबादी	
4.	गांव के हावी जनजाति	
5.	गांव से बाजार की दूरी	
6.	NTFPs संग्रहण कर्ताओं की संख्या	

(य) इन्फ्रास्ट्रक्चर		
1.	गांव का नाम	
2.	पंचायत की स्थिति	
3.	बिजली	
4.	पानी के स्रोत	
5.	सड़क	
6.	फसलों की जानकारी	

7.	षिक्षित जनसंख्या		
	महिला		
	पुरुष		
8.	वनों की जानकारी		
	कुल भौगोलिक क्षेत्रफल		
	वन क्षेत्रफल		
	कृषि क्षेत्रफल		
9.	मजदूरी दर/ दिन	महिला	पुरुष
10.	सिंचाई की स्थिति	सिंचित	असिंचित

(र) मौसम के अनुसार संग्रहण

मौसम	NTFPs का नाम	संग्रहण मात्रा		विक्रय मूल्य/ मात्रा		उपभोग मात्रा	
		किंट/ किलो	मूल्य	किंट/ किलो	मूल्य	किंट/ किलो	मूल्य
खरीफ							
रबी							
जायद							

(ल) बाजार चक्र

Commission agent		whole seller		Consumer	
मात्रा	मूल्य	मात्रा	मूल्य	मात्रा	मूल्य

(व) NTFPs की कम उपलब्धता के कारण

- 1.
- 2.
- 3.
- 4.
- 5.

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