ROLE OF JOINT FOREST MANAGEMENT COMMITTEE (JFMC) MEMBERS IN SUSTAINABLE FOREST MANAGEMENT (SFM)

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CERTIFICATE

This is to certify that the thesis entitled "**ROLE OF JOINT FOREST MANAGEMET COMMITTEE (JFMC) MEMBERS IN SUSTAINABLE FOREST MANAGEMENT (SFM)**" submitted by **AKSHATA RAMANNANAVAR** for the degree of **DOCTOR OF PHILOSOPHY** in **EXTENSION AND COMMUNICATION MANAGEMENT**, College of Community Science, University of Agricultural Sciences, Dharwad, is a record of bonafide research work done by her during the period of her study in this University, under my guidance and supervision and the thesis has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

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NOVEMBER, 2019

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DHARWAD
NOVEMBER, 2019 (***Akshata Ramannanavar)***

C O N T E N T S

Contd…..

LIST OF ABBREVIATIONS

JFM	Joint Forest Management
JFPM	Joint Forest Planning and Management
VFCs	Village Forest Committees
SFM	Sustainable Forest Management
NMPB	National Medicinal Plant Board
FDA	Forest Development Agency
KSFMBC	Karnataka Sustainable Forest Management And Biodiversity Conservation
DFID	Department For International Development, UK
NAP	National Afforestation Programme
JBIC	Japan Bank for International Co-operation
JICA	Japan International Co-operation Agency
VDF	Village Development Fund
VFDF	Village Forest Development Fund .

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Introduction

1. INTRODUCTION

Forests are crucial natural resources and have forever been central to human life. The Food and Agriculture Organization (FAO) has defined “forest as a land with tree crown cover of more than 10.00 per cent and area of more than 0.5 hectares”. The Indian Government defines “forest as a land having tree crown cover value of minimum 15.00 per cent, land area value of minimum 0.05 ha and tree height value of minimum 2 meters”.

The importance of forests in the natural ecosystem cannot be undermined. Forests are referred as lungs of the environment because they are factories of oxygen. Without forests neither would the environment survive nor the human kind. Forests are important global resources that give environmental, economic and social benefits. They supply a range of valuable products like timber, fuel wood, fibre, alternative wood & non-wood forest products and contribute to the livelihoods of rural communities. They provide vital ecosystem services, renewable raw materials & energy, maintain biological diversity, protect land & water resources by controlling water runoff, provide recreation facilities and improve air quality. Forests can also play a significant role in addressing global climate change issues. They are a source of livelihood for many human being and nearly 80 million indigenous people all over the world are dependent on agriculture.

Scenario of forest cover:

The global forest area is just over 4 billion hectares, which represents 31.00 per cent of the total land area (FAO, 2010). According to the National Forest Policy of India, 33.00 per cent of land should be under forest cover. However according to the World Bank data of 2016, the total forest cover in India is only 23.80 per cent of the total area of the country. The forest cover in Karnataka state is 37,550 sq km which is 19.58 per cent of the state’s geographical area. In terms of forest canopy density classes, the state has 4,502 sq km under very dense forest, 20,444 sq km under moderately dense forest and 12,604 sq km under open forest (Karnataka-ISFR-2017). This clearly indicates that the forest cover globally, in India and in Karnataka is below the stipulated levels.

Need for forest management:

In spite of the numerous advantages, forests are disappearing at an alarming rate. Between 1990-2015 alone 129 m.ha of forest area was lost. This does not just mean the loss

of trees, but it is the destruction of the ecosystem which can cause disastrous consequences to human kind. Forest cover depletion is mainly due to excessive harvest of timber, fuel wood, water and pasture. Urbanization is another important factor where forests are being cleared for housing, infrastructure and other development activities for the ever increasing population. The deterioration of forests has accelerated the process of soil erosion and sedimentation of rivers. It has increased flooding, and overtaxed the land's capacity to regenerate and sustain. It is therefore important to conserve the forests and preserve and protect all natural resources so as to maintain a balance in nature. Forest management is the process of controlling the use or exploitation of forested land. It is concerned with overall administrative, economic, legal and social aspects, as well as scientific and technical aspects. This includes management of water, wildlife, wood products, forest genetic resources, non-timber forest products. Management is also important for aesthetics and recreation.

Forest management alone is not sufficient but sustainable forest management is the need of the hour. Sustainable forest management is environmentally appropriate, socially beneficial, and economically viable management of forests for present generations, without compromising the ability of the future generation to use these forest resources. The United Nations General Assembly defines Sustainable Forest Management (SFM) as a "dynamic and evolving concept, which aims to maintain and enhance the social, economic and ecological values of all types of forests, for the benefits of present and future generations".

People's participation in Sustainable Forest Management

Since many poor people and indigenous communities are dependent on forests for their livelihoods, it is important that the local communities be involved in forest management. Involving local communities could also harness the indigenous and traditional knowledge practices of the people in protecting and conserving the forest. Governments are opening a number of opportunities for sustainable forest management and biodiversity conservation by decentralizing authority and responsibility for resource management in different parts of the world. The recent years have seen a number of changes in the management of forests. There is a major shift of managing forests from the government and centre based agencies towards a more decentralized and people oriented forestry. Responding to scarcities, villagers have started organizing themselves to reverse degradation and restore productivity. This has resulted in renewal of degraded ecosystems.

There are many forest management (FM) strategies in the Asia-Pacific, where local communities are involved in sustainable forest management and attention has been given to community-based forest management programs. Some examples and strategies are the devolution of management responsibilities on certain forestry activities to local government units in the Philippines, land and forest allocation programs of China, Laos and Vietnam, transfer of rights to forest user groups in Nepal, Joint Forest Management programs in India and privatization of forest plantations in New Zealand. Similar processes are underway in other parts of the world.

The various initiatives have led to greater access and control of forest resources by local people, in turn resulting improvement in forest protection & management and reducing pressure on resources. Substantial areas of degraded forests have been rehabilitated and new forests planted. Local people have started supporting forest conservation which is a win-win situation for the government and the local people. While forest cover has increased the people have been able to reap financial returns from the benefit-sharing schemes.

Concept of Joint Forest Management (JFM):

Joint Forest Management (JFM) is an approach and program initiated in India in the context of the National Forest Policy of 1988, wherein the state forest department support local forest dwellers and forest fringe communities to protect and manage forests and share the costs and benefits from the forests with them. Forest committees are constituted for working in coordination with villagers, where a micro plan for development of forests and villages is together prepared by the forest department and the forest committees. Additionally employment opportunities are created in villages by increasing the agriculture and forest production and establishment of processing units. This would prevent the villagers from illegal felling of trees and encroachments in the forests. Attempts are also made to provide other basic necessities to the villagers like LPGs for cooking, solar energy for heating etc. so as to minimize pressure of energy needs on forest resources.

Origin of Joint Forest Management (JFM) Theme:

In order to prevent the unprotected grazing and illegal harvesting of 'Sal' the major hardwood in the Bengal forests, the concept of Joint Forest Management originated in the Arabari forest range of West Bengal in 1971. Ajith Kumar Banergee, the Divisional Forest Officer of Arabari forest range was the brain child of the JFM theme. He was a silviculturist

who was conducting certain trails on sal trees, but was constantly disturbed by the grazing of animals and illegal felling of trees by the locals. He came up with the idea of “sharing the forests”. At that time there were no such concept of sharing of forest resources between the government and the locals. While the government considered many of the locals no more than "thieves", the locals felt that they had rights to use the forest resources which were their main source of livelihood. Much against the wishes of his co-workers, the officer sought representatives of eleven local villages and negotiated the terms of a contract with an *ad hoc* Forest Protection Committee. The initial program involved 612 families managing 12.7 square kilometres of forests which was classified as "degraded". According to this programme 25.00 per cent of profits from the forests that were earned by the government were shared with the villagers. The success of this experiment gave way to expansion of the programme to other parts of the state.

A few years later, JFM concept was adopted in the state of Haryana to prevent soil erosion and deforestation. In 1977, villagers were explained and persuaded not to graze on erosion-prone hills, but to build small dams which would help agricultural output on areas currently under cultivation. The program led to reforestation of many hills in the state.

The successful results of the pilot studies conducted, paved the way for the Government of India, under the Ministry of Environment and Forests, to initiate JFM in 1990 in all the states. Prior to Government of India order, during 1988 and 1989 Government of West Bengal and Odisha have passed respective state resolution of JFM by recognizing self-initiated Forest Protection System in the state. The following objectives have been framed for the effective implementation of JFM as given below.

The Objectives of JFM:

1. To elicit active participation of villagers in (a) creation of shelter for wild animals, food, security etc. (b) management of natural resources like land, water, trees etc. and (c) protection of plantations.
2. To achieve ecological needs consonant with sustainable productivity of wood and other non-timber forest resources.
3. To wean away the land owning communities from shifting cultivation by adopting an alternative that is tree farming (Cultivation of trees for the production of timber).

4. To productively utilize the degraded jhumland (The practice involves clearing vegetative/forest cover on land, drying and burning it before onset of monsoon and cropping on it thereafter) thereby checking soil erosion. Soil erosion is checked by plantation of trees on wastelands.

5. To conserve biodiversity through people's action.

6. To create and generate forest-based economy for the villagers.

Activities under Joint Forest Management Programme

1) Beneficiaries of village forest committees shall assist in identification of land, choice of species for plantations and raising of nurseries.

2) The beneficiaries of the Village Forest Committees (VFCs) shall be responsible for full protection of forest and plantations raised on such lands after three years, preferably through its volunteers or through watchman employed by the village forest committee out of its resources.

3) Enriching forest by preventing encroachment, regulating grazing, preventing forest fire, illicit felling, preventing smuggling of forest produce and poaching of wild animals etc. which is needed to develop forest resources

4) Regenerating the forest by protecting shrubs and bushes.

It could therefore be concluded that Joint Forest Management Committee (JFMC) members have different knowledge of dependence on and use of forest goods. The success of Joint Forest Management Programme largely depends on the extent of participation of the beneficiaries. They also have different benefits, access and control over forests. In order to achieve the objectives set forth, it is important for the development administrators to have an idea that the knowledge of this would help in increasing the efficiency of the field personnel of the Department of Forest. This is particularly important from the viewpoint of making village forest committee self-supporting and self-sustaining. Forest management projects that consider these needs and concerns have a greater chance of achieving a successful environmental and social impact. With this background the present investigation was planned with following objectives.

Specific objectives of the study

1. To study the knowledge of Joint Forest Management Committee (JFMC) members and non-members about forest management.

2. Participation of JFMC members in sustainable utilization, collection and processing of non-timber forest products.
3. To study the relationship between socio-economic characteristics of respondents with forest management activities.
4. To investigate and document the bio-cultural beliefs about forest and forest trees.
5. To find out constraints faced by the JFMC members in forest management.

Scope of the study

Success of forest conservation programmes depend upon the active involvement of local people and communities. Sustainable utilization of forest resources requires a holistic multi-disciplinary approach along with local people's participation. Forest dwellers must be involved in policy making and planning to ensure the most productive and efficient use of forest resources to improve their livelihoods. The study would help the environmental agencies, government departments and various non-government organizations to understand the roles of JFM members and harnessing the power and their indigenous knowledge in the conservation of forest resources.

Limitations of the study

The study being conducted by a student researcher has the limitation of time and other resources, and so the study has been limited to Western Ghats of Uttar Kannada district and is confined to the forest ranges with the highest number of Village Forest Committees (VFCs) which are active in forest conservation activities. Therefore, the findings of the present investigation have the limitation of wider generalization. In spite of these limitations efforts have been made by the researcher to keep this study as objective as possible.

Review of Literature

2. REVIEW OF LITERATURE

Research is a careful and detailed investigation into a particular issue by utilizing the logical strategy. This is usually verified by doing a lot of comparisons and tests in order to make sure that the results are valid. The review of literature identifies, evaluates and synthesizes the relevant literature within a particular field of research. It illuminates how knowledge has evolved within the field, highlighting what has already been done, what is generally accepted, what is emerging and what is the current state of thinking on the topic. In addition, within research-based texts such as a Doctoral thesis, a literature review identifies a research gap (i.e. unexplored or under-researched areas) and articulates how a particular research project addresses this gap. The review for relevant literature for the present study entitled "Role of Joint Forest Management Committee (JFMC) members in Sustainable Forest Management (SFM)" are chronologically presented under the following headings:

2.1 Concept of Sustainable Forest Management

2.2 Joint Forest Management Committees (JFMC) and their role

2.3 Knowledge of forest dwellers about forest management

2.4 Participation of JFMC members in sustainable utilization, collection and processing of non-timber forest products (NTFPs)

2.5 Socio-economic and personal characteristics of forest dwellers/ forest people

2.6 Investigation and documentation of bio-cultural beliefs about forest and forest tress

2.7 Constraints faced by forest dwellers in forest management.

2.1 Concept of Sustainable Forest Management (SFM)

The concept of sustainability was originally coined in forestry, it means never harvesting more than what the forest yields in new growth. The word Nachhaltigkeit is derived from German term for sustainability was first used in 1713.

According to United Nations World Commission on Environment and Development (1987) "Sustainability is meeting the needs of the present without compromising the ability of future generations to meet their needs."

According to Academic Advisory Committee for the Office of Sustainability at the

University of Alberta (2010) “Sustainability is the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity.”

United Nations documents refer to key sustainability concepts as intergenerational equity, ecological sustainability and fair distribution of wealth, community participation and access to resources. Many of these can be associated with quality of life or wellbeing. Underpinning them is a strong premise that both society and economy are dependent on a healthy environment that provides ecosystem services.

Sustainability is an ongoing learning process that actively involves stakeholders in creating their vision, taking action and reviewing changes.

Forest management is the process of controlling the use or exploitation of forested land. It is concerned with overall administrative, economic, legal and social aspects, as well as scientific and technical aspects. This includes management for aesthetics, recreation, water, wild land and wildlife, wood products, forest genetic resources and non-timber forest products. Management can be based on conservation, economics or both. Management techniques include timber extraction, planting and replanting of various species and preventing fire.

Sustainable forest management means using, conserving and enhancing the forest resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

Forests are home to a great variety of animals, plants and microbes, and provide a wide range of environmental, economic and social benefits. They influence our climate, and the quality of air, water and soil; they are important sources of food, fuel, building materials and income; they provide homes, employment and recreation. Ancient and native forests represent the cultural heritage of many people around the world recognition of the multiple roles and values of forests.

Sustainable forest management addresses forest degradation and deforestation while increasing direct benefits to people and the environment. At the social level, sustainable forest management contributes to livelihoods, income generation and employment. At the environmental level, it contributes to important services such as carbon sequestration and water, soil and biodiversity conservation.

According to European Forest Convention "Sustainable forest management" means the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems.

Sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations (United Nations Forum on Forests (UNFF).

Kotwal *et al.* (2008) studied ecological indicators: imperative to sustainable forest management in Bhopal. This study deals with the criteria and indicators developed under Bhopal–India (B–I) process in general and ecological indicators in particular for assessing sustainable forest management (SFM). Several attempts have been made the world over to develop criteria and indicators, which are specific to various forestry conditions and recognized as appropriate tools for assessing and monitoring progress towards SFM. In India, the process for measuring forest sustainability has started by evolving a national level set of criteria and indicators in the form of Bhopal–India process. The Bhopal–India process specifies 8 criteria and 43 indicators. The first 4 criteria pertain exclusively to ecology with 21related indicators. Thus, nearly half of the criteria and indicators pertain to ecological dimensions that largely govern sustainability of forests. Rest of the criteria of the base set pertains to economic and social aspects with related indicators. This provides holistic approach of monitoring the forest resources.

Mirjam *et al.* (2008) conducted a study on forest-related partnerships in Brazilian Amazonia. This study highlight the three different case studies as main forms of partnerships for sustainable forest management i.e., Company–community partnerships, Multi-sector partnerships and A civil society partnership. Forest-related partnerships can help to reduce some of the impediments to sustainable forest management by (i) creating an institutional framework for a multistakeholder perspective on forest use, (ii) locally advancing negotiated solutions to land use which may help reduce competing claims to forest land, (iii) enhance community involvement in forest management, (iv) create win–win situations and enhance the actors' capacities and scope for action by joining power, assets, knowledge and skills, and (v) compensate for a lack of enabling policies by lobbying the conditions for sustainable

forest management and the proper enforcement of environmental laws and tenure rights. However, several problems will have to be dealt with in order to create stable and successful partnerships. As far as product-oriented partnerships are concerned, the characteristics of successful partnerships include (i) fairly negotiated objectives and conditions of the deal, (ii) the empowerment of local communities in order to overcome power imbalances and diverging interests, (iii) the inclusion of brokers with a 'watchdog' function, (iv) equitable and cost-effective institutional arrangements with a flexible intermediate organization capable of mediating the parties' inputs at minimal transaction costs, (v) sufficient and fairly shared benefits based on economically viable operations, and (vi) the establishment of sustainable harvesting guidelines and appropriate monitoring systems. The more politically oriented partnerships clearly showed that the involvement of public sector actors and links with the judiciary are important conditions for good forest governance and sustainable forest management.

Hosseini (2011) carried out a research on effective extension methods in improving sustainable forest management in Iran. The total population for this study was 154 managers in Forests, Range and Watershed Management Organization (FRWO) in Iran. The data analysis by stepwise regression revealed that 73.00 per cent of the variance in the perception of managers could be explained by four variables namely; providing material incentives for managers, knowledge about indicators of sustainable forest management, extension/education classes and working experience. The study further indicated that the main factor in improving the sustainable forest management was participation of beneficiaries in related projects and programs. With regard to public awareness, the results showed that extension/education classes could inform public about importance and benefits of sustainable forest management and also there was a need for more training and education to change the attitude of managers about sustainable forest management and enhance their role in managing the natural resources.

Azadi *et al.* (2013) carried out a study on sustainable forest management in Iran. Forest Resources Management Plans (FRMPs) have been launched by the Iranian government in order to approach sustainable forest management in the Zagros area in West and South-West Iran. This study aimed at providing some policy recommendations in order to launch more successful FRMPs. Using a proportional cluster random sampling method, the data were

collected from 208 beneficiaries (forest dwellers) and 90 practitioners of forest management. The results showed that the FRMPs are far from being satisfactory because, the financial resources allocated to these plans are being used for other purposes, the inputs and supplies needed for effective forest management interventions are not in place in a timely manner and the forest management in the area is far from being decentralized. Factor analysis revealed the three factors influencing the Zagros management effectiveness as; "the management capabilities of the forest-dwellers", "the professional capabilities of the practitioners in forest management", and "the public support for the forest-dwellers". Also, the correlation analysis revealed that all the three factors are positively and significantly associated with the success of the government's forestry programs. The main recommendation of the study was to reformulate the forest management policies in the Zagros area by highlighting participatory approaches, not only as a tool, but also as a goal in the FRMPs.

Thus the reviews revealed that sustainable forest management as a dynamic and evolving concept aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations. It includes elements like; (i) extent of forest resources (ii) forest biological diversity (iii) forest health and vitality (iv) productive functions of forest resources (v) protective functions of forest resources (vi) socio-economic functions of forests and (vii) legal policy and institutional framework. Promote the participation of all stakeholders, including indigenous and local communities, forest dwellers and women in planning, formulating and implementing forest policies and recognizing &supporting their identity, culture and rights.

2.2 Concept of Joint Forest Management Committees (JFMC) and their role

The increasing depletion of India's forest resources has brought into sharp focus the inherent inadequacy of traditional state owned and run systems of forest management in sustaining the forest resource base against the growing human and livestock population pressures, industrialization, urbanization and overall economic development. The crisis in Indian forestry relating to high rates of deforestation, and unregulated and unsustainable use of forest produce in the past, can be attributed to the twin processes of erosion of customary resource management regimes and the acquisitive tendencies of the state in the period following independence. The effective and meaningful involvement of local communities has been attempted under the Joint Forest Management System in India by linking socio-economic incentives and forest development.

Joint Forest Management (JFM) is defined as a concept of developing partnerships between fringe forest user groups and the Forest Department (FD) on the basis of mutual trust and jointly defined roles and responsibilities for forest protection and development.

'JFM is a forest management strategy under which the Government (represented by the Forest Department) and the village community enter into an agreement to jointly protect and manage forestlands adjoining villages and to share responsibilities and benefits' (According to Government of India 2002).

Sinha (2000) conducted a study on forest and people: understanding the institutional governance, social identity, and people's participation in Indian forest management. The present study analyzed the various factors influencing the social identity and people's participation. Six indigenous community forest management units, four crafted community forest management and seven joint forest management units from three eastern states of India were studied. Both social identity and participation were significantly higher in indigenous community forest management than the joint forest management. Homogeneous community units under participatory leadership had more social identity and people's participation. Members of indigenous and crafted community forest management had higher satisfaction with its institutional rules, managing committee's functioning, and leadership pattern than joint forest management units. These factors of institutional governance directly enhanced social identity, and also participation.

Sudheendra and Hirevenkanagoudar (2005) conducted a study to know the characteristics of the beneficiaries and benefits derived by the members of joint forest management programme in Dharwad and Belgaum districts of Karnataka. Data was collected by personal interview method from 360 beneficiaries. The results revealed that beneficiaries had medium extension contact (55.28 %), high social participation (33.61 %), high cosmopoliteness (47.50 %) and medium level of aspiration (46.39 %) were found to be important variables influencing the behaviour of the beneficiaries. Further, beneficiaries were found to be benefited by firewood (46.45 %) and fodder (48.50 %) for household purpose. The mean employment generation after the implementation of joint forest management programme increased from 63.90 man-days to 99.31 man-days. Thus, the percentage increase in employment generation was 55.41 man-days.

Nuggehalli and Prokopy (2009) studied motivating factors and facilitating conditions explaining women's participation in co-management of Sri Lankan forests. A total of 68 interviews were conducted with village residents and one focus group each with Community Based Organizations (CBOs) members from Mahana and Alwara villages. The high level of women's participation is attributed to motivating factors and facilitating conditions. Motivating factors were a sense of social responsibility, concern for forest protection, and potential benefits to be gained from participation. Facilitating conditions represent a larger ecology than one directly connected to participation in the program under consideration. The social acceptability of participation within the community is another facilitator for individuals who want to participate. Obstacles to forest co-management outcomes include reduced forest dependency and top–down decision making. Adaptive implementation strategies compensate for these obstacles by establishing strong networks and structural organizations in forest boundary communities. This suggests that an intervention addressing the actual needs of stakeholders, rather than focusing on perceived problems, would allow for increased participation.

Das (2011) studied women's dependence on forest and participation in forestry. This is case study of joint forest management programme in West Bengal. The data was collected by intensive field inquiry of 431 households covering all members from eight villages with and without the JFM programme. Three female Forest Protection Committees (FPCs), three joint FPCs under the JFM villages, and two non-JFM villages lacking the JFM programme were selected for the study. The gender sensitive planning for JFM has made some positive roles for institutionalizing poor women's efficiency and equity implication in the conservation of forest resource. The setting up of female FPCs in some areas has motivated women to function as an important reference group in their own management system better than general group where men possess such controlling power. It has also helped the women FPCs to augment higher share of their household's income influencing thereby to contribute to better economic condition for their households after JFM scenario than JFM scenario. It is therefore suggested to launch more gender sensitive planning for JFM by establishing new female group in other areas of India not only to increase household's income but also to ensure some voice and space for this marginalized group within decision making process.

Lingani *et al.* (2011) analyzed factors influencing local people's participation in forest management program in Sissili and Ziro provinces in Southern Burkina Faso, West Africa. The data was collected through a household survey of 165 members of forest management groups. Factor analysis and multiple regression were used to analyze the data. Factor analysis resulted in a three-factor solution, which accounted for 64.82% of the total variance. Participation in decision-making, followed by participation in forest conservation and economic benefits were found to be the main factors influencing participation in the forest management program. Gender, household size, income source, land tenure status and technical assistance also appeared to influence members' participation in the program. The results indicate that participatory management program can be enhanced by changing the administrative structure of forest management groups in order to empower members in decision-making processes. In addition, increasing women's participation and more equitable benefit-sharing among user groups are essential in improving the success of the participatory forest management program. Thus, policies reforms to improve the structure of the forest management groups and to establish equitable benefit-sharing mechanisms are essential to improve the participation of local people in the forest management program.

Majhi (2016) analyzed community participation through joint forest management programme in India. State wise percentage of forest area under JFM committee, review articles and reports published by the different forest departments related to JFM programme were source of secondary data. Based on the studies he reported that issues of sustainable natural resource assumes greater importance, it is becoming clear that sustainability is clearly linked to the participation of communities living in close association with natural resources. Joint forest management &community forest management have achieved in protecting forest. The role of government & NGOs is significant in encouraging forest management. Joint forest management appears to be a workable system not only in providing for subsistence needs, but also potentially providing income-generating opportunities, and aiding in the regeneration of forests. However, he reported that villagers who are dependent on the forest for their livelihoods would first like to be assured of a continued source of income for their daily subsistence. People who have little or no dependence on the forest may look for indirect benefits like their recognition by others or they may protect the forest because it appeals to their genuine concern for the environment.

Bhat (2018) used secondary sources of information published by Government and Non-Government organization to report on forest conservation and livelihood generation through joint forest management in India. The results highlighted that alternate livelihood support to the communities not only provide employment opportunities but also results in conservation of forests over which they are traditionally dependent. Thus an integrated approach for the development of forest dependent population and natural resource conservation is suggested. This could be achieved through the joint forest management (JFM) by promoting forest and non-forest livelihoods.

A study was carried out by Yaseen *et al.* (2018) to assess and analyze the socio-economic impacts of joint forest management at Miandam, district Swat, Pakistan. Using random sampling technique 419 respondents from Miandam village and 20 forest department staff were selected for the study. Secondary data like forest area, ecology of the area and social status were collected from forest department, JFMCs, Village council/Union Council office and Agriculture office. The results revealed that the respondents received two types of benefits i.e. direct and indirect benefits from JFM. The direct benefits like fuel wood, timber and fodder for their basic needs and indirect benefits includes employment through nursery raising, plantation management and water channel construction, additional income by collection of NTFPs and medicinal plants in JFM managed forest area, trainings for skill development, external investment by government, NGOs and agencies for forest management activities. Due to JFMC many developmental works are also carried out in the village like roads construction, pathways construction and Hydro-electrical generator etc. With these benefits socio-economic condition of Miandam village local communities had improved, so majority of local population prefers JFM over traditional forest management. It was observed that after JFM, the status of forest and wildlife damages had decreased and there was positive improvement in forest management. It was observed that due to Joint Forest Management there was an increase in the population of beneficial insects which has an important role in pollination and natural product development including honey, silk and lac products. However some of the respondents were against of JFM due to ignorance and favoritism of JFMCs. Lack of interest was reported by some of the staff due to problems like lack of incentives, delay in community decisions, conflicts on forest resources and ban on permits. Future prospects of JFM will become successful through participation, involvement of other related agencies, democratic way of JFMCs formation and linkage with various running projects.

From the above reviews we can conclude that JFM programme was aimed at restoration of degraded forests with active cooperation and involvement of local villagers. Besides developing the forest resources to provide sustained ecological and economic benefits, efforts were made for socioeconomic development of the village as a whole. People's participation was encouraged from the initial planning stage onwards up to benefit sharing and to some extent for the management and protection of forests.

2.3 Knowledge of forest dwellers about forest management

Sinha (2000) studied forests and people to understand the institutional governance, social identity, and people's participation in Indian forest management. Using purposive sampling procedure, forest management was studied in the three eastern states of India i.e., Jharkhand, Orissa, and West Bengal. Seven Joint Forest Management (JFM) units i.e., two each from Jharkhand and Orissa, and three from West Bengal; six Indigenous Community forest Management (ICFM) units i.e., four from Jharkhand and two from Orissa; and four Crafted Community Forest Management (CCFM) units from Orissa were selected for the study. The study results explained that knowledge of local ecosystems helps in sustainable management of resources. Knowledge about species preservation, care of plantation, grazing rotation, and rotation of timbers is found to be sacred among forest dwellers. Indigenous community forest management (ICFM) and crafted community forest management (CCFM) provided more opportunities to the local inhabitants to design forest institutions incorporating their knowledge and values as compared to JFM. While JFM forests accommodated mostly commercial timber species, ICFM and CCFM forests had many non-commercial species, which not only met diversified local necessities but also saved forest lands from disease pests. Maintaining Indian Neem (*Azardichta indica*), or Sindwar (*Vitex negundo*) in forests was reported to serve the above purposes at many places. In JFM, forest department (FD) most often used exogenous technology guided by its commercial interest as compared to ICFM and CCFM where indigenously evolved technologies were preferred.

Tiwari (2015) studied about role of women in conservation and sustainable natural resource management in Chhattisgarh. The sample was 375 female Joint Forest Management (JFM) members from two villages (Charmar & Katangadih) which belong to Raigarh district are having good forest cover and remaining two villages (Amlipali & Pakariya) have less than 5.00% forest cover belong to Janjgeer district were selected. It was observed that in areas

where forest cover is good, women are better knowing about joint forest management programme. Women in Charmar (70.00 %) and Katangdih (75.00 %) had awareness about JFM and they were totally dependent on forest for their livelihood. The further results revealed that woman were also actively involved in forest protection and development in Charmar (65.00 %) and Katangdih (70.00 %). Where forest cover is less there women's participation in JFM is also very low. Though women of Pakariya (75.00 %) and Amlipali (70.00 %) collect their fuel wood from surrounding forest areas. During the Participatory Rural Appraisal (PRA) it was noticed that women of these areas are very keen to raise trees in their private land, though their response about forest protection was very poor Amlipali (45.00 %) and Pakariya (15.00 %).

Karki and Adhikari (2015) studied integrating indigenous, local and modern knowledge for sustainable conservation and management of forest ecosystems in Nepal. Five different community based forest management committees were selected based on ethnicity (culture, language, and social norms), agro-ecology, and indigenous local knowledge systems. Approximate number of beneficiary from five community based forest management committees were 3,412. The study findings indicated that around 64.00 per cent of the respondents felt that the quality of their forests was better than in the past due to collective actions and good resource governance practices followed by the people across five forest management committees. Only in Mustang district, about 22.00 per cent of the respondents felt that the situation of pasture and forest management is not working mainly due to rapid climate change phenomenon and government interventions. Majority (90.00 %) of the respondents indicated that their indigenous local knowledge and practices were predominantly related to agriculture, forestry, water management, animal husbandry and pasture management. The indigenous practices found in hilly and mountain districts were of more mixed and integrated types in comparison to Tarai districts where the practices were more related to flood management, housing and forestry. In terms of their coping strategy and adaptation strategies in forestry and pasture management, most of the respondents (89.00 %) agreed that their indigenous and local knowledge is helping them reduce the vulnerability to build resilience. They described how they are using their intuitive and experienced knowledge and innovative practices to prevent flood and landslide damage to forests and pastures by banning grazing and felling altogether. The communities in Khumbu and lower Mustang regions are following co-management system of forest and pasture management. While in

Khumbu, a good integration of indigenous/traditional and modern institutional arrangements is observed, in Mustang both traditional (*Mukhiya*) and modern Annapurna Conservation Area Project (ACAP) systems are operating in parallel.

From the reviews we can say that, indigenous communities have developed interdependent systems for forest management that are uniquely suited to the ecological requirements of the land they inhabit. Indigenous knowledge and system has been increasingly recognized as important role in promoting sustainable forest management, conservation efforts as well as a basis in managing the natural resources in many developing countries. Many indigenous communities in forest areas continuously use land use system in line with the concept of sustainability to ensure the availability of natural resources for their future generations. There are many examples that indigenous communities, through customary laws, tried to limit the extraction of natural resources and develop reserves area to protect their land and forests.

2.4 Participation of JFMC members in sustainable utilization, collection and processing of non-timber forest products (NTFPs)

Lise (2000) studied factors influencing people's participation in forest management in India. The random sample consists of 385 households in 32 villages in three states i.e., Haryana, Uttar Pradesh and Bihar. The findings revealed that two important considerations for participation as social and economic. He reported that the attitude towards meetings in the village (social participation) is the most important consideration in each case. When the condition of the forest is good and when people are dependent on the forest, participation goes up. Low average levels of education in the family and high levels of education of the respondent enhance participation. Greater involvement of women in the community stimulates participation. A high level of people's participation facilitates the initiation of a participatory institution. Once an institution is created, a lower level of participation is needed to keep the participatory process going. The main conclusion is that a high dependence on the forest and good forest quality enhances voluntary people's participation.

Sadashivappa *et al.* (2006) examined the role of non-timber forest products (NTFP) in the rural household economy in Tumkur district of Karnataka state. Being home for number of species the district contribute to an array of valuable NTFP from a vast area under the dry deciduous forests. Random sampling technique was used and 100 households (70 collectors

and 30 non-collectors) were selected. The results revealed that NTFP collection provided 64.42 days of employment, generating an annual income of Rs. 5,393 per household. It was observed that the average return from family labour employed in NTFP-EM (Rs.83.71 per days work) is much higher than the wage rate prevailing in the study area (Rs. 40 and 60 for woman and man labour, respectively), making the collection of NTFP as an economically viable option for the household. In NTFP, *Albezia amara* generated the highest annual income of Rs. 2,730 (50.64 % of total annual return from NTFP-EM), followed by *Feronia limonia* with an annual income contribution of Rs.611 per household (11.33 %). The return from a day's employment in the collection and marketing of this NTFP is about Rs.175. Though the average return per day was highest (at Rs.185.6) with *Gardenia gummifera*, the share of household income generated is comparatively less (5.95 %), owing to scarcity of the product.

Schreckenberg *et al.* (2006) analyzed the commercialisation of non-timber forest products (NTFPs) in Mexico. They concluded that commercialisation of NTFPs has been widely promoted as an approach to rural development in tropical forest areas. However, donor investments in the development of NTFP resources have often failed to deliver the expected benefits in terms of poverty alleviation and improved conservation of natural resources. To overcome this failure they found some key factors that influence the outcome of NTFP commercialization initiatives as; Innovation, Collaboration, Entrepreneurship and Conducive legislative and policy environment.

Dattagupta *et al.* (2010) carried out a study on non-timber forest products of the inner line reserve forest, Cachar, Assam. A total of 654 households were selected from nine villages to study the utilization and dependency of the forest dwellers of NTFPs. Data were collected through door to door interview using structured and semi structured questionnaire as well as focus group discussion. Interview and focus group discussion were made involving interviewees from different cross sections of the community such as NTFP collector, trader, traditional medicine practitioner, knowledgeable person, hunter and head man (chief) of the forest villages. Special efforts were made to involve women in the exercise. The study revealed that almost all of the forest dwellers depend on forest products other than timber to varying degrees. It was observed that 28.10 per cent of forest dwellers depend on the forest even for their cash income. They reported that NTFPs is a possible solution to release the

dependency on timber and can be a sustainable source of income for the people living in the forest and its near vicinity.

Toksoy *et al.* (2010) analyzed usage of non-timber forest products by women in forest villages of Trabzon, Turkey. The information about NTFPs was obtained from 611 women in 68 villages using questionnaires by face to face polling method. They examined the NTFPs, which are used for food & treatment, which part is collected & purpose and income earned. Results showed that about 14.40 per cent of the women were gathering the plants for food (17 species and 2-8 kg annually) and 09.20 per cent of the women were gathering the plants for medicinal purposes (16 species and 1-4 kg annually). These plants are usually used for additional medicinal treatments. Only four species are used for livestock treatment and two plant species were used as dyes for hand weaving materials.

Das (2011) examined women's dependence on forest and their involvement in participatory forest management. The data was collected through an intensive field inquiry on 431 households covering all members from eight villages from Bankura district of West Bengal, with and without of the JFM programme. The study found that women's participation in their own management unit is substantially higher than men's in the general forest management unit, and the farmers ensure their (women's) major contribution to the household's income with their greater physical dependence on forestry works. As women are more dependent on forest for their subsistence, they are extra sensitive to the economically sustainable goals under participatory forestry and are the most apt participants in forest conservation projects. But, despite of women's dominant role in forest sources of earning, men have free hand access to them money which undermine women's status in the studied forest fringe communities.

Sunderland *et al.* (2014) studied challenging perceptions about men, women, and forest product across different countries. They used household-level data from the Poverty Environment Network (PEN), overall robustness of previous findings on gender and forest use and explored what degree these findings are consistent across a large number of sites, countries, and regions. They examined whether this global data set supports common assertions about gender differences with respect to forest product collection, access, and management. The data revealed that there were considerable gender differentiation in the collection of forest products, indicating there are "male" and "female" roles associated to the

collection of forest products. However, we also found that men play a much more important and diverse role in the contribution of forest products to rural livelihoods than women. One of the key finding was that there are very strong differences across regions that cannot solely be explained by control variables.

Sharma *et al*. (2015) documented the status & utilization pattern of NTFPs and to assess their economic value. The study was carried out in eight districts of Arunachal Pradesh by covering 34 villages and 350 households. Altogether, 135 plant based non-timber forest products were recorded. Among plant based NTFPs, 54 species were collected for leaves, 30 for stem and 22 for fruits. On an average 20~40 kg of NTFPs were collected annually per household contributing more than 50.00 per cent of annual income of the people of the selected districts. An illiterate and unemployed person with minimum agricultural land was more dependent on forests for his livelihood than a literate job holder. The study also found that a large section of people of this state are dependent on NTFPs for their livelihood, however due to its unscientific harvesting, the availability of NTFPs is receding with time. The is an urgent need to promote cultivation and scientific harvesting of NTFPs in order to conserve the plant and animal diversity of this global biodiversity hotspot and for ensuring livelihood security of the people living in this area.

Tripti *et al.* (2015) carried out a study on livelihood dependency of rural people utilizing non-timber forest products (NTFPs) in the moist deciduous forest zone of West Bengal. The study was undertaken to assess the diversity of non-timber forest products (NTFPs) and its resource potential. Information about NTFPs was collected from 14 villages through preliminary survey, using secondary data, key informant interview and questionnaire. The study revealed that the diversity of collection of NTFPs varies with availability and local knowledge. Twenty three major categories of non-timber forest products were recorded. It 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 present investigation also revealed that although there is high resource potential in the study sites, there was lack of awareness, scientific knowledge, expertise and inadequate market information was also found to be very low. The forest dwellers are depended on NTFPs for sustaining their daily livelihood instead of utilizing it as a prospective income source for their socio-economic development.

Rawat and Chandra (2015) studied forest resource utilization by people of Nayar Valley of Garhwal, Himalaya. By using stratified random sampling method 30 villages were selected from Nayar Valley and 250 household were selected as sample for the study. The people of the Nayar valley use an enormous range of forest resources. The use of forest resources varies from food consumption items to non-food items. They use forest resources for making agricultural tools (*Juglans regia, Quercus spp., Morus serrata, Ilex dipyrena),* baskets (*Dendrocalamus strictus, Abutilon indicum*), mats and ropes (*Urtica dioica, Millettia extensa, Cannabis sativa*), brooms (*Sarcococca saligna Apluda mutica, Arundo donax, Neyraudia arundinacea*), colouring agents (*Juglans regia, Berberis spp., Symplocus paniculata, Euonymus tingens*), household construction and utensils & pots (*Cedrus deodara, Pinus roxburghii, Pinus wallichiana, Taxus baccata*), thatching of huts (*Dendrocalamus strictus, Arundo donax, Themeda arundinacea*), wood carving (*Juglans regia, Taxus baccata*), insecticides and pesticides (*Sedum rosulatum, Tenacetum dolichophylum*). Food items used are wild vegetable & fruits (*Chenopodium album, Diplazium esculentum, Amaranthus viridis, Prunus armeniaca, Juglans regia, Alliumglauca wallichi).* A sizeable proportion of the villagers also admitted to collect mushroom (*Morchella esculenta*) locally called as *guchchhi* during March to May to sell in the local market. Similarly roots of *Berberis* spp. and lichens (locally called Jhula) were collected and sold illegally in Ramnagar and Delhi. All the respondents of Nayar Valley regarded the surrounding forests as sources of their livelihood needs like; fuel wood, fodder, timber, forest litter, edible fruits, fibre, gum, resin, dyes, tannin, spices and important medicinal plants. All families use fuelwood for cooking and heating purposes.

Paloti and Hiremath (2015) carried out a research on socio-economic status and dependency of rural women of Dharwad, Karnataka on non-timber forest products (NTFPs). The data was collected from 150 rural women with the help of pre-tested schedule using personal interview method. The results showed that 42.00 per cent of the rural women were dependent on leaves of muttala (*Butea monosperma*) tree followed by fuel-wood (20.67 %), pongamia seeds (19.33 %) and edible gum (17.33 %). None of the rural women was dependent on collection of medicinal plant parts, honey, fodder and leaf litter. Equal percentage of rural women collected aonla fruits and raw materials for basket and broom making and karonda and jamun fruit collection.

Kumar and Choudhury (2016) studied enhancement of livelihood activities through non-timber forest products in Ranchi and Simdega districts of Jharkhand. Data was collected from the 125 respondents from both the districts. The results revealed that 53.00 per cent of respondents were involved in lac cultivation and they collect around 1200 kg to 2200 kg (Rs. 150 per kg) of lac throughout the year. The host plant for lac such as kusum, palas, ber, simialata are in abundance in the study area, so the women folk engage themselves more in lac cultivation as compared to other NTFPs. Nearly 47.00 per cent and 25.00 per cent respondents were involved in *mahua* and *chiranji* collection and processing respectively and they gather around 2900 kg to 3300 kg (Rs. 15-25 per kg) of mahua and 600 kg to 1100 kg (Rs.60 per kg) of chiranji for 2-3 months in a year. The study further revealed that after various awareness programmes, a large number of people were encouraged in the collection of NTFPs. However some women find it difficult to procure lac from the trees such as kusum and ber because of the height of the trees. For drudgery reduction of these women, trees that are short in height such as simialata can be planted to carry out lac cultivation.

Puneeth *et al.* (2016) conducted a study on collection and marketing of non-timber forest products by tribals in Sirsi forest division of North Canara district in Karnataka. Data was collected through personal interview method from 90 tribals engaged in the collection of NTFPs. It was found that 35.55 per cent of the tribals had travelled 4 to 6 km inside the forests for collecting the NTFPs and 66.66 per cent of the tribals had travelled 1 to 3 km for marketing the collected NTFPs. Cent per cent of the tribals were engaged in NTFP collection, while 88.88 per cent and 20.00 per cent of the respondents were engaged in agriculture and wage labour respectively for their livelihood. Nine NTFPs were extracted by the tribals in the study area and the tribals were supplying the collected NTFPs to the Joint Forest Management Committee for marketing the same.

Melese (2016) undertook a study on the importance of non-timber forest production in sustainable forest management and its implication on carbon storage and biodiversity conservation in of Ethiopia. He reported that NTFPs are increasingly being recognized for their contribution to the economic development and sustainable forestry management. The link between NTFPs and forest sustainability could be understood by taking some cases into consideration (e.g. properly managed vegetation for gum and resin can store carbon and conserve biodiversity). On the other hand, there are some obstacles that restrain sustainable management of NTFPs which are related to ecological change, socio-economic change and

institutional factors. He says that NTFP extraction affects the species and ecology and suggests certain management approaches for sustainable forests. They are, knowledge of collectors, qualities of NTFPs in national strategies and need for continuous research on NTFPs.

From the above studies it was noticed that Non-timber forest products (NTFPs) constitute an important source of livelihood for millions of people from the forest fringe communities across the world. The contribution of NTFPs to income varies across ecological settings, seasons, income level, etc. They contributed in improving nutrition either as part of the family diet or as a means to achieve household food security. It has been established that a significant number of rural, tribal and overall forest dependent communities derive a significant part of their food, nutrition, healthcare needs and income from NTFPs. However, a number of factors, including a policies, non-destructive harvesting, destruction of natural habitats, fire attack, population growth and high demand are hindering the use and development of NTFPs. An appropriate policy framework for a sustainable promotion of NTFPs, domestication of NTFPs, improving harvesting and processing techniques are necessary to facilitate food security, reduction of poverty and improved livelihoods, particularly for the economically-marginalized and forest-dependent communities. Augmenting livelihoods of the forest dependent communities requires some focused intervention on NTFPs. Facilities pertaining to storage, grading, processing and value addition through convergence of existing schemes and programs in private and public sectors should be promoted and created. Communities should be empowered with information about the market, policy and products to enable them strategizing and accessing better returns from NTFPs.

2.4.1 Participation of JFMC members in forest management activities:

Kumari *et al*. (2013) studied women empowerment in Forest Development Agencies (FDAs). The study was conducted in nine FDAs of Himachal Pradesh (HP) and five FDAs of Punjab. From each FDA two to four committees were chosen from selected JFMCs/FPCs and only female members were interrogated. It was observed that maximum empowerment of women in Himachal Pradesh (67.00 %) and Punjab (32.07 %) was shown by their participation in planning, implementation and maintenance and representation in various committees. Overall empowerment index was 54.34 per cent in Himachal Pradesh and 26.56 per cent in Punjab which is not very encouraging. The results revealed that the forest

resources used by JFMCs to regenerate the degraded forests were physically and financially more sound in Himachal Pradesh as compared to Punjab.

Joshi and Bhardwaj (2015) studied participation of women in water and forest conservation activities in micro watershed areas in Nainital district of Uttarakhand with a sample of 150 women farmers. The results indicated that participation in water conservation activities was medium (four to seven activities) 73.33 per cent of the respondents. High participation (> seven activities) was seen by 25.00 per cent of the respondents and low participation (up to four activities) was by two per cent respondents. Majority of the respondents (54 - 100 %) participate mainly in four activities like crop cultivation, animal husbandry, application of surface mulch and construction of water conservation tanks. Further results showed that more than half of the respondents (65.33 %) had high level of participation in activities like replanting, fodder and fuel wood collection and collection of NTFPs. About 31.00 per cent of respondents had medium level of participation and very few of the respondents (04.00 %) had low level of participation. Majority of the respondents had medium to high level of participation in water and forest conservation activities which indicates that the respondents are directly linked with water and forest conservation activities.

Bhui (2015) studied status of forest protection committee (FPC) in Paschim Medinipur, West Bengal. Sixty FPC members were selected for the study. The study reported that in rainy season the FPC members conduct a meeting with forest department officers and decide the activities to be done for conservation of forest. They collect seedling of sal, tick, eucalyptus plants for plantation. The secretary of this committee allots the duty to various active members for planting the seedlings, watering, fencing and protecting the seedlings from domestic animals. The task for members of FPC also protect older and matured trees of their area.

From the above studies it was observed that, successful conservation of forest resources requires the participation of local people, and that government's play a key role in this process by providing a supportive legal and institutional environment. Many studies show that the optimal formula for successful forest conservation is joint control and management by government and local people. Many case studies is that non-governmental organizations have played important roles as mediators between governments and other stakeholders in forest conservation. Like the communities and states in which they operate, non-governmental

organizations differ widely in terms of their ideology, political and economic power, and organizational capacity. The presence of capable and environmentally concerned non-governmental organizations in many countries indicates that changes are taking place in response to growing struggles over natural resources. These open our eyes to the social and political complexities of forest genetic resource conservation, and raise our hopes that sustainable forest management is possible through people's participation.

2.5 Socio-economic and personal characteristics of forest dwellers/ forest people

Age

Sudheendra and Hirevenkanagoudar (2005) studied characteristics of beneficiaries and benefits derived through joint forest management programme. The study was conducted in Dharwad and Belgaum districts of Karnataka State with a sample of 360. The results showed that majority (51.94 %) of the respondents belonged to middle age group followed by young (25.00 %) and old age group (23.06 %).

Kumari *et al*., (2013) assessed women empowerment in Forest Development Agencies (FDAs). The study was conducted in nine FDAs of Himachal Pradesh (HP) and five FDAs of Punjab. From each FDA two to four committees were chosen from selected JFMCs/FPCs and only female members were interrogated. The results showed that 64.91 per cent women in Himachal Pradesh and 52.27 percent in Punjab belonged to middle age group (35-55 years). The age of members was important factor in determining the people's participation in JFM because the old age people are less dynamic and innovative.

Joshi and Bhardwaj (2015) undertook an investigation on the socio- personal profile of women involved water and forest management in micro watershed areas in Nainital district of Uttarakhand. Out of 38 villages in Dhari and Okhalkanda blocks, eight villages were selected randomly using simple random sampling technique, from these eight villages a sample of 150 women farmers were selected using stratified random sampling method. They noticed that 43.33 per cent were of old age (above 51 years) followed by 40.67 per cent respondents of middle age (29-51 years) and a lesser number of respondents i.e., 16.00 per cent were found to be in the young age group.

Education

A study was conducted by Sudheendra and Hirevenkanagoudar (2005) on benefits derived from the joint forest management programme in Dharwad and Belgaum districts of

Karnataka State on a size of 360 beneficiaries. It was observed from the study that 38.30 per cent of the respondents had studied up to primary school, followed by 33.60 per cent of illiterates, 13.60 per cent were educated up to high school and a negligible percentage (02.50 %) were educated up to PUC and degree level.

The study by Kumari *et al*. (2013) in Himachal Pradesh (HP) and Punjab revealed 49.12 per cent respondents of Himachal Pradesh and 56.82 per cent respondents of Punjab were illiterate and they had low level of education. They also reported that education has no role in participation activities.

Joshi and Bhardwaj (2015) carried out a study on socio- personal profile of women involved water and forest management in micro watershed areas in Nainital district of Uttarakhand and reported that 30.67 per cent of the respondents had formal education up to primary level, followed by middle school (32.00 %), illiterates (13.33 %), intermediate (10.00 %), high school (06.00 %), graduation and above (04.00 %). It shows that 82.67 per cent respondents were literates and the rest were illiterate.

Rawat and Chandra (2015) studied forest resource utilization by people of Nayar Valley of Garhwal Himalaya. The sample consisted of 250 households from 30 villages. They reported that education status was very poor i.e., less than 30.00 per cent head of household were educated and 85.00 per cent senior women were illiterates.

Caste and Marital status

Kumari *et al*., (2013) study revealed that majority of the respondents in Himachal Pradesh were from general category (65.45 %) followed by schedule caste (23.64 %) and in Punjab 75.00 per cent respondents belonged to schedule caste and 15.91 per cent were from general category.

Joshi and Bhardwaj (2015) studied the socio- personal profile of women involved water and forest management in micro watershed areas in Nainital district of Uttarakhand and revealed that the study area is dominated by general caste category (81.33 %) followed by SC/ST (12.67 %) and OBC (6.00 %). They also reported that 98.67 per cent were married women and only two women were widows.

Family type and Family size

Sudheendra and Hirevenkanagoudar's (2005) study in Dharwad and Belgaum districts of Karnataka State revealed that, 61.67 per cent of the beneficiaries were from nuclear families and the rest i.e., 38.33 per cent were from joint families.

Kumari *et al*., (2013) reported that size and type of family influence the participation of people in joint forest management activities to a greater extent as in Himachal Pradesh because joint and big families were more dominant in economically weaker sections as compared to Punjab which have more number of nuclear and small families in the society.

Joshi and Bhardwaj's (2015) study showed that in Uttarakhand majority of the respondents belonged to joint families (76.00 %) followed by nuclear families (24.00 %). With respect to family size majority of the respondents (90.67 %) have a medium family size (4-11 members). The small family size (< 4 members) and large family size (> 11 members) were only 05.33 per cent and 04.00 per cent respectively. The average family size was large (4-11 members).

Rawat and Chandra (2015) studied forest resource utilization by people of Nayar Valley of Garhwal Himalaya. The families of the respondents were large in size with an average of eight members upto a maximum of 32 members in some families.

Land holding

Sudheendra and Hirevenkanagoudar (2005) reported that 32.50 per cent of respondents were big farmers, followed by 29.70 per cent marginal farmers, 20.30 per cent small farmers and 17.50 per cent landless labours.

Kumari *et al*. (2013) reported in their study that in Himachal Pradesh majority of the women respondents had marginal land holding (60.00 %) i.e, below 1 ha whereas in Punjab majority of them (81.82 %) were landless.

Betta land holding

To fulfill the various needs of the farmers nine acres of betta/soppina betta would be allocated for every acre of arecanut garden and four acres for each acre of coconut plantation. Tree species diversity or Betta land is blessing for the people of Sirsi taluk of Uttarakannada district. Use of green leaves from the Betta land for mulching and preparing compost using cow dung to arecanut garden and other horticultural crops helped the farmers to maintain the soil fertility since 300 years in arecanut fields**.**

Benefits of Bettaland

The rainfall is more than 2500 mm and moderate temperature has supported the Betta land to cherish with lush green trees providing food, honey, fodder, fuel, foliage, medicine for man and domestic animals, and raw materials for small scale industries, shading and wind break to arecanut gardens, timely food supply to birds and animals.

Annual income of the family

Sudheendra and Hirevenkanagoudar (2005) reported that a large majority of beneficiaries (96.67 %) had an annual income of Rs < 20,000 per year (Below Poverty Line) and very less beneficiaries (03.33 %) annual income was Rs >20,000 per year (Above poverty line).

Joshi and Bhardwaj (2015) reported that 52.67 per cent respondents were in the Above Poverty Line (APL) category which might be due to the involvement in various income generating activities. About 42.66 per cent respondents were in medium income category, who mostly depend on the agriculture and livestock rearing and only 04.67 per cent respondents were in very low income category.

Occupation of the family

Kumari *et al*. (2013) reported that in the study area agriculture was the main occupation of respondents in Himachal Pradesh but in Punjab labour was the main occupation.

Joshi and Bhardwaj (2015) reported a large majority of the families (82.00 %) were engaged in two to three occupations. Only 09.33 per cent respondents' families were having more than three occupations. About 8.67 per cent of families were engaged in single occupation. Agriculture and dairying were the traditional activities of the respondents while business had been introduced by the Uttarakhand Diversified Watershed Development Project (UDWDP) personnel which has raised the income of the respondents. This factor might have led to majority of respondents' family having two to three occupations.

The study by Rawat and Chandra (2015) in Nayar Valley of Garhwal Himalaya reported that 95.00 per cent of respondents were involved in agriculture, horticulture and livestock rearing as a primary source of occupation. About 30.00 per cent people were involved in labouring and only 03.00 per cent were in salaried jobs.

Extension participation

Sudheendra and Hirevenkanagoudar's (2005) study revealed that 55.28 per cent of respondents had medium level of extension participation followed by low (25.28 %) and high (19.44 %).

Organizational participation

The study conducted by Kumari *et al*., (2013) showed that 73.00 per cent respondents in Himachal Pradesh (HP) and 84.09 per cent in Punjab were members either of Mahila Mandals or SHGs and amongst the surveyed FDAs 27.00 per cent and 15.91 per cent respondents in HP and Punjab respectively were office bearers of JFMCs/ Mahila Mandals or SHGs.

The study by Joshi and Bhardwaj (2015) showed significant positive correlation between participation in water management & occupation (r = 0.958) and between participation in forest management & age (r = 0.873). Relationship between participation in forest management & occupation (r = -0.067) were negatively significant. More than two third of respondents' families were involved in two to three occupations and the majority of women were engaged in livestock and agriculture for subsistence farming. Since these economic activities require more water, the significant positive association between participation in water management & occupation may have occurred. The area is dominated with middle to old aged women, thus majority of aged women's participation in water and forest management might have led to significant positive correlation between water/ forest management and age.

Paloti and Hiremath (2015) carried out a research on socio-economic status and dependency of rural women of Dharwad, Karnataka on non-timber forest products (NTFPs). The data was collected from 150 rural women with the help of pre-tested schedule using personal interview method. The results revealed that a large per centage of the respondents belonged to middle age group (60.00 %), were married (76.00 %) and illiterate (94.70 %), engaged as farm labourers (68.67 %) having annual family income of more than Rs 11,500 (46.00 %) and lived in nuclear families(94.00 %).

Contact with extension agency & Mass media participation

No studies were reported in these aspects as relevant to Joint forest management committee/Forest user groups/Forest dweller organizations and such similar groups.

2.6 Investigation and documentation of bio-cultural beliefs about forest and forest tress

Rawat and Singh (2010) conducted study in Uttarkashi district of Garhwal, Himalaya, India to document the medicinal plants used by the local communities. Fifty six plant species distributed in 46 families were documented. In the documented plant species, 52.00 per cent were herbs, 25.00 per cent trees, 20.00 per cent shrubs and 03.00 per cent climbers. Seventeen different plant parts were used by local communities for different ailments. Some of the plants viz., *Aconitum heterophyllum, Angelica glauca, Commiphora mukul, Dactylorhiza hatagirea, Picrorhiza kurroa and Saussurea costus* are very rare in the wild. *Zanthoxylum armatum, Rumex nepalensis, Cinnamomum tamala, Zingiber officinale, Allium sativum* and *Angelica glauca* were the preferred medicinal plant species. These plants were mainly used for common colds, asthma, skin and liver diseases.

Sharma and Pegu (2011) investigated religious and supernatural beliefs of the Mising tribes of Assam with special reference to the 'Dobur Uie'. They reported that tribal folklore is rich in magico-religious beliefs and taboos. They believe that some gods and deities reside on the trees in the forest. If they do not show a mark of respect to them, their full clan will be destroyed. So they preserve the plants which they regard sacred for social, cultural and religious purposes. Their taboos, festivals, rituals and other cultural aspects are closely associated with the surrounding vegetation preserved on religious ground. The fear of getting attacked by the forest spirits or getting cursed by the deities eventually makes the local communities to resort to worship the spirits and making sacrifices and offerings to pacify them. The study further revealed that nearly 30 plants belonging to 23 families have been identified as medicinal plants used by the Mising people of Assam in Dobur Uie ritual. These plants are used in the treatment of some very common ailments like diarrhoea, dysentery, indigestion, flatulence, stomach problems, liver problems etc.

Singh (2015) studied the role of women in natural resources in Western Himalayas. He says that forests are an integral to the "Cosmo vision" of indigenous communities of the study area, which manifest in a direct relationship between cultural events and beliefs with the tree or forest. For example no person is allowed to go to the forest without reason and they have to visit for some specific purpose only. In the forest people are not supposed to talk in the loud voice, or shout or laugh because it is believed that in these trees exist of the "Kali" roop (negative face) who immediately enters into the body of the person and bring harm to

them. Most people believe that ancestral spirits also come and rest on these trees. The local knowledge of forest /tree resources for cultural /religious purpose is within the complex social network of the forest dwellers. Researcher also found that in the forest there is a tree called Bhoj tree from which Bhojpatra (yantra is made up of). Bhojpatra is basically the skin of old bhoj tree which is used as medicine for back pain and thigh pain.

2.7 Constraints faced by forest dwellers in forest management.

Himberg *et al.* (2009) assessed constraints in the participation of forest management in Taita Hills of Kenya. Using a self-completion questionnaire data was obtained from 172 respondents. Constraints in forest management are: lack of unity & lack of transparency among stakeholders in resource sharing leading to prejudices and uneven distribution of benefits. Other constraints are ignorance, lack of commitment of members, insufficient knowledge about management techniques, no knowledge of legal rights, income from forest products not benefiting the forest itself or the community at large, lack of funds, more time consumption, over supply on the butterfly market sector causing competition and blockage, insufficiently equipped to fully engage in forest conservation, unsolved human-wildlife conflict, unpredictable weather conditions, forest fire outbreaks, conservation efforts going wrong because of lacking management capacities and theft.

Nathan and Boon (2012) reported the constraints in local forest management in Cambodia. One of the most serious constraints encountered by the local communities is the increasing number of conflicts in the forest sector. There are conflicts between the communities and powerful external actors, and within and between the communities. Constraints encountered by community forestry groups are lack of substantial incentives and insufficient motivation to protect the forest.

Madegowda and Rao (2013) measured effects of the ban of NTFPs collection in Biligirirangaswamy temple wildlife sanctuary on migration of soligas. The study was conducted in Chamarajanagara district of Karnataka on a sample of 370 households. The NTFPs collection was banned in 2006 under the Wildlife Protection Act, 1972, due to which Soligas faced unemployment & wage problem, food, income, migration, and health problems. About 33.00 per cent of the Soligas migrated to different places of Kodagu, Tamil Nadu, and Kerala, as well as to nearby coffee estates and villages for employment. Soliga families

migrate from 10 to 300 days in a year which has affected the children's education, culture, health etc.

Puneeth *et al.* (2016) conducted a study on collection and marketing of non-timber forest products by tribals in Sirsi forest division of North Canara district. Data were collected from 90 tribals engaged in the collection of NTFPs through personal interview method. Major problems faced by the tribals in the collection, processing and marketing of the NTFPs are perishable nature of NTFPs (93.33 %), seasonal availability of NTFPs (82.22 %), scattered distribution of NTFPs (76.66 %), travelling long distance to collect NTFPs (74.44 %), remote areas (68.88 %), lack of processing facilities (64.44 %), exploitation from the middlemen (55.55 %) and lack of storage facilities (54.44 %).

Yaseen *et al.* (2018) studied impact of the joint forest management and socio-economics of local communities in Miandam village Swat district of Pakistan. They reported that a few respondents were against of JFM due to ignorance and favoritism of JFMCs towards certain people. The staff did not have interest to work because of lack of incentives, delay in community decisions, conflicts about forest resources and ban on permits.

Methodology

3. METHODOLOGY

This chapter explains the various methods and procedures used to collect information and data in carrying out the present study. A detailed description of these methods and procedures are presented under the following heads:

3.1. Research design

3.2. Locale of the study

3.3. Selection of the respondents

3.4. Instrument for data collection

3.5. Selection of variables for the study

3.6. Operationalization and measurement of variables

3.7. Statistical tools used in the study

3.1. Research design

Research design is the determination and statement of the general research approach or approaches followed for the specific task. It is the heart of planning. If the design sticks to the research objectives, it will guarantee that the client's needs will be served.

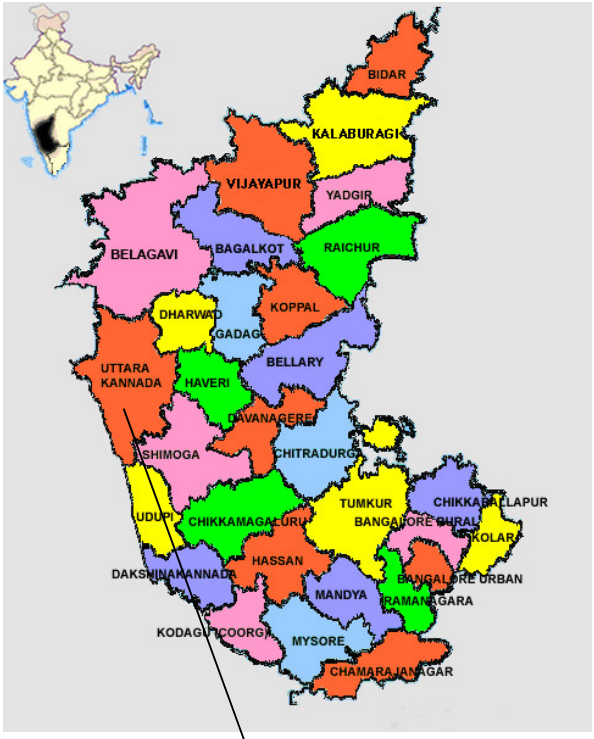
In the present research both descriptive and explorative research designs were adopted to fulfill the specific objectives of the study related to sustainable forest management. Hence, both qualitative and quantitative data was collected from the respondents.

3.2. Locale of the study

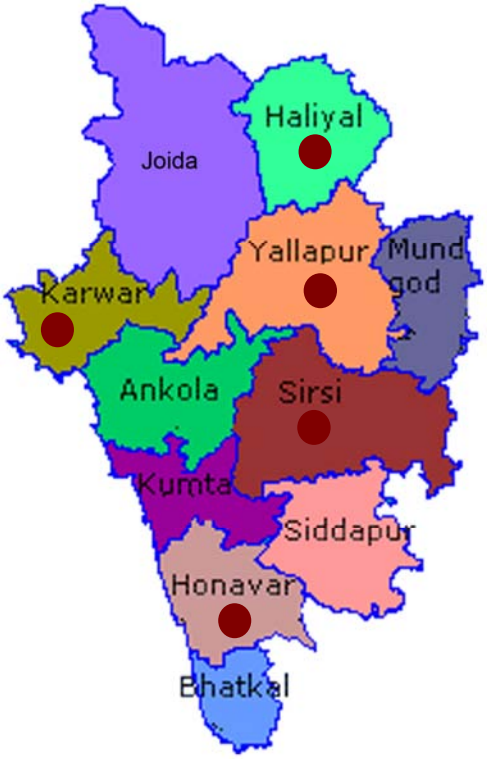
The study was conducted in the Western Ghats region of Uttara Kannada district of Northern Karnataka (Fig. 1.) during the year 2018-19.

India is a subcontinent with a geographical area of 32,87,782 sq.kms extending from the snow covered Himalayan heights in the north to Kanyakumari in the south. The country is divided into 29 states and 9 union territories. Karnataka is one of the major states in the country, situated at the centre of the Deccan Plateau. Karnataka state covers an area of 1,91,791 sq.kms. divided into 29 districts. The Western ghats cover the districts of Uttara Kannada, Shimoga, Udupi, Dakshina Kannada, Chickmagalur, Hassan and Kodagu. Uttara Kannada which falls in the UAS Dharwad jurisdiction, is one of the important districts in the state of Karnataka with abundant natural resources.

India **Karnataka state**



Uttara Kannada District



Forest divisions

Fig. 1. Map showing study area

3.2.1. Geographical Location:

Uttara Kannada district is situated on the western part of the state on the coast of Arabian Sea extending from North latitude 13.922° N to 15.5252° and east longitude 74.0852° E to 75.0999°. The district is surrounded by Goa and Belguam in the north, Dharwad in the east, Shimoga and Udupi districts in the south and the Arabian Sea in the west. Natural diversities make Uttara Kannada the only district in Karnataka State which consists of three natural divisions *viz*, the Coastal region, Upghat region (*Malenad region*) and the Plain region. The district is blessed with natural floral beauty and splendour by the evergreen rich forests in Sahyadri hills and the Western Ghats. Beautiful river valleys and the calm blue Arabian sea contribute towards infinite beauty of the region.

3.2.2. Forest Area:

Uttara Kannada district has forest covering 80.00 per cent of the total geographical area. Major forest cover in Uttara Kannada district is concentrated in Joida, Yellapur, Sirsi and Ankola taluks. These four talukas account for 57.02 per cent of total forest area. The district consists of five forest division viz. (i) Haliyal (ii) Yellapur (iii) Karwar (iv) Honavar and (v) Sirsi.

3.3. Selection of the respondents

Since Joint Forest Planning and Management (JFPM) programmes are implemented by Village Forest Committee (VFCs) and these committees are formed by people interested in protecting and conserving the forests. These VFC members are called as JFMC members.

Uttara Kannada district consists of three natural divisions viz, the Coastal region, Upghat region (*Malenad region*) and the Plain region. By using stratified random sampling technique 70.00 percent of the forest range areas in each zone were selected and in each forest range one Village Forest Committee (VFC) was selected. Thus 4 VFCs from Coastal region, 11 VFCs from Upghat region and 7 VFCs from plain region were selected.

In order to compare the knowledge of JFMC members with that of non JFMC members both JFMC members and non JFMC members where considered for the study. Further from each of these forest range 70.00 per cent of respondents were selected (35.00 % JFMC & 35.00 % non JFMC members). They include 96 respondents from coastal region,

252 respondents from upghat region and 116 respondents from plain region. Thus making a total sample of 464 respondents (232 JFM and 232 Non-JFM members). (Fig 2)

3.4. Instrument for data collection

Keeping in view the objectives and the variables under study, a interview schedule was prepared in consultation with experts. The interview schedule was pre-tested and based on the pre-test results, necessary modifications were made in the schedule. The finalized interview schedule was used for data collection by personal interview, informal discussion and focused group discussion methods.

3.5. Selection of variables for the study

A variable is either some force or is itself the force that causes a change in another variable. In experiments these are called dependent and independent variables respectively.

Variables selected for the study

Dependent Variables:

1. Knowledge of forest management
2. Conservation Practices
3. Gender Participation

Independent Variables:

1. Age
2. Education
3. Caste
4. Marital status
5. Family size
6. Family type
7. Land holding
8. Betta land holding
9. Annual income of the family
10. Occupation of the family
11. Contact with extension agency
12. Extension participation

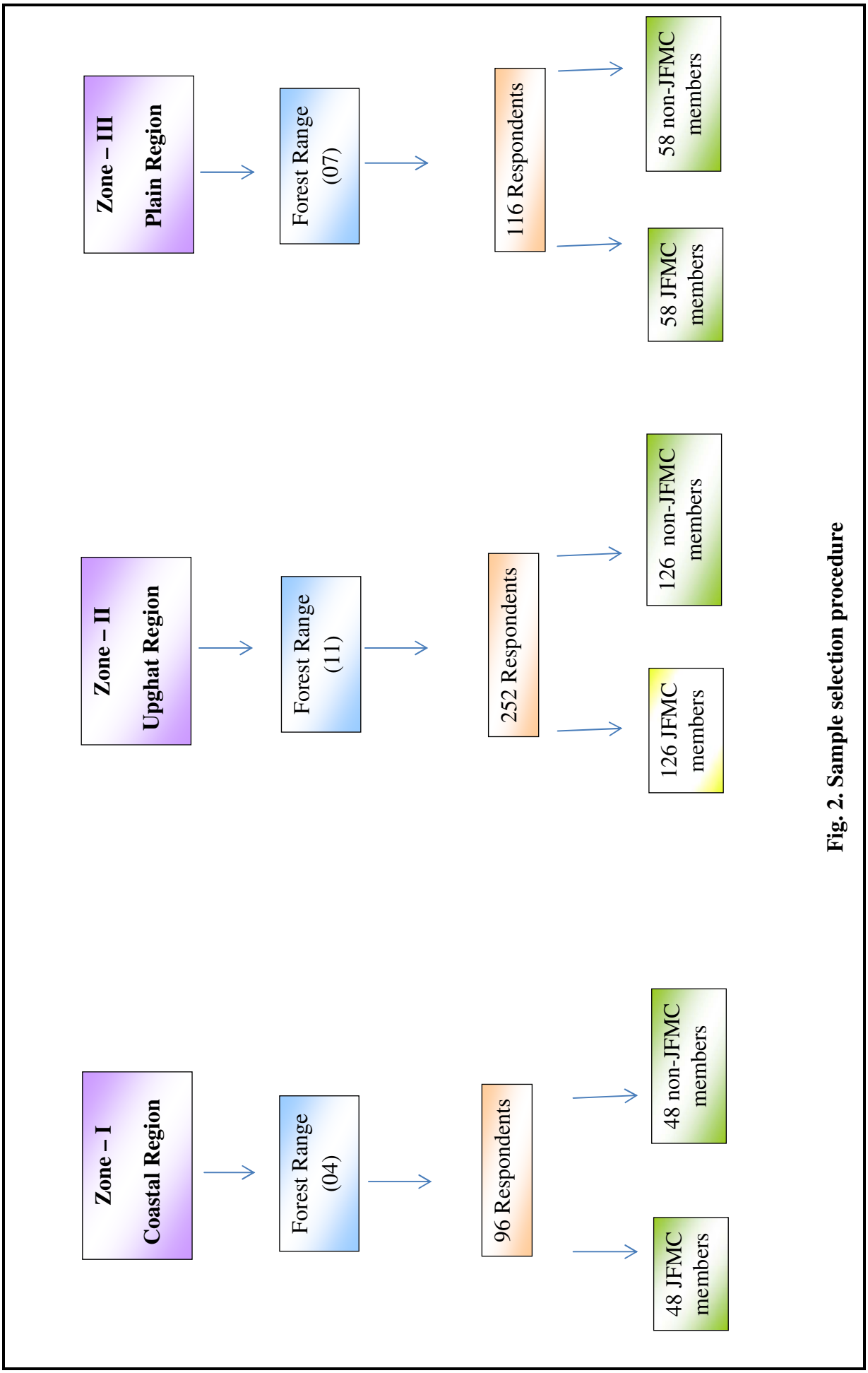


Fig. 2. Sample selection procedure

13. Mass media participation

14. Organizational participation

3.6. Operationalization and measurement of variables

Sl. No	Variables	Empirical Measurements
	Dependent variables	
1	Knowledge	Teacher made test
2	Conservation Practices	Teacher made test
3	Gender Participation	Teacher made test
	Independent variables	
1	Age	Procedure followed by Karigar (2017)
2	Education	Procedure followed by Karigar (2017)
3	Caste	Procedure followed by Patil (2015)
4	Marital status	Procedure followed by Kurbetta (2016)
5	Family size	Procedure followed by Rayangoudar (2009).
6	Family type	Procedure followed by Rayangoudar (2009).
7	Land holding	Procedure followed by Patil (2018)
8	Betta land holding	Procedure developed by the researcher (2019)
9	Annual income of the family	Procedure followed by Patil (2018)
10	Occupation of the family	Procedure followed by Patil (2018)
11	Contact with extension agency	Procedure followed by Kurbetta (2016)
12	Extension participation	Procedure followed by Patil (2015)
13	Mass media participation	Procedure followed by Patil (2015)
14	Organizational participation	Procedure followed by Kurbetta (2016)

3.6.1. Methods used for measurement of dependent variables

Both qualitative and quantitative methods used for the study, the tools and techniques used for measurement are as follows.

Qualitative research approach:

A qualitative research approach is a process of exploring and understanding the meaning of complex aspects in a holistic manner. The qualitative research approach emphasizes the importance of the participant's experiences, their perceptions and the meaning that they associate with a particular event or issue. Since qualitative research typically occurs within a natural setting. This allows the researcher to conduct the research on site, and this involvement lets them gain a deeper understanding of the people and the site being studied.

The qualitative approach was considered the most appropriate and relevant approach for studying knowledge of forest management and conservation of forest. Qualitative measures like observations, in-depth interviews and focused group discussions were carried out to understand the knowledge of JFMC members about forest management activities & conservation practices. The interviews were based on open-ended questions related to study questions related to knowledge & conservation practices about biodiversity conservation, fire management, soil & moisture conservation and deforestation & land degradation.

The qualitative results are presented in verbatim as quoted by the respondents.

Quantitative research approach:

Quantitative research methods emphasis objective measurements and statistical tools, mathematical or numerical analysis of data. Quantitative methods used for the study for the different variables are explained as below:

3.6.1.1 Knowledge:

Knowledge was operationally defined as the extent to which the forest management and conservation practices are known by the respondents.

According to Webster's dictionary, knowledge is "the fact or condition of knowing something with familiarity gained through experience or association".

Knowledge is also a familiarity, awareness or understanding of particular concept such as facts, information or skills, which is acquired through experience by perceiving, discovering or learning.

Construction of teacher made knowledge test: Teacher made knowledge test was developed to understand the knowledge of the JFMC members and non-members about sustainable forest management activities.

To know the knowledge of respondents about sustainable forest management activities, close ended and open ended questions were framed on different topics like Environmental awareness programmes, Plantation management, Fire management, Biodiversity conservation, Soil & moisture conservation, Deforestation & land degradation and Conservation & sustainable harvesting techniques of NTFPs. Close ended questions help to know whether respondents are having knowledge about particular topic or not (Yes/No). A score of 1 was given to the response "Yes" and 0 to the response "No". For the response 'Yes' qualitative data was collected.

Based on the total score, the respondents were grouped into two categories following the equal distribution method based on class intervals as follows. This categorization procedure was followed by Natagal (2016).

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{2}$$

$$\text{Class interval} = \frac{8 - 0}{2} = \frac{8}{2} = 4$$

Taking the class interval as four, the following three categories were made.

Category	Range
Low	1- 4
High	5- 8

3.6.1.2 Conservation Practices:

Conservation practices are voluntary practical methods or practices used for sustainable forest management. Forest conservation practices included for the study were nursery management, seed collection, plantation activities and soil & moisture conservation. A total of 9 statements were prepared on these topics. Respondents were asked about their knowledge regarding forest conservation practices by assigning score of 1 was for the response Yes and 0 to the response No.

Based on the total score, the respondents were grouped into three categories following the equal distribution method based on class intervals as follows. This categorization procedure was followed by Natagal (2016).

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{3}$$

$$\text{Class interval} = \frac{9 - 0}{3} = \frac{9}{3} = 3$$

Taking the class interval as three, the following three categories were made.

Category	Range
Low	< 3
Medium	3-6
High	>6

3.6.1.3 Gender Participation:

Gender Participation refers to the different activities performed by men and women in terms of forest management activities.

In order to identify the activities performed by the JFMC members, a list of various activities was prepared by consulting the forest department officials as well as from review of relevant literature. A total of 23 statements were framed to understand the participation of men and women in each of the activities. The 23 statements covered three areas mainly pre sowing treatment: six statements, land preparation: four statements and post planting: 13 statements. Based on the responses obtained frequencies and percentages were calculated to know, which are the activities were male dominated, female dominated and jointly performed.

3.6.2 Independent variables

3.6.2.1 Age

The number of years completed by the respondents at the time of study was collected. The respondents were categorized into 3 categories namely young, middle and old age groups based on the classification as followed by Karigar (2017).

Category	Age (years)
Young	(18-35 years)
Middle	(36 – 50 years)
Old	Above 50 years

3.6.2.2 Education

Education was operationally defined as the numbers of years of formal education acquired by respondents and were grouped into the following categories Karigar (2017).

Category	
Illiterate	No schooling
Primary school	1 – 4 standard
Middle school	5-7 standard
High school	8-10 standard
PUC	10+2
Degree	6

3.6.2.3 Caste

The name of the caste of the respondents was recorded and later classified by following the norms prescribed by the Dept. of Social Welfare, Govt. of Karnataka as mentioned below Patil (2015).

Category	Caste
Forward caste (GM)	Brahmin, Lingayat, Jain and Muslim
Backward caste	Ambiga, Maratha, Gouli, Vakkaliga, Pattar, Kambar and Weaver
Scheduled caste	Bovi, Jennkuruba, Harijan and Madar
Scheduled tribe	Talwar and Koraga

3.3.2.4 Marital status

The respondents were classified based on their marital status as Kurbetta (2016).

Category
Married
Unmarried
Widow
Divorced

3.6.2.5 Family size

Family size was operationally defined as total number of members residing together in the family at the time of interview. This classification was followed by Rayangoudar (2009).

Categories
Small (1-4 members)
Medium (5-8 members)
Larger (9 and above)

3.6.2.6 Family type

Family type refers to two way classification of family as nuclear and joint. The basic grouping of mates and their children is called nuclear family and collection of more than one nuclear family on the basis of close blood ties and common residence is called joint family. This classification was followed by Rayangoudar (2009).

Category
Nuclear family
Joint family

3.6.2.7 Land holding

It refers to the number of acres of land possessed by the farmer. The criteria prescribed by the Karnataka Land Reforms Act 38 to 1966. According this act one acre of irrigated or garden land was equal to 3 acres in dry land. This classification was followed by Patil (2018).

Category	Land Holding (in acres)
Marginal	Upto 2.5 acre
Small	2.5 – 5.0acre
Medium	5.0 – 10.0 acre
Big	Above 10.00 acre

3.6.2.8 Betta land holding

Betta land or Soppinabetta is private access to forest that occurs only in the three hill talukas of the district: Sirsi, Siddapur and Yellapur. In 1890s, British administration leased 9 acres of surrounding forest for every one acre of arecanut garden owned by the farmers. This was allowed farmers to harvest leaves to use as mulch for areca nut trees. Farmers have complete control over the extraction of fuel wood, fodder, soil and dry & green leaves on these betta land. Out of a sample of 464 respondents there were only 18 betta land holders. This variable was therefore not accountable for any statistical analysis.

Category
Betta land holders
Non betta land holders

3.6.2.9 Annual income of the family

The annual family income of the respondents was worked out by taking into account the income from the farm produce, wages earned as labour as well as from subsidiary occupation during the previous year. It was quantified by taking into account the total annual income of all the family members from all sources. This classification was followed by Patil (2018).

Category	Range
Low	Upto Rs. 1,32,000 /-
Medium	Rs.1,32,000 /- to Rs. 5,72,000 /-
High	› Rs. 5,72,000 /-

3.6.2.10 Occupation of the family

The families were classified based on the main occupation as follows Patil (2018).

Category
Agriculture
Wage labour
Service
Business
Others

3.6.2.11 Contact with extension agency

Extension contact refers to the contact made by the respondents with different grass root level extension workers like Range Forest Officer (RFO), Deputy Range Forest Officer (DRFO), Forest Gurd (FG), Agriculture Officer, Horticulture Officer, KVK scientists, Veterinary Officer, Fisheries Officer and facilitator etc. Such contacts will have an effect about exposure to new ideas. The variable was measured by using the procedure followed by Kurbetta (2016).

Contact with extension agency	**Score**
Regular	3
Occasional	2
Rarely	1
Never	0

The minimum and maximum scores ranged from 0-27. Further the respondents were grouped into three categories following the equal distribution method based on class interval as follows. The categorization procedure was followed by Natagal (2016)

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{3}$$

$$\text{Class interval} = \frac{27 - 0}{3} = 9$$

Taking the class interval as nine, the following three categories were made

Category	Range
Low	< 9
Medium	9-18
High	>18

3.6.2.12 Extension participation

The participation in various extension activities like demonstrations, training & capacity building programmes, field visit, exhibitions and campaign. Regular participation, occasional participation, rarely participation and never participate in the activities were given 3, 2,1 and 0 respectively. This classification was followed by Patil (2015).

Extension Participation	Score
Regular	3
Occasional	2
Rarely	1
Never	0

The minimum and maximum scores ranged from 0-21. Further the respondents were grouped into three categories following the equal distribution method based on class interval as follows. This categorization procedure was followed by Natagal (2016)

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{3}$$

$$\text{Class interval} = \frac{21 - 0}{3} = 7$$

Taking the class interval as seven, the following three categories were made

Category	Range
Low	< 7
Medium	7-14
High	>14

3.6.2.13 Mass media participation

This refers to the exposure of the respondents to various mass media communication related activities such as listening to radio, viewing television, reading printed materials like newspapers, magazine, using mobile phones and internet. Detailed information about the

mass media exposure of the respondents was obtained with respect to frequency of listening, viewing and reading habit of the respondents. The quantification of mass media utilization as a source of information was done as per the procedure followed by Patil (2018).

Category	Scores
Regularly	3
Occasionally	2
Rarely	1
Never	0

The minimum and maximum scores ranged from 0-18. Further the respondents were grouped into three categories following the equal distribution method based on class interval as follows: Natagal (2016).

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{3}$$

$$\text{Class interval} = \frac{18 - 0}{3} = 6$$

Taking the class interval as six, the following three categories were made

Category	Range
Low	< 6
Medium	6-12
High	>12

3.6.2.14 Organizational participation

This refers to frequency of participation of respondents in local organizations (Gram panchayat, Talukpanchayat and Zillapanchayat, Co-operative societies, Farmer producer organizations (FPOs), Farmer forums, JFM committee, SHGs, etc.) and their activities either as member or as office bearer. This variable was measured by procedure followed by Jyothi (2012). This categorization procedure was followed by Kurbetta (2016)

Category	Score
Non- membership	0
Membership	1

Degree of participation	Score
Regularly	4
Occasionally	3
Rarely	2
Never	1

The minimum and maximum scores ranged from 0-24. Further the respondents were grouped into three categories by following the equal distribution method based on class interval as follows. This categorization procedure was followed by Natagal (2016).

$$\text{Class interval} = \frac{\text{Maximum score} - \text{Minimum score}}{3}$$

$$\text{Class interval} = \frac{24 - 0}{3} = 8$$

Taking class interval as eight, the following categories were made.

Category	Range
Low	< 8
Medium	8-16
High	>16

3.8. Statistical tools used in the study

The following statistical tools and tests were employed in the analysis and interpretation of data.

3.8.1. Frequency and percentage

Frequency and percentage were used to interpret the categories of socio-personal characteristics, knowledge and gender participation in different forest management and conservation practices.

3.8.2 Correlation

In order to find out the relationship between independent and dependent variables correlation test was used. The correlation between the independent variables viz age,

education, family size, land holding, family income, family occupation, contact with extension agency, extension participation, mass media participation, organizational participation and knowledge about forest management activities and forest conservation practices, raw scores obtained for dependent and independent variables during data collection were used to get correlation coefficient.

Correlation is a measure of intensity or degree of linear relationship between two variables for 'n' pair of observation. Numerical measure of correlation co-efficient is given by

$$r(x,y) = \frac{\Sigma XY - (\Sigma X)(\Sigma Y)/n}{\sqrt{[\Sigma X^2 - (\Sigma X)^2/n)(\Sigma Y^2 - (\Sigma Y)^2/n]}}$$

Where,

r is the correlation coefficient

x and y are two variables

n is the sample size

The significance of the correlation coefficient (r) is tested by using 't' statistic and is given by,

$$t_{(n-2)} = \frac{|r|\sqrt{(n-2)}}{\sqrt{1-r^2}}$$

Where,

'r' is the correlation coefficient

'n' is the sample size

Test statistics value is compared with table value for (n-2) degrees of freedom at a given level of significance.

3.8.3. Garret ranking technique

To analyze the constraints faced by the respondents during forest management and collection of NTFPs, Garret ranking technique was used. As per this method, respondents were asked to assign the rank for all the constraints and outcome of such ranking have been converted into score value with the help of the following formula,

$$\text{Percent Position} = \frac{100\ (Rij\ - 0.5)}{Nj}$$

Where,

Rij = Rank given for the i^{th} factor by the j^{th} respondents

Nj = Number of factors ranked by the j^{th} respondents.

By referring the Garrette's table, the percent position estimated is converted into scores. For each of the factors the scores of every individual are added and then mean values are converted to be the most important. First rank was given for the highest score. Second rank for the next descending order and so on.

Results

4. RESULTS

The results of the present study are presented under the following heads.

4.1 Socio-personal characteristics of the JFMC and non- JFMC members

4.2 Knowledge of JFMC and non- JFMC members about sustainable forest management activities

4.3 Knowledge of JFMC members about forest conservation practices

4.4 Gender participation of JFMC members in forest management activities

4.5 Sustainable collection, processing, utilization and income of NTFPs

4.6 Documentation of the bio-cultural beliefs about forest and forest tress.

4.7 Constraints faced by the JFMC members in forest management & collection of NTFPs

4.8 Relationship between independent and dependent variables.

4.9 Qualitative findings of JFMCC members about forest management

4.1 Socio-personal characteristics of the JFMC and non- JFMC members

Table 1 depicts the socio personal characteristics of JFMC and non JFMC members

4.1.1 Age

Data on age wise distribution of the JFMC members shows that majority of them were in the middle age group (36-50 years). This was 60.40 per cent in coastal, 61.10 per cent in upghat and 72.40 per cent in plain region. This was followed by the older group of members (>51 years). There were 31.30 per cent, 31.00 per cent and 19.00 per cent in coastal, upghat and plain region respectively. About 8.00 per cent of JFMC members belonged to young age group (18-35 years) in all the three regions.

In case of non JFMC members, majority of them were in the young age group. There were 70.83 per cent, 74.60 per cent and 70.70 per cent in coastal, upghat and plain regions respectively. This was followed by the older group of members. They were 16.67 per cent in coastal, 14.28 per cent in upghat and 8.60 per cent in plain region. About 12.00 per cent (12.50 %), 11.12 per cent and 20.70 per cent of them belonged to middle age group in coastal, upghat and plain regions respectively.

4.1.2 Gender

With regard to gender equal per cent of JFMC and non JFMC members were drawn from the three regions.

4.1.3 Education

The results pertaining to education of respondents revealed that in coastal region 22.91 per cent of them had completed high school education, 20.84 per cent had primary school education, 18.75 percent were illiterate, 16.67 per cent had received middle school education, 14.58 per cent had completed PUC and only 6.25 per cent were degree holders. In case of non JFMC members about 25.00 per cent had completed PUC, 18.76 per cent had high school education, around 16.66 per cent were degree holders, 16.66 per cent had received middle school education, 18.75 percent were illiterate and only 10.42 per cent had completed primary school education.

With respect to upghat region, 20.64 per cent of the JFMC members were educated upto middle school, 19.84 per cent were illiterate, 17.46 per cent were degree holders, 16.66 per cent of them were educated up to primary school, 13.50 per cent were educated up to PUC and 11.90 per cent of them were educated up to high school. While non JFMC members, around 41.28 per cent had professional degree, 14.28 per cent were illiterate followed by PUC (12.69 %), middle school (12.69 %), high school (11.11 %) and primary school (07.95 %) respectively.

It could be seen that, in plain region, 39.65 per cent of the JFMC members had primary school education, 24.24 per cent were illiterate, 13.79 were educated up to PUC, 8.62 per cent had middle school education. An equal per cent (06.90 %) of members were educated up to high school and degree level. Whereas non JFMC members, 34.48 per cent were had middle school education, 20.68 per cent were had high school education followed by primary school (17.25 %) and PUC (12.06 %), 10.35 per cent were illiterate and only 5.18 per cent were degree holders.

4.1.3 Caste

It is evident from the Table 1 that, in coastal region 31.25 per cent of JFMC members belonged to backward caste, 25.00 per cent were scheduled caste (SC), 22.92 per cent were scheduled tribes (ST) and 20.83 per cent belonged to forward caste. In case of non-

JFMC members, 33.34 per cent were SC, 29.17 per cent of them were ST, 20.83 per cent were forward caste and 16.66 percent belonged to backward caste.

With regard to upghat region, 29.40 per cent of JFMC members belonged to backward caste followed by forward caste (25.40 %), SC (24.60 %) and ST (20.60 %). Where as in case of non-JFMC members, 30.15 per cent of them belonged to forward caste, followed by SC (25.40 %), ST (24.60 %) and backward caste (19.85 %).

In the plain region, 39.70 per cent of JFMC members belonged to backward caste followed by SC (29.30 %), ST (19.00 %) and forward caste (12.10 %). While among non JFMC members, 27.58 per cent of them belonged to SCs, an equal per cent (25.86 each) belonged to backward caste and ST categories. Only 20.68 per cent of them belonged to forward caste.

4.1.4 Marital status

Data in table 1 indicates that, majority (93.80 %) of the JFMC members in coastal region were married and 6.25 per cent were widows. In case of non JFMC members 54.16 per cent were unmarried and 45.84 per cent were married.

In case of upghat region, cent percent of the JFMC members were married. However in non JFMC members, a little over half (55.55 %) of them were married followed by unmarried (42.86 %). Only 1.59 per cent were widows.

With respect to plain region, large majority (96.60 %) of the JFMC members were married and only 3.43 per cent were unmarried. While in case of non JFMC members, 56.90 per cent were unmarried and 43.10 per cent of them were married.

4.1.5 Type of family

Regarding the type of family, in coastal region, 56.25 per cent of the JFMC members belonged to joint families and 43.75 per cent belonged to nuclear families. Whereas among no JFMC members, a majority (75.00 %) belonged to nuclear families and only 25.00 per cent belonged to joint families.

A majority (67.46 %) of the JFMC members in upghat region were from nuclear families, while 32.54 per cent were from joint families. In case of non JFMC members, 61.90 per cent were from nuclear families and 38.10 per cent were from joint families.

About half of the plain region JFMC members (51.72 %) belonged to nuclear families and 48.28 per cent belonged to joint families. In non JFMC members, 55.18 per cent belonged to nuclear families and 44.82 per cent belonged to joint families.

4.1.6 Size of the family

The data on size of the family (Table1) clearly indicates that, in coastal region half of the JFMC members (52.10 %) belonged to medium family size of 5-8 members, 35.40 per cent were from large family size with more than nine members and 12.50 per cent of them were from small family size of 1-4 members. In non-JFMC members, 43.75 per cent of the respondents belonged to medium family size, 31.25 per cent were from small family size and 25.00 per cent of them were from large family size.

With regard to the upghat region, 57.91 per cent of JFMC members had small size families (1-4 members), 34.94 per cent had medium size families (5-8 members) and only 7.15 per cent of them had large size families. While among non-JFMC members, half of the members (51.58 %) belonged to small size families, 38.88 per cent had medium size families and only 9.54 per cent of them had large size families.

It could be noticed that, in plain region half of the (50.72 %) JFMC members belonged to small size families, 29.32 per cent were from medium size families and 18.96 per cent of them were from large size families. While in non JFMC members, half of them (50.00 %) were from small size families, 34.48 per cent were from medium size families and 15.52 per cent of them were from large size families.

4.1.7 Land holding

The results presented in Table 1 also indicate that, among JFMC members in coastal region majority (72.91 %) of them were marginal farmers (<2.5 acres), 14.58 per cent of them were landless labourers and 12.50 per cent of them were small farmers (2.5-5 acres). In case of non JFMC members, 66.66 per cent of them were marginal farmers, 25.00 per cent were landless labourers and only 8.34 per cent were small farmers.

In case of upghat region, 31.00 per cent of JFMC members were marginal farmers followed by landless labourers (30.20 %), small farmers (19.80 %), medium farmers (15.00 %) and only 4.00 per cent of them had big size land holding. However, in case of non JFMC members, 38.13 per cent were landless labourers, 35.75 per cent were marginal, 14.30 per

cent were small farmers, 9.54 per cent were medium farmers and only 2.28 per cent were big farmers.

With regard to the plain region, 39.70 per cent of the JFMC members were landless labourers, 34.50 per cent were marginal farmers, 24.10 per cent were small farmers and only 1.70 per cent were medium farmers. Among non JFMC members 48.27 per cent were marginal farmers and 37.93 per cent were landless labourers and 13.80 per cent were small farmers.

4.1.8. Betta land:

Regarding betta land holding only 10.31 per cent of JFMC members and 3.96 per cent of the non JFMC members in upghat region had bettaland.

4.1.9 Occupation of the family

It is clear from Table 1 that, in coastal region 60.42 per cent of JFMC members mentioned their occupation as wage labour, 29.16 per cent were agriculturists, 6.25 per cent were in services and only 4.17 per cent were doing business. While 39.58 per cent of non JFMC members were wage labours followed by agriculturists (31.26 %), services (20.83 %) and only 8.33 per cent were business men.

In case of upghat region, 61.90 per cent of JFMC members were dependent on agriculture and that was their main occupation. About 32.53 per cent of them were wage labours and remaining 2.38 per cent and 3.17 per cent were involved in service and business respectively.

Regarding occupation of the JFMC members in plain region, 60.30 per cent of them were dependent on agriculture and 39.70 per cent were wage labours. In case of non JFMC members 48.27 per cent of them were wage labours and 34.49% were agriculturists. Only 8.62 per cent were involved in business.

4.1.10 Annual income of the family

It was observed from the Table 1 that, 79.17 per cent of coastal JFMC members belonged to low income category (upto Rs. 1,32,000/year) and 20.83 per cent of them belonged to medium level of income (Rs. 1,32,000- 5,72, 000/year). Same trend was observed in non-JFMC members also i.e., 75.00 per cent belonged to low income and 25.00 per cent of them belonged to medium level of income category.

Table 1: Socio-personal characteristics of JFMC members and Non- JFMC members

n=464

Sl. No	Variables	Category	Coastal Region (n_1=96)		Upghat Region (n_2=252)		Plain Region (n_3=116)		Total (n=464)	
			JFMC Members (48)	Non-JFMC Members (48)	JFMC Members (126)	Non-JFMC Members (126)	JFMC Members (58)	Non-JFMC Members (58)	JFMC Members (232)	Non-JFMC Members (232)
			F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Age	Young (18 – 35 years)	04 (08.30)	34 (70.83)	10 (7.90)	94 (74.60)	05 (08.60)	41 (70.70)	19 (8.18)	169 (72.84)
		Middle (36 – 50 years)	29 (60.40)	06 (12.50)	77 (61.10)	14 (11.12)	42 (72.40)	12 (20.70)	148 (63.80)	32 (13.80)
		Old (› 51 years)	15 (31.30)	08 (16.67)	39 (31.00)	18 (14.28)	11 (19.00)	05 (08.60)	65 (28.02)	31 (13.36)
2	Gender	Male	24 (50.00)	24 (50.00)	63 (50.00)	63 (50.00)	29 (50.00)	29 (50.00)	116 (50.00)	116 (50.00)
		Female	24 (50.00)	24 (50.00)	63 (50.00)	63 (50.00)	29 (50.00)	29 (50.00)	116 (50.00)	116 (50.00)
3	Education	Illiterate (0)	09 (18.75)	06 (12.50)	25 (19.84)	18 (14.28)	14 (24.24)	06 (10.35)	48 (20.68)	30 (12.94)
		Primary School (Class 1-4)	10 (20.84)	05 (10.42)	21 (16.66)	10 (07.95)	23 (39.65)	10 (17.25)	54 (23.27)	25 (10.77)
		Middle school (Class 5 – 7)	08 (16.67)	08 (16.66)	26 (20.64)	16 (12.69)	05 (08.62)	20 (34.48)	39 (16.81)	44 (18.96)
		High school (Class 8 -10)	11 (22.91)	09 (18.76)	15 (11.90)	14 (11.11)	04 (06.90)	12 (20.68)	30 (12.94)	35 (15.09)
		PUC (Class 11 - 12)	07 (14.58)	12 (25.00)	17 (13.50)	16 (12.69)	08 (13.79)	07 (12.06)	32 (13.80)	35 (15.09)
		Degree (› 12)	03 (06.25)	08 (16.66)	22 (17.46)	52 (41.28)	04 (06.90)	03 (05.18)	29 (12.50)	63 (27.15)
4	Caste	Forward	10 (20.83)	10 (20.83)	32 (25.40)	38 (30.15)	07 (12.10)	12 (20.68)	49 (21.13)	60 (25.86)
		Backward	15 (31.25)	08 (16.66)	37 (29.40)	25 (19.85)	23 (39.70)	15 (25.86)	75 (32.32)	48 (20.68)

Table 1: Contd…..

Sl. No	Variables	Category	Coastal Region (n_1=96)		Upghat Region (n_2=252)		Plain Region (n_3=116)		Total (n=464)	
			JFMC Members (48)	Non-JFMC Members (48)	JFMC Members (126)	Non-JFMC Members (126)	JFMC Members (58)	Non-JFMC Members (58)	JFMC Members (232)	Non-JFMC Members (232)
			F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
		SC	12 (25.00)	16 (33.34)	31 (24.60)	32 (25.40)	17 (29.30)	16 (27.58)	60 (25.86)	64 (27.60)
		ST	11 (22.92)	14 (29.17)	26 (20.60)	31 (24.60)	11 (19.00)	15 (25.86)	48 (20.69)	60 (25.86)
5	Marital Status	Married	45 (93.75)	22 (45.84)	126 (100.00)	54 (42.86)	56 (96.60)	25 (43.10)	227 (97.85)	101 (43.54)
		Unmarried	-	26 (54.16)	-	70 (55.55)	02 (03.40)	33 (56.90)	02 (0.86)	129 (55.60)
		Widow	03 (06.25)	-	-	02 (01.59)	-	-	03 (1.29)	02 (0.86)
		Divorcee	-	-	-	-	-	-	-	-
6	Family type	Nuclear	21 (43.75)	36 (75.00)	85 (67.46)	78 (61.90)	30 (51.72)	32 (55.18)	136 58.62	146 62.94
		Joint	27 (56.25)	12 (25.00)	41 (32.54)	48 (38.10)	28 (48.28)	26 (44.82)	96 41.38	86 37.06
7	Family size	Small (1 – 4 member)	06 (12.50)	15 (31.25)	73 (57.91)	65 (51.58)	30 (51.72)	29 (50.00)	109 46.99	109 46.99
		Medium (5 – 8 members)	25 (52.10)	21 (43.75)	44 (34.94)	49 (38.88)	17 (29.32)	20 (34.48)	86 37.06	90 38.79
		Large (9 & above)	17 (35.40)	12 (25.00)	09 (07.15)	12 (09.54)	11 (18.96)	09 (15.52)	37 15.95	33 14.22
8	Land holding	Landless	07 (14.58)	12 (25.00)	38 (30.20)	48 (38.13)	23 (39.70)	22 (37.93)	68 29.32	82 35.34
		Marginal farmers (Upto 2.5 acre)	35 (72.91)	32 (66.66)	39 (31.00)	45 (35.75)	20 (34.50)	28 (48.27)	94 (40.52)	105 (45.25)
		Small farmers (2.5 – 5.0 acre)	06 (12.50)	04 (08.34)	25 (19.80)	18 (14.30)	14 (24.10)	08 (13.80)	45 (19.39)	30 (12.94)
		Medium farmers (5.0 – 10.0 acre)	-	-	19 (15.00)	12 (09.54)	01 (01.70)	-	20 (8.62)	12 (5.18)

Table 1: Contd…..

Sl. No	Variables	Category	Coastal Region (n_1=96)		Upghat Region (n_2=252)		Plain Region (n_3=116)		Total (n=464)	
			JFMC Members (48)	Non-JFMC Members (48)	JFMC Members (126)	Non-JFMC Members (126)	JFMC Members (58)	Non-JFMC Members (58)	JFMC Members (232)	Non-JFMC Members (232)
			F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
		Big farmers (Above 10 acres)	-	-	5 (04.00)	03 (02.28)	-	-	5 (2.15)	3 (1.29)
		Bettaland	-	-	13 (10.31)	05 (03.96)	-	-	13 (5.60)	5 (2.15)
9	Occupation of the family	Agriculture	14 (29.16)	15 (31.26)	78 (61.90)	62 (49.22)	35 (60.30)	20 (34.49)	127 (54.74)	97 (41.82)
		Wage labour	29 (60.42)	19 (39.58)	41 32.53	51 (40.48)	23 (39.70)	33 (56.89)	93 (40.08)	103 (44.39)
		Service	03 (06.25)	10 (20.83)	03 (02.38)	08 (06.34)	-	-	6 (2.59)	18 (7.76)
		Business	02 (04.17)	04 (08.33)	04 (03.17)	05 (03.96)	-	05 08.62	6 (2.59)	14 (6.03)
10	Annual income	Low (Upto Rs. 1,32,000)	38 (79.17)	36 (75.00)	98 (77.80)	95 (75.40)	58 (100.00)	58 (100.00)	194 (83.62)	189 (81.46)
		Medium (Rs. 1,32,000- Rs. 5,72,000)	10 (20.83)	12 (25.00)	26 (20.60)	31 (24.60)	-	-	36 (15.51)	43 (18.53)
		High (> Rs. 5,72,000)	-	-	02 (01.60)	-	-	-	02 (0.86)	- -

In case of upghat region, majority (77.80 %) of the JFMC members belonged to low income category and 20.60 per cent belonged to medium level of income and only 2.60 per cent belonged to high level of income category (>Rs. 5,72,000). Whereas, in case of non JFMC members, 75.40 per cent of them belonged to low income category and 24.60 per cent belonged to medium level of income.

Cent per cent of JFMC and non JFMC members from plain region belonged to low income category i.e., up to Rs. 1,32,000/year.

4.1.11 Contact with extension agency

Table 2.1 depicts the level of contact with extension agency of JFMC and non JFMC members. Majority (77.58 %) of the JFMC members had medium extension contact, 12.94 per cent of them had low contact with extension agencies and only nine per cent of them were in the high category.

In case of non JFMC members, large majority (78.02 %) of non JFMC members had low contact with extension agencies and 21.98 per cent of them had medium extension contact.

4.1.12 Extension participation

Table 3.1 showed that, cent per cent of the JFMC members had medium level of extension participation. In case of non JFMC members cent per cent of them had low level of extension participation.

4.1.13 Mass media participation

The data presented in table 4.1 showed that, majority (62.94 %) of the JFMC members had medium mass media participation and 37.06 per cent of them had high mass media participation and none of them were in the low category.

In case of non JFMC members, nearly half of them (51.72 %) had medium mass media participation and 48.28 per cent belonged to high category and hence none in the low category.

4.1.14 Organizational participation

The results presented in the 5.1 indicate that majority (57.75 %) of the JFMC members had low organizational participation, 42.25 per cent had medium participation and none belonged to high organizational participation.

Table 2: Contact with extension agency

n=464

Sl. No	Personnel	JFMC Members (n_1=232)				Non JFMC Members (n_2=232)			
		Level of participation				Level of participation			
		Regularly	Occasionally	Rarely	Never	Regularly	Occasionally	Rarely	Never
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Range Forest Officer (RFO)	-	232 (100.00)	-	-	-	-	24 (10.34)	208 (89.66)
2	Deputy Range Forest Officer (DRFO)	232 (100.00)	-	-	-	-	-	-	232 (100.00)
3	Forest Guard (FG)	232 (100.00)	-	-	-	-	-	-	232 (100.00)
4	Agricultural Officer	-	-	98 (42.25)	134 (57.75)	-	-	92 (39.65)	140 (60.35)
5	Assistant Horticulture Officer	-	-	84 (36.20)	148 (63.80)	-	-	76 (32.75)	156 (67.25)
6	KVK Scientist	-	-	15 (06.46)	217 (93.54)	-	-	08 (03.44)	224 (96.56)
7	Veterinary Officer	-	-	08 (03.44)	224 (96.56)	-	-	10 (4.31)	222 (95.69)
8	Fisheries Officer	-	-	12 (5.17)	220 (94.83)	-	-	12 (5.17)	220 (94.83)
9	NGO - Motivator/Facilitator/ Co-ordinator	-	-	46 (19.82)	186 (80.18)	-	-	36 (15.51)	196 (84.49)

*Multiple responses are possible

Table 2.1: Level of contact with extension agency **n=464**

Category	JFMC Members (n_1=232)		Non-JFMC Members (n_2=232)	
	F	%	F	%
Low	30	12.94	181	78.02
Medium	180	77.58	51	21.98
High	22	09.48	-	-

Table 3: Extension participation of the JFMC and Non-JFMC members

n=464

Sl. No	Activities	JFMC Members (n_1=232)				Non- JFMC Members (n_2=232)			
		Level of participation				Level of participation			
		Regularly	Occasionally	Rarely	Never	Regularly	Occasionally	Rarely	Never
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Demonstrations	-		232 (100.00)	-	-	-	-	232 (100.00)
2	Group discussion meetings	-	232 (100.00)	-	-	-	-	-	232 (100.00)
3	Training and capacity building programmes	-	-	232 (100.00)	-	-	-	-	232 (100.00)
4	Field/Exposure visit	-	-	232 (100.00)	-	-	-	-	232 (100.00)
5	Vanmahostva	-	232 (100.00)	-	-	-	-	50 (21.55)	-
6	Exhibitions	-	-	232 (100.00)	-	-	-	-	232 (100.00)
7	Campaign	-	-	232 (100.00)	-	-	-	32 (13.79)	-

*Multiple responses are possible

Table 3.1: Level of extension participation of the JFMC and Non-JFMC members n=464

Category	JFMC Members (n_1=232)		Non-JFMC Members (n_2=232)	
	F	%	F	%
Low	-	-	**232**	**100.00**
Medium	232	100.00	-	-
High	-	-	-	-

Table 4: Mass media participation of the JFMC and Non-JFMC members

n=464

Sl. No	Media	JFMC Members (n_1=232)				Non- JFMC Members (n_2=232)			
		Level of participation				Level of participation			
		Regularly	Occasionally	Rarely	Never	Regularly	Occasionally	Rarely	Never
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Newspaper	32 (13.79)	-	12 (5.18)	188 (81.03)	95 (40.95)	-	-	137 (59.05)
2	Radio	-	-	22 (09.49)	210 (90.51)	-	-	18 (07.75)	214 (92.25)
3	Television	180 (77.58)	-	-	52 (22.42)	195 (84.05)	-	-	37 (15.95)
4	Magazines	-	-	15 (06.46)	217 (93.54)	-	-	-	-
5	Mobile	200 (86.20)	-	-	32 (13.80)	212 (91.38)	-	-	20 (8.62)
6	Internet	-	28 (12.06)	-	204 (87.94)	-	52 (22.42)	-	180 (77.58)

*Multiple responses are possible

Table 4.1: Level of mass media participation of the JFMC and Non-JFMC members n=464

Category	JFMC Members (n_1=232)		Non-JFMC Members (n_2=232)	
	F	%	F	%
Low	-	-	-	-
Medium	146	62.94	120	51.72
High	86	37.06	112	48.28

Table 5: Organizational participation of the JFMC and Non-JFMC members

n=464

Sl. No	Organizations	JFMC Member (n_1=232)				Non JFMC Member (n_2=232)			
		Level of participation				Level of participation			
		Regularly	Occasionally	Rarely	Never	Regularly	Occasionally	Rarely	Never
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Gram panchayat	-	-	75 (32.32)	157 (67.68)	-	-	22 (09.49)	210 (90.57)
2	Taluk panchayat	-	-	32 (13.80)	200 (86.20)	-	-	18 (07.75)	214 (92.25)
3	Zilla panchayat	-	-	12 (05.18)	220 (94.84)	-	-	05 (02.15)	227 (97.85)
4	Co-operative society	-	138 (59.50)	47 (20.25)	47 (20.25)	-	-	52 (22.42)	180 (77.58)
5	Farmer producer organizations (FPOs)	-	-	30 (12.94)	202 (87.06)	-	-	10 (04.32)	222 (95.68)
6	Farmers forums	-	-	-	232 (100)	-	-	-	232 (100)
7	JFMC committee	232 (100.00)	-	-	-	-	-	-	232 (100)
8	Self Help Groups(SHG)	98 (42.24)	-	-	134 (57.75)	-	67 (28.88)	-	165 (71.12)

*Multiple responses are possible

Table 5.1: Level of organizational participation of the JFMC and Non-JFMC members n=464

Category	JFMC Members (n_1=232)		Non-JFMC Members (n_2=232)	
	F	%	F	%
Low	134	57.75	232	100.00
Medium	98	42.25	-	-
High	-	-	-	-

Among non JFMC members, cent per cent of the members had low organizational participation.

4.1.15 Trainings received by the JFMC members from the forest department

The information collected regarding trainings attended by the JFMC members shows (Table 6) that, in forest management aspects large majority (92.67 %) of the JFMC members attended training on plantation management followed by importance of soil & moisture conservation (77.58 %), fire management (51.72 %) and conservation of NTFPs (38.36 %). In agriculture and allied activities, about 27.58 per cent of the JFMC members attended training onhoneybee rearing, techniques of handling honey bee box and harvesting techniques of honey. Whereas, women JFMC members attended trainings related to income generating activities (32.32 %) and processing & value addition of NTFPs (19.82 %). While few youths of JFMC members attended skill trainings like computer training (6.46 %) followed by yakashgana (5.17 %).

4.1.16 Source of energy needs

Table 7 indicates the source of energy needs of JFMC and non JFMC members. In all the three regions cent per cent of the respondents were using electricity and LPG as source of energy followed by firewood (80.00 %) and solar lights (75.00 %).

4.2 Knowledge of JFMC and non- JFMC members about sustainable forest management activities

The data of Table 8 represents knowledge of JFMC and non JFMC members about sustainable forest management activities. In all the three regions cent per cent of the JFMC members had knowledge about environmental awareness programmes, plantation management, fire management, biodiversity conservation, soil & moisture conservation and deforestation &land degradation. It could also be seen that 25.00 per cent, 50.00 per cent and 24.13 per cent in coastal, upghat and plain region respectively had knowledge about conservation & sustainable harvesting techniques of NTFPs.

In case of non JFMC members, 62.50 per cent in coastal, 95.23 per cent in upghat and 77.58 per cent in plain region had knowledge about environmental awareness programmes. About 25.00 per cent, 35.71 per cent and 43.10 per cent in coastal, upghat and plain region respectively had knowledge about plantation management. Regarding knowledge

Table 6: Trainings attended by the JFMC members

n=232

SL. No		Duration (Days)	F	%
	Forest Management			
1	Grafting techniques	02	62	26.72
2	Plantation management	01	215	92.67
3	Importance of Mangroves Plantation	01	12	05.17
4	Conservation of NTFP species	02	120	51.72
5	Importance of Soil & Moisture Conservation	01	180	77.58
6	Sustainable harvesting techniques of NTFPs	02	48	20.68
7	Awareness & Conservation of Medicinal plants	02	56	24.13
8	Fire management	03	120	51.72
	Agriculture and allied activities			
1	Honeybee rearing ,Techniques of handling honey bee box and Harvesting techniques of honey	03	64	27.58
2	Dairy management	03	30	12.93
3	Poultry management	03	30	12.93
	Income generating Activities			
1	Cashew processing and value addition	03	24	10.34
2	Income generating activities related trainings for women	05	75	32.32
3	Processing and value addition of NTFPs	07	46	19.82
4	Bedi making	01	12	05.17
5	Tailoring	15	25	10.77
	Skill training			
1	Yakashgana	05	15	06.46
2	Computer applications training	30	12	05.17
3	Snake trapping	02	06	02.58
4	Auto mobile repair training	45	05	02.15

*Multiple responses are possible

Table 7: Source of energy for cooking

n=464

Sl. No	Source of energy	Coastal Region (n_1=96)		Upghat Region (n_2=252)		Plain Region (n_3=116)		Total (n=464)	
		F	%	F	%	F	%	F	%
1	Firewood	85	88.54	218	86.50	98	84.48	401	86.42
2	Kerosene	18	18.75	80	31.74	32	27.58	130	28.01
3	Electricity	96	100.00	252	100.00	116	100.00	464	100.00
4	LPG	96	100.00	252	100.00	116	100.00	464	100.00
5	Bio-gas	02	2.08	58	23.01	14	12.06	74	31.89
6	Solar lights	67	69.79	200	79.36	85	73.27	352	75.86

*Multiple responses are possible

Table 8: Knowledge of JFMC and Non JFMC members about sustainable forest management activities

n=464

SL. No	Particulars	Coastal Region (n_1=96)		Upghat Region (n_2=252)		Plain Region (n_3=116)		Total (n=464)	
		JFMC Members	Non JFMC Members	JFMC Members	Non JFMC Members	JFMC Members	Non JFMC Members	JFMC Members	Non JFMC Members
		F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
1	Environmental awareness programmes	48 (100.00)	30 (62.50)	126 (100.00)	120 (95.23)	58 (100.00)	45 (77.58)	232 (100.00)	195 (84.05)
2	Plantation Management	48 (100.00)	12 (25.00)	126 (100.00)	45 (35.71)	58 (100.00)	25 (43.10)	232 (100.00)	82 (35.34)
3	Fire Management	48 (100.00)	08 (16.00)	126 (100.00)	20 (15.87)	58 (00.00)	10 (17.24)	232 (100.00)	38 (16.37)
4	Biodiversity conservation	48 (100.00)	11 (22.91)	126 (100.00)	40 (31.74)	58 (100.00)	30 51.72	232 (100.00)	81 (34.91)
5	Soil and moisture conservation	48 (100.00)	07 (14.58)	126 (100.00)	20 (15.87)	58 (100.00)	05 (08.62)	232 (100.00)	32 (13.79)
6	Deforestation and land degradation	48 (100.00)	26 (54.16)	126 (100.00)	52 (41.26)	58 (100.00)	15 (25.86)	232 (100.00)	93 (40.08)
7	Conservation of NTFPs	12 (25.00)	-	63 (50.00)	-	14 (24.13)	-	89 (38.36)	-
8	Sustainable non timber forest products (NTFPs) harvesting techniques	12 (25.00)	-	63 (50.00)	-	14 (24.13)	-	89 (38.36)	-

*Multiple responses are possible

Table 8.1: Categorization of respondents based on their knowledge about sustainable forest management activities

n=464

Sl. No.	Category	JFMC Members (n_1=232)		Non-JFMC Members (n_2=232)	
		Frequency	Percentage	Frequency	Percentage
1.	Low (1-4)	32	13.79	180	77.58
2.	High (5-8)	200	86.20	52	22.41

about biodiversity conservation i.e., 22.91 per cent in coastal, 31.74 per cent in upghat and 51.72 per cent in plain region had knowledge about the same.

Table 8.1 indicates the categorization of respondents based on their knowledge about sustainable forest management activities. A large majority (86.20 %) of the JFMC members had high level of knowledge and only 13.79 per cent had low knowledge about forest management activities. In case of non JFMC members, majority (77.58 %) of them had low level of knowledge and about 22.41 per cent had high knowledge about sustainable forest management activities.

4.3 Knowledge of JFMC members about forest conservation practices

With respect to forest conservation practices (Table 9) cent per cent of the JFMC members from all the three regions had knowledge about forest land preparation & planting of seedlings, necessity of planting of indigenous species rather than exotic species, application of FYM at the time of planting and watering the plants as per requirement. Further it was observed that many JFMC members i.e., 58.33 per cent in coastal, 67.24 per cent in upghat and 56.03 per cent in plain region had knowledge about growing plants and intercultural operations. Knowledge about other practices like use of traditional plants for pest and soil erosion was known by 66.66 per cent of coastal region JFMC members, 48.27 per cent of upghat and 41.37 per cent of plain region JFMC members. Regarding water catchment area conservation, 72.00 per cent in coastal, 54.31 per cent in upghat and 44.82 per cent in plain region had knowledge about the same. The JFMC members also had knowledge about fire preventative measures i.e., 45.83 per cent, 60.34 per cent& 53.44 per cent in coastal, upghat and plain region respectively. About 17.00 per cent, 27.58 per cent and 20.68 per cent in coastal upghat and plain region respectively had knowledge about growing wind breaks in rows for afforestation. A few JFMC members *i.e.,* 10.34 per cent in upghat and 4.31 per cent in plain region had knowledge about soil testing before initiating forestry work. It was observed that none of the JFMC members had knowledge about establishment of nursery for seedling production, seed identification and collection of seed from forest. This is because these works were taken up by the forest departments.

Table 9.1 depicts the categorization of JFMC members based on their knowledge about sustainable forest conservation practices. Majority (66.38 %) of the JFMC members had medium level of knowledge and 33.62 per cent had a low level Knowledge about forest conservation practices.

Table 9: Knowledge of JFMC members about forest conservation practices

n=232

Sl . No	Statements	Coastal Region (n_1=48)		Upghat Region (n_2=126)		Plain Region (n_3=116)		Total (n=232)	
		F	%	F	%	F	%	F	%
1	Seed identification, collection and establishment of nursery for seedling	-	-	-	-	-	-	-	-
2	Forest land preparation & planting activities	48	100.00	126	100.00	116	100.00	232	100.00
3	Planting indigenous species rather than exotic species	48	100.00	126	100.00	116	100.00	232	100.00
4	Soil testing before initiating forestry work	-	-	12	10.34	05	04.31	17	07.32
5	Application of FYM at the time of planting	48	100.00	126	100.00	116	100.00	232	100.00
6	Watering the plants as per requirement (Protective irrigation)	48	100.00	126	100.00	116	100.00	232	100.00
7	Growing wind breaks in rows for afforestation	08	16.66	32	27.58	24	20.68	64	27.58
8	Water catchment area conservation	35	72.00	63	54.31	52	44.82	150	64.65
9	Fire preventive measures	22	45.83	70	60.34	62	53.44	154	66.37

*Multiple responses are possible

Table 9.1: Categorization of JFMC members based on their knowledge about forest conservation practices

n=232

Sl. No.	Category	Frequency	Percentage
1.	Low (< 3)	78	33.62
2.	Medium (3-6)	154	66.38
3.	High (>6)	-	-

4.4 Gender participation of JFMC members in forest management activities

Table 10 showed the gender participation of JFMC members in forest management activities.

In "pre sowing treatment" the study revealed that all women were involved in pre sowing treatment activities like preparation & filling of potting mixture and seed sowing.

In "land Preparation", majority of the activities were carried out by men alone. Site preparation, layout for planting and digging the pits were all done by men alone. Whereas, planting the seedlings was carried out by both.

In "post planting activities", 50.00 per cent in each of all these activities like fencing, handling the pests & disease management, fire protection, lopping, scrapping and control of illegal harvesting were carried out by men. In some of the post planting activities, cent per cent of the men and women were involved in the activities like cleaning the surrounding area of plants, watering the plants, pruning, thinning, application of manure, mulching and hoeing.

4.5 Sustainable collection, processing, utilization and income from NTFPs

Table 11 depicts details on various NTFPs available and their common &scientific name & family, period of availability, method of collection, plant part used and end use. The NTFPs collected by the JFMC members are largely classified as (1) Fruits: kokam, jamoon, (2) Spices: rampatre, cloves, cinnamom, (3) Souring agents: uppage, monkey jack fruit, (4) Fruits for pickling: Indian gooseberry, wild mango, tender bamboo shoots, (5) Edible: honey, wild mushroom, and (6) Herbal products: soapnut, shikakai. Non timber forest products were collected the whole year because some of the NTFP was available in one or the other season. The main season for NTFP collection are late winters and summer season (February to May) and monsoon season (June – September). However monsoon is where NTFP collection is highest for example honey, kokum and uppage are mostly collected in this monsoon season. Collection of NTFP is done by JFMC members in group as well as individually for household consumption and commercial purpose.

4.6 Documentation of the bio-cultural beliefs about forest and forest trees.

Table 13 highlights the trees listed by the respondents as holy trees. The "Peepal tree" (*Ficus religiosa*) is a symbol of Lord Krishna and "Indian fig" (*Ficus racemosa*) is a symbol of fertility. The "banyan tree" (*Ficus benghalensis*) represents the 'Trimurti' i.e., Lord

Table 10: Gender participation of JFMC members in forest management activities **n=232**

Sl. No	Activities	Men (n_1=116)	Women (n_2=116)	Jointly (n=232)
		F (%)	F (%)	F (%)
I	**Pre sowing treatment**			
i	Selection of seeds	-	-	-
ii	Soaking seeds for 24 hours in hot/boiling water	-	-	-
iii	Boiling/ soaking of seeds in hot water	-	-	-
iv	Chemical treatment	-	-	-
v	Preparation and filling of potting mixture	-	116 (100.00)	-
vi	Seed sowing	-	116 (100.00)	-
II	**Land Preparation**			
i	Site preparation	116 (100.00)	-	-
ii	Layout for planting	116 (100.00)	-	-
iii	Digging the pits	116 (100.00)	-	-
iv	Planting the seedlings	-	-	232 (100.00)
III	**Post planting activities**			
i	Cleaning the surrounding area of plants	-	-	232 (100.00)
ii	Watering the plants	-	-	232 (100.00)
iii	Fencing	116 (100.00)	-	-
iv	Pruning	-	-	232 (100.00)
v	Thinning (Reducing the plant population)	-	-	232 (100.00)
vi	Application of manure	-	-	232 (100.00)
vii	Handling the pests & disease management	116 (100.00)	-	-
viii	Fire protection	116 (100.00)	-	-
ix	Mulching	-	-	232 (100.00)
x	Lopping	116 (100.00)	-	-
xi	Scrapping	116 (100.00)	-	-
xii	Hoeing	116 (100.00)	-	-
xiii	Control of illegal harvesting	116 (100.00)	-	-

*Multiple responses are possible

Table 11: Sustainable collection, processing and utilization of NTFPs by JFMC members

Sl. No	Local Name of the NTFP	Common name	Scientific name	Family	Period of availability	Method of collection	Plant part used	Processing	End use
I. Fruits									
1	Murugalu	Kokam	*Garcinia indica*	Clusiaceae	April-May	Plucking	Rinds, Pulp, Seed, Whole fruit	Skin & seeds of the kokum are separated and traditionally sun dried	Cold drinks like Juice, Squash, Syrup & Kokum butter
2	Nerale	Jamun	*Syzygium cumini*	Myrtceae	April-June	Hand picking	Whole fruit, Seeds	-	Edible
II. Spices									
1	Rampatre	Mace	*Myristica malbarica*	Myristicaceae	Feb – August	Hand picking	Leaves	-	Culinary Purpose
2	Lavang	Cloves	*Syzygium aromaticum*	Myrtaceae	Whole year	Hand picking	Unopened flower bud	Dried over several days under Sun	Culinary Purpose
3	Dalchinni	Cinnamomum	*Cinnamomum zeylanicum*	Lauraceae	April-June		Bark, Leaf	-	Culinary Purpose
III. Souring Agents									
1	Uppage	-	*Garcinia gummigutta (L.) Robson*	Guttiferae	June-August	Hand picking	Dried rind	De-seeded & dried in wooden fired oven	Culinary Purpose
2	Vatehuli	Monkey Jackfruit	*Artocarpus lacucha*	Moreceae	March-April	Hand picking	Fruit	-	Culinary Purpose
IV. Fruits for Pickling									
1	Nellikai	Indian gooseberry	*Phyllanthus emblica*	Phyllanthaceae	September – February	Hand picking	Fruit	-	Pickle, Jam, Jelly Juice, Powder
2	Appemidi	Wild Mango	*Mangifera indica L.*	Anacardiaceae	February – May	Hand picking	Tender mango	-	Pickles

Table 11: Contd…..

Sl. No	Local Name of the NTFP	Common name	Scientific name	Family	Period of availability	Method of collection	Plant part used	Processing	End use
3	Kalale	Tender Bamboo Shoots	*Bambusa vulgaris , Phyllostachys edulis*	Poaceae	June-July	Hand picking	Shoots	-	Pickles
V. Edible									
1	Jenu	Honey	*Apis florea Apis cerana indica*	Apidae	November – April	-	Syrup	-	Edible
2	Anabe	Wild Mushroom	*Morchella esculenta*	Morchellaceae	June-July	Hand picking	Whole part	-	Edible
VI. Herbal Products									
1	Antavala	Soapnut	*Sapindus mukorossi*	Sapindaceae	April-May	Hand picking	Whole part		Herbal Hair Care Proucts
2	Sheegekai	Shikakai, Soap pod	*Acacia concinna*	Fabaceae	August-September	Hand picking	Whole part		Herbal Hair Care Products
VII. Seed Collection									
1	Honge	Pongamia/ Indian beech	*Millettia pinnata*	Fabaceae	April-May	Pods are removed from the tree by beating branches with stick	Pods (Seeds)	Decorticated	Oil extraction
2	Sagawani	Teak	*Tectona grandis*	Lamiaceae	-	Hand picking	Fruits (Seeds)	Decorticated	Plantation

Table 12: Utilization and income generated through NTFPs collection by JFMC members

Sl.No	Common Name of the NTFP	Quantity processed (Kg)		Marketing Facility	Cost per Kg	Place of Collection
		Household Purpose	Marketing			
1	Kokam	5-10	5000-10000	Kadamba Marketing & Co-operative Society, Tender by VFC	60-70 /-	Sirsi, Siddapur, Yellapur,Kathgal
2	Jamoon	2-3	10-15	Local Market	40/-	Yellapur, Siddapur
3	Mace	1-2	40-50	APMC, Tender by VFC	300-400/-	Kathgal, Honnavar
4	Cloves	1	100	APMC	700/-	Kathgal
5	Cinnamomum	1-2	200-300	Local Market	100-150/-	Yellapur, Siddapur
6	Uppage	20-25	20,000-25,000	Local Market, Tender by VFC	70-80/-	Honnavar, Sirsi, Siddapur, Janmane
7	Monkey Jackfruit	5	20-30	Local Market	5-10/-	Sirsi,Yellapur,Bhatkal,Kumta
8	Indian gooseberry	2-3	20-50	Local Market	10-20/-	Sirsi, Siddapur,Yellapur
9	Wild Mango	500 midi	2000-5000 midi	Local market	100 midi - 250-300/-	Sirsi,Siddapur
10	Tender Bamboo Shoots	-	-	Household	-	Sirsi, Siddapur, Yellapur
11	Honey	2-3	150-200	Tender by Forest Department, Local Market	200-300/-	Haliyal, Yellapur,Janmane
12	Wild Mushroom	2-4	5-10	Local Market	180-250/-	Sirsi, Siddapur,Yellapur,Kumta
13	Soapnut	5	500	Local Market	20-30/-	Sirsi, Siddapur,Yellapur
14	Shikakai,	5-10	180-200	Local Market	30-40/-	Sirsi, Siddapur,Yellapur
	Seed Collection					
15	Pongameia	-	5-10	Local Market	180/-	Yellapur
16	Teak	-	200	Collection from Forest Department	100-120/-	Haliyal

Table 13: List of the holy trees mentioned by the JFMC members

SL.No	Local name	Common name	Scientific name	Family	Purpose
1	Arali mara	Peepal tree	*Ficus religiosa*	Moraceae	Worshiped by hindus
2	Atthi mara	Indian fig	*Ficus racemosa*	Moraceae	Religious significance
3	Alada mara	Banyan tree	*Ficus benghalensis*	Moraceae	Holy tree
4	Banni mara	Indica Mesoquite Shamee Sponge tree	*Prosopia spicigera*	Fabales	Worshiped during navarthri
5	Sita ashok mara	Ashoka tree	*Saraca indica*	Fabaceae	Symbol of happiness & prosperity
6	Bilpatre mara	Bale Beli wood	*Aegle marmelos*	Rutaceae	Leaves represents three eyes of Lord Shiva
7	Yekkegida	Crown flower	*Calotropis gigantea*	Asclepiadaceae	Religious significance
8	Kumkumdamara	Dyer's rottler	*Mallotus philippensis*	Euphorbiaceae	Red dye is produced which is used for pooja
9	Bevina mara	Neem	*Azdirachta indica*	Meliaceae	Symbol of Goddess Durga

Table 14: List of the tress that are not harvested by the forest dweller

SL.No	Local name	Common name	Scientific name	Family	Reasons
1	Suragi mara	Surangi	*Mammea suriga* *Orchrocarpus longifolius*	Calophyllaceae	Ooze out latex
2	Ekanayak Sapthachakra	Chinese Salacia	*Salacia chinensis*	Hippocrataceae	Medicinal value
3	Kaasaraka	Nux Vomica Poison nut	*Strychnos nux vomica*	Strychnaceae	Poisonous
4	Hunase	Tamarind	*Tamarindus indica*	Caesalpiniaceae	Religious value
5	Basari mara	White fig	*Ficus virens* *Ficus infectoria*	Moraceae	Ooze out latex
6	Koove	Poonspar tree Sirpoon tree	*Calophyllum polyanthum* *Calophyllum tomentosum*	Clusiaceae	Ooze out latex
7	Thare mara Ghotimava shanthi	Baheda Belliric Myrobalan	*Terminalia bellerica*	Combretaceae	Ooze out latex
8	Kaadu kanagilu	Dellenia	*Dillenia pentagyna*	Dilleniaceae	Religious value
9	Sampige mara	Champak	*Michelia champaca L*	Magnoliaceae	Religious value
10	Dhoopada mara	Camphor tree	*Vateria indica L*		Religious value
11	Holageri mara				Swelling of body

Brahma, Lord Shiva and Lord Vishnu. "Indica Mesoquite" (*Prosopia spicigera*) is worshipped during navaratri. The element of water was identified with the plant Ashoka (Saraca indica) is considered sacred for worship and is a symbol of happiness and prosperity. Sacred 'Bel' (*Aegle marmelos*) represents three eyes of Lord Shiva. The crown flower (*Calotropis gigantean*), is offered to Lord Shiva. In Hindu culture, Neem (*Azadirachta indica*) is manifested as the Goddess Durga. A red dye extracted from the Kumkum tree (*Mallotus phillippensis*) is used in pujas and ceremonies as kumkum (red powder).

Table 14 showed the trees that are not cut by the local forest dwellers. Trees like Chinese salacia (*Salacia Chinensis*), Tamarind (*Tamarindus indica*), Dellenia (*Dellenia pentagyna*), Champak(*Michelia champaca*) and Camphor tree (*Vateria indica*) are not cut because the leaves, fruits, flowers and gum of these trees are used for several religion and cultural functions. Some trees that are harmful to human beings like poison nut (*Strychnos nux vomica*) and Holageri mara cause problems if touched or handled. Some other trees are not cut down because they ooze out latex and it is believed that in such type of trees god is present. The latex producing trees are: Surangi (*Mammea suriga*), White fig (*Ficus vivens*), Poonspar tree (*Calophyllum polyanthum*) and Myrobalan (*Terminalia bellerica*).

4.7 Constraints faced by the JFMC members in forest management & collection of NTFPs

The Garret ranking applied to the data regarding the constraints faced by the JFMC members in forest management activities (Table 19) shows that, overlapping of agricultural and JFMC activities was ranked first (I) followed by the non-availability of regular work (II), non uniformity in fixing the financial grants for different VFCs (Sukthanidhi) (III), lack of emphasis on quick economic activities (IV), village politics (V), forest fire (VI) and busy schedule of forest officials (VII).

The Garret ranking applied to the data regarding constraints in the NTFP collection by JFMC members shown in Table 20. It could be seen that the important constraints in the order were: lack of marketing facilities (I), absence of fixed price for NTFPs (II), lack of processing units (III), ignorance of people about the availability of resources (IV) and outbreak of diseases (V).

Table 21 indicates the constraints faced by the forest department officials in implementing the JFMC activities. Constraints expressed by the forest officials were absence of committee

Table 15: Constraints faced by the JFMC members in forest management

n=232

SL. No	Constraints	Total	Percent	Rank
1	Non-availability of regular work	15812	68.15	2
2	Overlapping of agricultural and JFMC activities	16184	69.75	1
3	Lack of emphasis on quick economic activities	12464	53.72	4
4	Village politics	8464	36.48	5
5	Forest fire	7156	30.84	6
6	Busy schedule of forest officials	6884	29.67	7
7	Non uniformity in fixing the financial grants for different VFCs (Sukthanidhi)	12612	54.36	3

Table 16: Constraints faced by the JFMC members in collection of NTFPs

n=232

SL. No	Constraints	Total	Percent	Rank
1	Absence of fixed price for NTFP	14170	61.07	2
2	Lack of marketing facilities	14650	63.14	1
3	Lack of processing units	12920	55.68	3
4	Ignorance of people about the availability of resources	11398	49.12	4
5	Outbreak of diseases	6318	27.23	5

Table 17: Constraints faced by the forest department officials

n=44

SL. No	Constraints	Total	Percent	Rank
1	Villagers desire for immediate benefits	2715	61.70	2
2	Absence of committee members in meeting	2725	61.93	1
3	Rules and regulations of the department in implementing the programme	1491	33.88	4
4	Limited decision power of lower forest staff	1281	29.11	5
5	Lack of staff	2700	61.36	3

members in meeting (I), followed by desire of forest dwellers for immediate benefits (II), lack of staff, (III), procedural delays of the department in implementing the programme (IV) and limited decision power of lower forest staff (V).

4.8 Relationship between independent and dependent variables.

Table 18 explains the relationship between socio-personal characteristics of the JFMC members and Non-members with knowledge of sustainable forest management activities. The correlation values for contact with extension agency, mass media participation and organizational participation had positive and highly significant relationship with knowledge of JFMC members at 1 per cent level of significance. Family size and extension participation had positive and significant relationship at 5 per cent of significance. Whereas, no relationship was found between knowledge of JFMC members and the remaining independent variables i.e., age, education, land holding, family income and family occupation.

In case of non JFMC members education had a positive and significant relationship with knowledge of non JFMC members at 5 per cent level of significance. However no relationship was found between remaining independent variables of age, family size, land holding, family income, contact with extension agency, mass media participation and organizational participation.

Table 19 indicates the relationship between socio-personal characteristics of the JFMC members with knowledge of forest conservation practices. The results of the test revealed that the contact with extension agency had positive and highly significant relationship with knowledge of JFMC members at 1 per cent level of significance. Extension participation, mass media participation and organizational participation had positive and significant relationship at 5 per cent of significance. The other independent variables viz., age, education, family size, land holding, family income and family occupation did not show significant relationship with knowledge of JFMC members about forest conservation practices.

Table 18: Relationship between independent variables and knowledge level of JFMC and non JFMC members about sustainable forest management activities

n=464

Sl. No	Independent Variables	JFMC Members	Non-Members
1	Age	0.021 ^{NS}	0.058^{NS}
2	Education	0.106 ^{NS}	0.310*
3	Family size	0.132*	0.010^{NS}
5	Land holding	0.034 ^{NS}	0.017^{NS}
6	Family income	0.084 ^{NS}	0.014^{NS}
7	Family occupation	0.029 ^{NS}	0.009^{NS}
8	Contact with extension agency	0.668**	0.087^{NS}
9	Extension participation	0.138*	0.054^{NS}
10	Mass media participation	0.485 **	0.074^{NS}
11	Organizational participation	0.453**	0.025^{NS}

** Significant @ 0.01 level (2-tailed)
* Significant @ 0.05 level (2-tailed)
$^{NS-}$ Non Significant

Table 19: Relationship between independent variables and knowledge level of JFMC members about forest conservation practices

n=232

Sl. No	Independent Variables	JFMC Members
1	Age	0.090 ^{NS}
2	Education	0.002 ^{NS}
5	Family size	0.120^{NS}
6	Land holding	0.034 ^{NS}
7	Family income	0.084 ^{NS}
8	Family occupation	0.110 ^{NS}
9	Contact with extension agency	0.258**
10	Extension participation	0.132*
11	Mass media participation	0.154*
12	Organizational participation	0.054*

** Significant @ 0.01 level (2-tailed)
* Significant @ 0.05 level (2-tailed)
$^{NS-}$ Non Significant

4.9 Qualitative findings on knowledge of JFMC members about forest management and conservation practices

Theme	Sub-Themes
Forest Management	**I) Conservation Practices by JFMC members**
	i) Biodiversity conservation
	ii) Soil & moisture conservation (SMC) techniques
	iii) Fire management
	iv) Deforestation, land degradation & encroachment

Theme: Forest Management

Forests are an important part of our state's environment and economy. When they are well managed, forests provide clean air and water, home for wildlife, beautiful scenery, places for recreation and products that we all use every day in our day lives. When not managed well forests become unhealthy and unproductive. This is because of over exploitation, overgrazing, overcrowding and diseases of plants. To keep forests healthy and productive a number of management techniques are needed. They are biodiversity conservation, soil & moisture conservation, forest fire management and reforestation.

Sub-Theme 1: Biodiversity conservation

Biodiversity refers to the number and variety of organisms found within a specified geographic region. Biodiversity comprises all the millions of different species that live on our planet, as well as the genetic differences within species. It also refers to the different ecosystems in which species from unique communities, interact with one another and the air, water and soil. Biodiversity conservation is about saving life on earth in all its forms and keeping natural ecosystem functioning and healthy. Conservation as a scientific discipline has grown enormously over the past few decades and has increased awareness and understanding about the great extent to which humans depend on natural ecosystems & biodiversity.

Conservation of biodiversity is very important because humans are dependent on other species of plant and animals for their very existence. They desire a number of economic

benefits from nature like food, firewood, fibers, medicines and more. Conservation plays an important role in maintaining and sustaining the supply of goods and services. It is also important to preserve every species of plants and animals as each one is dependent on one another either directly or indirectly, each has a role to play in nature.

The importance of biodiversity and conservation practices followed by the respondents are quoted here in verbatim.

Zone I - Coastal Region:

R_1: *"Forest provides the basic requirements for our daily life such as fresh water, clean air and food as well as many other products such as timber & firewood and so we needed to take care of them"*

R_2: *"Many forest plant species are useful to us in home for remedies to treat various health conditions"*

R_3: *"Animals like deer, sambar, wild buffalo and rabbit graze the vegetation, which in-tern it helps to grasses to flourish and so we should not kill them in large number."*

R_4: *"We should plant more plants, trees and animals the soil improves and become stronger. This makes land less prone to erosion and in-turn drought and flood"*

R_5: *"The Lion Tailed Macaque (LTM) is an old world primate which is endemic to the Western Ghats of India, inhabit in the thick evergreen forests. Habitat destruction, collection of NTFP and habitat fragmentation being the major threats for the primates, it is now considered as an endangered species (by IUCN- International Union for Conservation of Nature). These primates are one of the specialties of Honnavar division and this is our sincere efforts to throw light on this not so well-known but endangered species which is a flagship species. To reach more number of people and spread message towards the conservation of LTM, "Singalika Eco Park" was started in 2011 at Gerusoppa." Uppage is a main source of food for these LTM so in this conservation area people are not allowed to harvest uppage, forest department and JFMC committees are planting tree species like uppage, jack fruit and other fruit bearing tree species."*

Since uppage is the main for LTM we do not harvest uppage and through JFMC we are palnting uppage and jack fruit trees.

R_6: *"Many medicines and herbal extracts are derived from the forest tress that are useful to us. So Medicinal Plants Board along with the VFCs of Jankadkal village of Honnavar taluk and Shirgunji village of Kumta taluk declared the areas of Medicinal Plant Conservation Area (MPCA) to conserve the medicinal plants."*

R_7: *"We should plant threes because it can lessen the effects of climate change"*

R_8: *"Forest is managed well by the local people because of the strict rules enforced by the forest department. For instance cutting of trees is banned and only local people are allowed to collect dead & fallen tree branches. Grazing of animals in forest area is also prohibited"*

Zone II - Upghat Region:

R_1: *"As a Head of the VFC, my role in the village is to monitor and take care of my village forest area, I need to protect, conserve, and properly manage the bettaland areas, forests and overall biodiversity of the village and make sure that the people in the village know about which areas are being protected and what are the future planation activities and their role in conservation".*

R_2*: "Being JFMC members it's our duty to ensure that the villagers are monitored about over-felling, over-grazing or over-collection of forest products within the JFMC area. It is important that as JFMC members we enforce the laws and monitor the forest and wildlife activities in order to make sure that there is enough forest cover, wildlife and a healthy environment for the future generations."*

R_3*: "We live in the jungle and there are jungles all around us. We have the best jungle here in our Western ghats. It is big, dense and full of healthy trees. The jungles are everything to us and it's our foremost duty to conserve these and pass on to our future generation otherwise our children will be left to know about forest & wild life only through pictures or films or hear stories about forests from their elders."*

R_4: "*If only the forest is thick and other wild trees then we consider that you are in a forest. Forests need to have a good thick cover of trees. If you have good forests then you get a good environment which leads to good rain and which results in production of food grains, fruits, spices and other edibles."*

R_5: *"Forests are a necessity and are a necessary part of our lives especially for us who live around forest. The forests help to keep flooding and landslides in check so that we are more*

protected and safe if they were to hit the village. They also help to make the environment less polluted because they release lots of oxygen and store the bad pollutants and carbon."

R_6: *"In Our jungle everything is green which you can see in all of the areas surrounding us."*

R_7: *"We have rights to use the broken, uprooted and dried trees as fuelwood. We never harm the nature because we worship and love the forests so much."*

R_8: *"People have rights to their forests. They have the right to collect fuelwood, medicines, grasses & hay. They can graze their animals in the forest as well. The locals also have the responsibility to follow the rules, they cannot go into newly planted areas, cannot graze their animals in fenced areas and they cannot cut trees".*

R_9: *"The rights that people have to their village forest are: the right to collect timber wood for house construction, the right to collect fuel wood, and medicinal plants. Also people have the right to graze their animals in the forest and they have the right to collect wood to make agricultural tools. They also have to respect and adhere to the rules set out by the forest department to ensure that the forests are not being overused."*

R_{10}: *"I am entirely dependent on the forests because I need the betta land for my acreanut fileds and my other crops for mulching and fuel wood is also required for boiling & processing of arecanut. Fuel wood from the betta land helps us survive in the winters and rainy season. Being a betta land owner I use the forest in a sustainable way and I also take up plantations in the betta land. If there were no forests here, I could not live and my family would not have a good life. We can't imagine our lives without the forest".*

R_{11}: "*Earlier people had to travel several miles, spending half a day to go into the jungles and even then were unable to collect enough fuel wood. Forest department is providing free LPG connections to households as to reduce the fuel wood burden on forests."*

R_{12}: *"We collect a herb from the forest that acts as a sweetener for our tea and coffee. we do not collect any other medicinal plants."*

R_{13}: *"In the past the forests were so important that they were considered as God and so were called as forests of god (Devarakadu). It is a traditional way of conserving the forest and forests were preserved through generations as Devarakadu, where patches of forests are dedicated to deities and used for worship and cultural activities by the local communities. Similarly now forest departments started a initiative to conserve and protect scared*

grooves/kans by implementing a scheme called "Development of Tree Parks and Daivivanas". Under this scheme Daivivanas (forests) are established by the side of places of worship i.e., near temples which will attract the devotees so that they can spend some time enjoying the beauty of Mother Nature. Areas adjacent to selected temple/ religious places are chosen for Daivivanas to conserve local biodiversity. Places like Rashivana, Pavitravana, Nakshatravana, Navagrahavana, Tapovana, Asthadikkapalakvana, etc. are also selected for this purpose where planting of local flowering and fruit trees is taken up. On pilot basis in the Uttara Kannada district the forest department established Daivivana near Ulavi forest area. Visitors to the temple are motivated to learn about conservation of forest and wildlife. Seedlings are also made available for the people to pick up for planting and nurturing in place of their choice. This scheme helped in forest protection & conservation to make sure that their forests are well managed and maintained by the forest department, JFMC members and other voluntary environmental conservation agencies".

R_{14}: "*There are innumerable living beings o the earth. Protection of existence of living beings is important wealth of nature. So it is our duty to protect them".*

R_{15}: "*Conservation of biodiversity is essential for our children and grandchildren. We should not deprive them of the forest wealth"*

R_{16}: *"Forests contribute to the economic development of the country because they provide wood for hawing agricultural implements and furniture. They provide raw materials for industries and some food items also."*

R_{17}: "*Our ecosystem also reflects our history and contributes to our sense of belonging. Our nature has inspired our imagination, folk, poetry and art for thousands of years. It act as a source of inspiration for artists*"

R_{18}: *"Karnataka state forest banned planting acacia and eucalyptus plantation because these trees have caused severely affected ground water table and rainfall."*

R_{19}: *"Living beings require food for lioing. Food is produced by agriculture, agriculture is dependent on rain, and rain depends on forest. Therefore conservation of forest is necessary for well-being of human beings."*

R_{20}: *"By adopting social forestry in the village, we are using common village lands to produce firewood, fodder and small timber. By this we are not destroying forests to meet our basic needs".*

R_{21}: *"We are conserving the forest to maintain the humidity, as humidity is an important factor which affects areca nut yield and yields of other plantation crops like vanilla, cardamom etc."*

R_{22}: *"Each VFC member should plant 12 trees, they should take care of those plantations and after three years, the forest department and VFC head will check the growth of the plantations. If all the 12 plants have survived then incentives are awarded and incentives are given to the members"*

Zone III – Plain Region:

R_1: *"Forest conservation is the conservation of all living beings; it includes conservation of the habitat, heredity and ecosystem. By conservation wildlife will increase as well as the quality of the environment will improve."*

R_2: *"There are innumerable living beings on the earth; protecting the existing living beings on earth is the duty of the people."*

R_3: *"Vegetation, animals, birds and other creatures have ornamental value. People do not have to spend money to build nature but they can utilize the natural gift by conserving it. It helps for the development of tourism. This will contribute to the economic development of the country by using the available natural resources."*

R_4: *"All living creatures both plants and animals are dependent on one another. Ecosystem is a group of life forms that live together in a balanced way. The more the plants, animals & insects in a particular area, the healthier is the ecosystem"*

R_5: *"All plants and animals have own rights and value to exist on this earth irrespective of whether human need them or not. This is the law of nature"*.

R_6: *"There are many projects taken up by the forest department, for conservation of rich biodiversity and management of protected areas in the form of Eco-park, Eco-beach, Tree-parks and Daivivanas, Sanctuaries and Nature Camps. These provide visitors environmental education along with recreational activities."*

R_7: *"Eco Development Committees (EDC) have been formed in Dandeli wild life conservation area to protect national park and wildlife sanctuaries. These EDCs includes the concept of eco-tourism in protected areas to provide new livelihood option to the local*

communities, in the form of activities like, collection of entrance fees & ticketing for visitors, parking charge for vehicles, watchmen, catering service and maintenance of park."

R_8: *"In order to conserve and increase the endangered species population and reintroduce them to their natural habitat, wild life protected area and bird sanctuaries have been created. In our Uttara Kannada district we have National Tiger Reserve Park – Anshi, Dandeli Wildlife Sanctuary, Topical Rainforest Ecological Camp, Gudavi ,Bird Sanctuary – Sirsi, Mundige Kere Bird Sanctuary – Sonda, Attiveri Bird Sanctuary-Mundgod, LTM Eco park – Gerusoppa".*

R_9: *"If I use the forests in a judicious way by following the with protection and conservation practices, it will supply forest products like leaf, fire wood, timber and fodder regularly. If I protect the forests today, our children and grandchildren will see what I see today.' Having good forest means having increased in wildlife's population which are an attraction for local as well as international tourists. So, forests can be a source of income to the village."*

R_{10}: *"Awareness programmes during Vanmashostava increase people's knowledge about conservation of biodiversity along with tree plantation activities."*

R_{11}: "*In National Tiger Reserve Park – Anshi, forest department officials relocated people residing nearby this national park under the scheme, 'Voluntary Rehabilitation of families from Tiger Reserves and National Parks' by providing a rehabilitation package as well as payment of amount as per the valuation fixed by the revenue department for revenue lands. This motivated the villagers to give up their lands near the national park"*

R_{12}: "*Elephant menace is major problems for agricultural cultivation. Protection work like excavation of elephant proof trenches, erection of solar fencing between forest area and agricultural land were taken up to control crop loss or damage"*

R_{13}: "*Wildlife wing performs protection and conservation of all wildlife. Dandeli forest is home to large variety of wild animals such as tigers, leopards, black panthers, elephants, bison, hornbill and crocodile. In this region conservation is mainly towards protection of wild animals."*

R_{14}: "*A healthy relationship between insects, birds, animals and plants helps in pollination, which is increasing the fruit production and seed setting. This in turn increases the population of fruit bearing tress when seeds are dispersed*."

Sub Theme 2: Soil & moisture conservation (SMC) techniques

Since streams and rivers originate from the forests, it is very important to conserve soil and moisture in the catchment area. Forests not only supply timber, fuel, fodder and a variety of other products but also have a moderating influence against floods and erosion and help to maintain soil fertility. Development of forest resources is an integral part of forest management activity for optimum land utilization. Forests have important protective as well as productive functions.

Soil & moisture conservation is one of the important activity in the degraded forest area to fulfill the objectives of conserving fertile top soil, enhancing soil moisture regime and conserving surface runoff for reducing erosion. The forest department has taken up SMC work by constructing ponds, bunds, contour bunding, trenches, percolation tanks, check dam, gully plugging, gabion model, water harvesting structures and mulching. These SMC works are common in most of the regions. However in coastal region along with these SMC techniques is the concentration on mangrove plantation while in plain region cattle proof trenches and elephant poof trenches are during to avoid animal-human conflicts. The SMC techniques are explained below in brief:

Bunds:

Bunds are narrow base terraces and earth embankments built across the slope of the land. They are built with purpose of reducing the runoff velocity before attending erosive velocity, checking soil loss and improving local soil moisture profile.

Contour Bunding:

Stone or earthen walls are built across (along the contours) to act as barriers to runoff water. Thus reducing the amount and velocity of the runoff. This helps to control soil erosion and maintains the soil fertility by better infiltration of water into bunds and ultimately replenishing the groundwater.

Trenches:

Trenches are dug around the hill slopes at given contours especially used for non-arable area of hill slopes. Trenches control erosion in hills by intercepting the runoff water which enters into the soil increasing the soil moisture. They hold water in upper reaches which recharge ground water and also reduce erosion.

Percolation Tank:

Percolation tanks are constructed in relatively permeable soils in the upper reaches of the watershed so as to facilitate groundwater recharge. The runoff from the catchment gets harvested in the percolation tank from where it slowly recharges the groundwater. The percolation tanks are generally constructed in the first and second order streams. Since the average catchment area in these streams is 50 ha., one percolation tank is constructed in a 50 ha catchment area.

The main purpose is to arrest runoff, to enable collection and percolation of surface water so as to recharge the ground water table.

Check Dams

Check dams are generally constructed on small rivers or nallas in order to break the flow of water during the monsoons and allow it to seep into the soil. Check dams range in size, shape and cost and are often built with easily available materials and at low costs. A check dam essentially has an earthen dam and masonry spillway. Check dams cut the velocity of water and reduce erosive activity. The stored water improves soil moisture and the percolation recharge the aquifers.

Gully Plugging:

Gully plugs protect gully beds by reducing the velocity of the flow of water. Redistribution increases its infiltration, encourages silting and improves the soil moisture regime for establishing grasses and other vegetative cover. Such structures are combined with vegetative measures to help stabilization. Since gully plugs are made of locally available materials, earth, sand bags, loose rock dams and others. It is easier and economical to construct these earthen gully plugs wherever possible.

Gully plugs prevent soil erosion and settle sediments & pollutants conserve moisture by infiltration. Prevent unwanted gully formation during floods. Can reduce salinity in ground water and allows ground water recharge.

Gabion Structure

Gabions are rectangular shaped cages made of galvanized wire which are filled with locally found rocks or stones. The gabion check dams are made by connecting several gabions in both horizontal and vertical direction. The greatest advantage of gabion structure is its

flexibility which will shape itself according to stream bed when changes occur due to erosion without loosing its stability. They help to reduce the velocity of running water, as the rock dissipate its energy, which helps to reduce erosion and the gaps between the rocks allow water to flow through the structure, helping to maintain a low ground water level.

Water Harvesting Structures:

Water harvesting structures are constructed to store rainwater which helps recharge ground water irrigating the crops at later time when the crops need it. These structures intercept and reduce runoff trap eroded materials there by reducing sediments in streams and reservoirs and create irrigation potential in mini commands.

Mulching:

Mulching is done by covering the soil between rows of tress or around trees with leaves, cut grass, straw, crop residues or other plant materials. This helps to retain soil moisture by reducing evaporation, prevents weed growth and enhances soil structure. Since mulch layer is rougher than the surface of the soil it inhabits runoff. The layer of plant material protects the soil from splash erosion and limits the formation of crust.

Coastal Region:

Mangrove Plantations:

Mangroves are salt tolerant shrub or small trees which are adapted to coastal conditions. They have a root system that can cope with salt water and wave action. They act as natural barriers to prevent high tides and tsunamis. They are homes for a variety of fish, birds and mammals. It is therefore important to conserve mangroves to prevent soil erosion, high tides and tsunamis from damaging the main land.

Mangrove plantations have been taken up by the forest department in Karwar and Honnavar division. According to the forest survey of India in the past to grow the mangrove patches in Karwar and Honnavar divisions have increase by 350 ha and 250 ha respectively. This increase is entirely due to local conservation efforts, both by forest officials and communities by reforestation and protection.

Conservation and Management of Mangroves: This centrally sponsored scheme aims to check and prevent sea erosion in the coastal region. Activities under this scheme included raising mangrove plantations, maintenance of older mangrove plantations in coastal divisions and education and awareness raising programs are also undertaken.

Mangrove Plantations

Check dams to control water runoff

Trenches to conserve soil moisture

Plate 1: Soil and Moisture Conservation (SMC) activities of the JFMC members

Plain Region:

Cattle proof trenches (CPTs):

Since forest boundaries lack clean demarcation of boundaries, cattle grazing into forest areas is a major issue because this can take away the fodder wild animals inhabiting the forest areas. To address this issues MGNREGS is really gives ample opportunity to the Foresters/local VFC members through Cattle proof trenches (CPTs) are during up through MGNREGS labour and local VFC members. The CPTs in the forest areas serve multi-purposes to address various forest conservation issues. They acts as a micro-reservoir and a physical fencing to the newly created plantations. It is one of the best low cost measures to prevent illegal land encroachment at village levels. It checks the run- off water during heavy rainfall, which improves soil moisture percolation. The CPTs also became a strong physical barrier against forest fires during summer.

Elephant poof trenches (EPTs):

Elephant poof trenches (EPTs) are trenches that are doing along borders of fringe villages to prevent wild elephants from damaging agricultural crops. These EPTs acts as a natural barrier as against electric fences which claim lives of the elephants. Hence the forest department has been encouraging farmers to adopt EPTs rather than erecting electric fences.

The forest department is constructing ponds and waterholes for wild animals within the forests. When roads pass through forests speed breakers are also constructed to limit the speed of vehicles and to reduce animal accidents. To prevent the animal accidents notice boards have been designed by forest department cautioning riders to slow down.

Soil & moisture conservation (SMC) techniques have become an integral part of the forest department. These SMC works are carried out as per the site specific approved treatment plan by the forest department. The JFMC members gained knowledge about all the different SMC techniques because they are involved in carrying out these different activities like digging the trenches, construction of ponds & check dams, cattle proof trenches, elephant poof trenches, planting mangrove etc.

Sub Theme 3: Fire Management

Forest fire are defined as an unclosed and freely spreading combustion that consumes the natural fuels. Combustion is nothing but fire. When a fire burns out of control it is known as wild fire. Forest fires caused by humans are either due to negligence or unknowingly. Fires

Plate 2. Animal proof trenches to prevent straying of animals into human habitations

are also caused by natural reasons like lightning, extreme rise in the temperature etc., but are very rare.

Causes of forest fire:

1. Often negligence by humans is the one of the causes of forest fires. Some examples are unextinguished camp fires of trekkers and labour camps. Nomads moving through the forest with their animals, do not put out fire properly. All these lead to devastating forest fires.
2. Sparks from transformers installed in the forest or nearby vehicles passing through the forest- may sometimes ignite fires in forest areas.
3. The charcoal used to smelt coal tar during road construction in forest areas may light up the dry litter causing in huge forest fire.
4. The firewood used for cooking in households residing near forest areas may sometime cause fire in the nearby forests.
5. Cigarettes & bidi stubs, match sticks carelessly thrown by travelers, picnickers, villagers, nomadic grazers or even forest laborers may result in fires destroying valuable timber worth millions of rupees.
6. The forest department taken up controlled burning in forest areas just before the onset of the fire prone season to burn all the combustible material in the forest. However due to negligence this fire may spread and cause damage to the forests.

In order to prevent forest fires the forest department has initiated a system of fire-lines around valuable timber 'compartments' or coupes. These fire-lines are cleared before the onset of summer, so that if forest fires occur could be confined to a few compartments. All the preventive measures are taken in advance before the fire season starts during February - April. Fire lines are cleared in time and fire watchers are employed or VFC members also work as fire watchers.

Every year before the forest fire season an awareness campaign on prevention, detection & communication and suppression of forest fire is conducted by involving college students, JFMC committees, non-Government and other voluntary organizations.

A central fire management research and training institute offers training courses for foresters and public agencies to provide knowledge and skills for fire managers which include trainers at JFMC unit levels. The members through JFMC, VFC, and NGOs are involved in creating awareness among people on forest fire management. Local communities are involved by providing them some initiatives to protect forests from fires.

Community participation through Joint Forest Planning and Management (JFPM) programme has proved very useful in forest fire management. Karnataka Forest department has modern methods and equipment to tackle forest fire. The VFC members also expressed that in Uttara Kannada forest fire incidents were less and most of the VFC villages have been declared as 100 % forest fire free areas.

Sub Theme 4: Deforestation, land degradation & encroachment

Karnataka State Forest Department (KSFD) approach to forest management has undergone significant changes during the 1980s and 1990s. This period brought about a major shift in forest management practices from production forestry to conservation forestry. This change was due to the change in the national forestry scenario which highlighted the need for ecological security, preservation of natural forest and biodiversity conservation. Sincere attempts were made at the state level to protect forests in general and protect evergreen and semi-evergreen forests in particular. In 1983, clear-felling of natural forest for regeneration was stopped and the felling of natural green trees was restricted. In 1987, felling in the evergreen forests was altogether stopped and in 1989, it was decided to stop all concessions to the wood-based industries, who were now required to obtain their requirements in the open auction. In 1990, felling of all naturally growing green trees was totally banned. These changes brought about by the state were in conformity with the National Forest Policy of 'conservation oriented forest management' approach.

The new approach has brought down the destruction of forests for timber and fuel wood is limited to salvaging of only dead and fallen trees and felling of man-made fuel wood plantations. Most evergreen, semi-evergreen forests and deciduous forests in inaccessible areas and on steep slopes have been brought under the ambit of 'Bio-diversity conservation' where tree felling is prohibited and rigid protection measures are prescribed. Protection from fire is given the utmost priority. These measures have resulted in the reduction of human interference in the forests, thus leading to their restoration and rejuvenation.

Forest development activities

Due to the increasing human and capital population, acts of encroachment, unauthorized felling, fires, poaching etc is happening in the natural forests causing degradation and denudation. This calls for a need to replenish the depleted forest resources and so it is the endeavor of the department of forests to plant trees and encourage tree planting outside the notified forests so as to reduce pressure on natural forests. In addition, the department takes up tree planting in areas where there has been thinning/extraction. Tree planting has been a core activity of the forest department which received a fillip with the launching of the World Bank aided Social Forestry Project (1983-1992). This was followed by a series of externally funded projects such as the Official Development Assistance (ODA) assisted Western Ghats Forestry and Environment Project (1993-1999), the Japan Bank for International Co-operation (JBIC) assisted Eastern Plains Forestry and Environment Project (1997-2005) and the Japan International Co-operation Agency (JICA) assisted Karnataka Sustainable Forest Management and Biodiversity Conservation Project (KSFMBCP) (2005-2013), etc. In addition, the Forest department has been implementing a number of state and centrally sponsored schemes for tree planting in order to supplement the growing stock in degraded forest areas and to replant in clear felled or thinned areas. Some of the ongoing schemes are described below in brief:

Development of degraded forests (DDF): Degraded forests are rejuvenated by planting seedlings of suitable species to meet local requirement of small timber, fuel wood and fodder. Strict protection is provided against grazing and forest fire.

National Afforestation Program through Forest Development Agency (NAP-FDA): Under this centrally sponsored scheme plantations are raised by the Forest Development Agencies as per the programme approved by the Government of India (GOI). The FDA is a federation of Village Forest Committees (VFCs) in a forest division. The center and the states share is is 60:40 percent.

Green India Mission (GIM): Launched in 2014, this centrally sponsored scheme aims at protecting, restoring and enhancing India's diminishing forest cover. It also aims at responding to climate change by a combination of adaptation and mitigation measures, which includes improvement of quality of the existing forest and tree cover. The sharing pattern of the scheme is 60:40 per cent.

The Compensatory Afforestation Fund Management and Planning Authority (CAMPA): CAMPA has been constituted by the Government of India to manage the money collected towards Compensatory Afforestation, Net Present Value and any other money recoverable from the user agency. Works implemented under the CAMPA include, (a) raising of compensatory plantations, (b) project specific activities like fencing of safety zone, raising of plantation in safety zone, canal plantation, dwarf and medicinal plantation, soil and moisture conservation works, supply of energy saving devices to the people living in fringe villages, etc. and (c) activities for the utilization of net present value or NPV like forest consolidation, forest protection, regeneration in natural forests, wildlife protection and management, infrastructure development, etc.

Krishi Aranya Protsaha Yojane (KAPY): To enlist co-operation of farmers and general public for increasing forest cover, the forest department launched this programme (2011-12). As per the guidelines of the programme, farmers, public and NGOs can avail seedlings at subsidized rates from the nearest nurseries of the department. Seedlings so obtained and planted in their lands are to be nurtured and for each surviving seedling they are paid cash incentive from the department. For every surviving seedling at the end of the first year the department provides Rs 10/- as incentive. A sum of Rs 15/- and Rs 20/- per seedling is provided for each surviving seedling after completion of second and third year respectively. The incentive not only encourages the farmer to plant the seedling but also to nurture it at least for three years. The total amount of Rs 45/- paid per seedling compensates the cost incurred by the farmer in procuring and planting the seedling. The incentive amount is quite substantial when the farmer plants more number of seedlings. In addition to this financial incentive, the farmers to get handsome returns from the matured tress like fruits, seeds, fodder, firewood, timber etc. In the last five years more than three crore seedlings have been raised and distributed under this scheme. To encourage farmers to take up tree planting the state government with since 19-06-2017 has revised the incentive package to Rs 100/- per seedling with yearly installments as Rs 30/-, Rs 30/- and Rs 40/- respectively.

Tree for every child and a park for every school : (Maguvigondu mara Shalegondu vana):

With an intention to create awareness about ecology and the environment among school children and to encourage them to plant trees voluntarily open areas around educational

institutions will be identified for planting seedlings. These seedlings will be provided at subsidized rate to school authorities for planting. Under this project all schools from the primary level upto college and universities are involved.

Green school for each Taluka (Talukigondu Hasiru Shala Vana) :

Under this program, in every taluk all the schools / colleges which are at a distance of 3 to 5 Kms or having government / forest land to an extent of 3 to 5 acres will be selected and in one of the Government schools / colleges the students will be involved in planting of seedlings and maintenance of plantation. This is a 5 year program.

People are also aware about forest department rules like penalty and F.I.R (First Information Report) for illegal activities in the forest. Those whose commit illegal activities are punishable with imprisonment for a term which may extend upto one year or with a fine or with both which may vary according to the illegal acts. With all these programmes, schemes & rules of the government and cooperation from the local people forest department has become successful in controlling deforestation, land degradation & encroachment.






Plate 3. Interaction with the JFMC members and Forest Department Staff

Discussion

5. DISCUSSION

The results of the present study are discussed in length and interpreted under the following sub headings.

5.1 Socio-personal characteristics of the JFMC members.

5.2 Knowledge about sustainable forest management and forest conservation practices.

5.3 Gender participation of JFMC members in forest management activities.

5.4 Sustainable collection, processing, utilization and income from NTFPs

5.5 Documentation of the bio-cultural beliefs about forest and forest trees.

5.6 Constraints faced by the JFMC members in forest management & collection of NTFPs.

5.1 Socio-personal characteristics of the JFMC members.

5.1.1 Age:

The results of the Table1 revealed that, majority (63.80 %) of the JFMC members were middle aged that is 36-50 years. The middle age group members are more enthusiastic and concerned about the forest management and conservation. Since the local people themselves organize the VFC groups at the village level, more members were from this age group. However, 28.00 per cent of JFMC members belonged to old age group. Older people have more knowledge about forest management, so local people select elder's as VFC heads or executive committee members. There were few youngsters (8.18 %) who had become JFMC members of their own interest to take care of the forests. The results are in accordance with the findings of Sudheendra and Hirevenkanagoudar (2005) and Kumari *et al*., (2013)

5.1.2 Gender:

With respect to the gender there were equal per cent of male and female respondents because they were purposively selected for the study. The government order has been amended to enroll both husband and wife in a family as VFC members and hence the present findings.

5.1.3 Education:

Majority of the JFMC members were either illiterate (20.68 %) had education up to primary (23.27 %) and middle school level (16.81 %). This might be due to the fact that they

are living in interior areas adjacent to forests. Where there were only schools up to 7th standard. For higher education they have to travel or move to main cities which many avoid. Only some members had education up to high school and degree level. This is because of realization of importance of formal education in the present situation. The higher educated respondents were from better off families and could afford to go to cities for the same. The results are in line with Kumari *et al*. (2013) and Rawat and Chandra (2015).

5.1.4 Caste:

It is evident from Table 1 that, there was not much variation among JFMC members with regard to caste. The percentages ranged from 32.32 – 20.12 per cent for the four caste categories i.e. Backward Caste (32.32 %), SC (25.86 %), Forward Caste (21.13 %) and Scheduled Tribes (ST) (20.69 %). This data clearly indicates that there is no discrimination among JFMC members regarding caste and all the people of the villages were found to be participating in forest management activities without any hesitation. The results are in conformity with the findings of Joshi and Bhardwaj (2015).

5.1.5 Marital status:

It was noticed that most respondent JFMC members (97.85 %) were married and a small percent (1.29 %) were widow/widowers and unmarried (0.80 %). It is a norm in India to marry at adulthood and prime importance is given to this part of their life. Hence the present findings. The results of the present study agree with the findings of Joshi and Bhardwaj (2015).

5.1.6 Type and size of family:

In rural areas joint families still prevalent and so we see that (58.60 %) had joint families while 41.38 per cent were from nuclear families. Correspondingly nearly 53.00 per cent had medium to large sized families. The joint family system is slowly breaking down and giving way to nuclear families even in rural areas. Mostly the nuclear families are having small size (37.06 %) families with 1-4 members. The results are in accordance with the findings of Kumari *et al.* (2013), Joshi and Bhardwaj (2015) and Rawat and Chandra (2015).

5.1.7 Land holding:

Table 1 shows that, 40.52 per cent of them were marginal farmers (<2.5 acres), 29.32 per cent were landless labourers, 19.39 per cent of them were small farmers (2.5-5.0 acres).

These three categories make a total of nearly 89.00 per cent. This data is a reflection of the national data where it is said nearly 80.00 per cent of the farmers of the country own less than 5 acres of land. In the present study however only about 11 per cent owned more than five acres of land. This is because in forested areas land holdings are generally small compared to other parts. So most of the JFMC members living in the forest areas have small landholdings and a very few have marginal to large landholdings. The results are in line with the findings of Kumari *et al*. (2013).

5.1.8 Occupation of the family:

Corresponding to the ownership of land 54.74 per cent of JFMC members were dependent solely on agriculture and that was their main occupation. About 40.00 per cent of them were wage labours which also include people with very small land holdings. Such people work on others farms in addition to their own farms. A small per cent are working as angawadi workers or had petty business (2.59 %) like pan shop, cold drink shop etc. The results are in conformity with the findings of Kumari *et al*. (2013) and Joshi and Bhardwaj (2015).

5.1.9 Annual income of the family:

A majority (83.62 %) of the JFMC members had low income of less than Rs. 1,32,000 per annum, 15.51 per cent had medium level income of 1,32,000 – 5,72,000 and only 0.86 per cent had high level of income (> 5,72,000) . The probable reason, which could be attributed for low income of JFMC members is due to the small size of the land holding, less work opportunities in places surrounding the forest and low income generating avenues in the forest areas. For instance NTFP collection does not generate much income. The results of the present study agree with the findings of Sudheendra and Hirevenkanagoudar (2005) and Joshi and Bhardwaj (2015)

5.1.10 Contact with extension agency:

Majority (77.58 %) of the JFMC members had medium contact with extension agency. From this it could be inferred that the JFMC members were in touch with the Deputy Range Forest officer (DRFO) and Forest Guard (FG) for getting information about different forest management activities through not on a regular basis. It may be noted that DRFO and FG were the persons in charge of local forest area. About 13.00 per cent of them had low contact

with extension agency. This could be because forest officials are male, so women JFMC members may hesitate to keep in touch with male extension worker. About 9.00 per cent of JFMC members had high extension contact which may be due to good relationship between the VFC head and forest department officials. They may be with each other to discuss and plan about forest management activities. The results are in accordance with the findings of Sudheendra and Hirevenkanagoudar's (2005).

5.1.11 Extension participation:

The data in Table 3.1 indicate that, cent per cent of JFMC members had medium extension participation. The forest officials are regularly arranging some or the other activity in the villages with regard to forest protection and conservation. There may be the female JFMC members probably because of their involvement in household activities. They do not have the time to regularly participate in group discussions and training programmes. However mainly the male JFMC members, involved in group discussion, demonstration, field visit, exhibitions, campaign and vanamahostava programmes.

5.1.12 Mass media participation:

Mass media inform educate and entertain people and influence the way people look at the world and make them change their views. The data on mass media show that majority (62.94 %) of the JFMC members had medium mass media participation and 37.06 per cent had high mass media participation. This is because the newspaper, radio, television and the internet play a big role in the society. Many people these days read newspapers/magazine and watch TV. Mobile phones are now owned by everyone and the internet is accessed through mobile phone.

5.1.13 Organizational participation:

Majority (57.75 %) of the JFMC members had low organizational participation and 42.25 per cent had medium participation. Mainly respondents are involved in only VFC activities and some respondents are members of other organizations like SHGs (women JFMC members), Co- operative societies (KMF) and other Farmer Producer Organizations, hence we see low to medium level of the organizational participation. The results are in line with the findings of Kumari *et al.,* (2013)

5.1.14 Trainings attended by JFMC Members

Trainings are planned programmes which are designed based on the local needs. Trainings are to improve knowledge, skill and attitude of the people. Keeping this in view forest department organizes regular training programmes for JFMC members on aspects of forest management, agriculture & allied activities, income generating activities and skill trainings.

A large majority (92.67 %) of the JFMC members attended training on plantation management, importance of soil and moisture conservation (77.58 %), fire management (51.72 %) and conservation of NTFPs (51.72 %). These are fundamental components of forest management and conservation. In order to increase the knowledge and awareness among the JFMC members, forest department is organizing training programmes on these topics, and so most of the JFMC members attend these trainings. In agriculture & allied activities, some of JFMC members attended training on honeybee rearing (27.58 %). About 12.00 per cent each of JFMC members undergone training on dairy and poultry management. These trainings were organized by forest department to support and encourage forest dwellers to adopt different livelihood options. Some of the JFMC members who were interested to take up these activities availed the benefit of the trainings organized. Trainings on income generating activities (IGA) are also organized and 32.32 per cent of women JFMC members underwent IGA trainings on Papad making, Agarbatti making, Candle preparation and Soap & Detergent preparation. About 19.00 per cent of members attended training on processing and value addition to NTFPs like kokam, uppage and vatehuli. Further some of the members attended trainings like cashew processing and value addition (10.34 %), tailoring (10.77 %) and beedi making (5.17 %). All these trainings are organized by forest department to provide additional income security to women JFMC members through SHGs. These activities helped women to be economically empowered.

To overcome unemployment problems among the younger group of JFMC members, the forest department organized some non-forest based trainings like computer training which were availed 6.46 per cent and automobile repair 2.15 per cent. Yakshagana trainings attended by 5.17 per cent of JFMC members. These trainings are arranged to encourage and promote traditional cultural activities among the younger generations. A few youths attended skill training on snake trapping (2.58 %) because forest department organize occasional self-defense training for protection from wild life attack.

5.1.15 Source of energy for cooking:

Cent per cent of the respondents were using electricity and LPG as a source of energy followed by firewood (80.00 %) and solar lights (75.00 %). These results are because the activities taken up in VFC under the Village Development Fund (VDF) emphasize on reducing the pressure on forest resources and to provide the basic needs to the people to lead a healthy life. The different activities taken up under VDF are: providing domestic LPG connection under the Pradhan Mantri Ujjwal Yojana (PMUY). Conventional fuel wood saving devices like ASTRA chula (smokeless Chula) are provided for efficient use of fuel wood. Solar driers, water heaters, house lighting system, CFL bulbs and bio-gas units are provided to reduce power consumption. Two schemes namely Special Component Plan (SCP) and Tribal Sub Plan (TSP) aim at reducing pressure on forest and at uplifting scheduled caste and scheduled tribe families through provision of basic household energy needs.

5.2 Knowledge about sustainable forest management and forest conservation practices

Knowledge is the understanding of a subject which may be acquired through experience, association or education and in this instance it is understanding of sustainable forest management (SFM) and conservation of forest resources.

The concept of SFM has been specifically designed by the forest department to ensure more sustainable use of forest resources by incorporating different interests related to forests in decision making and management. Sustainable forest management is the use of forest resources in such a manner that it does not compromise the ability of the future generation to use the resources. The SFM addresses issues of forest degradation and deforestation. When forests and trees are sustainably managed they make vital contributions to the people as well as the planet. It improves livelihood, provide clean air & water and conserves biodiversity.

It was thought that effective conservation and sustainable management was possible only by involving the local communities because forests are home to the forest dwellers and they will go all out to conserve and protect them. In order to involve village communities living in the vicinity of forests, the Karnataka Forest Department (KFD) has evolved a comprehensive forest management process called the Joint Forest Planning and Management (JFPM). This programme focuses on providing the basic needs of communities, while at the same time regenerating and maintaining the natural forests. The JFMC concept is developing

partnership between JFMC members and the forest department based on common trust and jointly defined roles and responsibilities with regards to forest protection and development.

The duties and responsibilities of the JFMC members is to 1) Assist the forest department to plan, protect, conserve and develop water lands. 2) Help identify land, choose the species and mode of protection & management. The JFMC members are themselves responsible for protecting the forests and plantations raised under the JFPM area. 3) Attend general body meetings conducted by forest department once every three months to discuss management strategies. 4) Attend the training programmes organized by the forest department to update knowledge and develop skills about forest management.

In the present study it could be observed that, cent per cent of the JFMC members had knowledge about environmental awareness programmes, plantation management, fire management, bio diversity conservation, soil and moisture conservation and deforestation & land degradation. This is because it is enshrined in the programme that all JFMC members will actively participate in the JFMC programmes implemented by the forest department. Each of areas are where JFMC members have cent per cent knowledge discussed in detail as below:

A number of programmes on environment awareness are implemented by the forest department through the VFCs by involving JFMC members. Some are state funded while others are central government funded schemes. They are Karnataka Sustainable Forest Management and Biodiversity Conservation (KSFMBC), National Afforestation Programme (NAP), Krishi Aranya Protsaha Yojane (KAPY), Samrudha Hasiru Grama Yojane (SHGY) and Maguvigondu Mara, Shalegondu Vana, Talukigondu HasiruShala Vana. All these programmes are implemented by forest department with the involvement of JFMC members who are persuaded to attend and participate in the programme. Hence they were having good knowledge about environmental programmes. Similarly the Vanamotsava is an important awareness creation programme. It is celebrated every year in the month of July (1^{st} to 7^{th}) with the collaboration of forest departments, VFC members, gram panchayat and schools. It is considered a great festival for people living in forest areas. It implies forest conservation and planting as many as trees possible. It is a people's programme of tree planting, where everyone can participate in. For this auspicious occasion seedlings are distributed free of cost.

Knowledge of plantation management was possessed by all the respondents. The JFMC members are involved in nursery raising activities like preparation of soil, filling of potting mixture & seed sowing and caring for the seedlings till they are ready for transplanting. The JFMC members raise commercial as well as miscellaneous plantations. They are engaged in protecting the plants raised by them from grazing, illegal harvesting, smuggling and other offences. They also put all efforts to see that the plantations survive well and hence good knowledge.

Regarding forest fire management all JFMC members are provided knowledge by the forest department in prevention of and control of forest fires. The JFMC members also have knowledge about forest fire protection measures like regular clearing of fallen tree branches, vegetation and flammable materials, clearing fire lines, fire tracing and informing control room etc. All these are made known to JFMC members by the forest department officials by way of lectures, discussions and trainings organized by the forest department. In case of fire incidents, the VFC members inform forest department and take primary measures to control the same.

Conservation of biodiversity is known to all the JFMC members. This is because of the JFMC members. This is because of the native and indigenous knowledge of the JFMC members. Biodiversity is also maintained because the JFMC members themselves take decisions on management like: grazing regulations on community lands, lake maintenance and riverside vegetation. They control illicit felling of trees in the plantation area and natural forests. A number of eco-development committees (EDCs) are established around wildlife area and eco- tourism spots for conservation of forest, water bodies and wildlife. In all of which the JFMC members actively participate.

Soil and moisture conservation is another important aspect where JFMC members had good knowledge because they were involved in SMC works and explained with scientific reasons. The SMC techniques like the importance of planting of trees in restoring soil fertility, improving soils by maintaining organic matter, fixing nitrogen, recycling of nutrients and increasing soil moisture. This knowledge is also inherent among the forest dwellers who are aware that forests also control soil erosion and maintain biodiversity.

The forest officials take help of the JFMC members in identifying degraded forest land and raising plantations in such areas. Since they are actively involved in protecting and

regenerating degraded forests through many afforestation programmes taken up by the forest department, they are highly knowledgeable deforestation and land degradation.

Regarding conservation of NTFPs and scientific harvesting only 38.00 per cent of the JFMC members had knowledge. Forest resources have always been important for subsistence as well as livelihood for forest dwellers and rural communities. The NTFPs are an integral part of development and survival of people living in and around forests. Collection and either consumption / value addition / sale of NTFPs is important for addressing issues of poverty by contributing to livelihoods, food security, income, health and sustainable human development.

The reasons for less people having knowledge is that collection of NTFP has been an age old practice for the people. When population pressure was not much, the forest dwellers collected NTFPs enough for their consumption and a little for sale. However overtime the NTFPs are being over harvested and the younger generations are not aware of the scientific methods of harvesting. The other reason is that among the sampled respondents all of them were not NTFP collectors.

Sustainable harvesting of NTFPs is important so as to provide a constant supply of plant resources throughout the year. Sometimes the yield of the NTFPs may also be increased by improved harvesting methods. Some sustainable and scientific NTFP harvesting techniques are; determining the right time for harvesting, selecting healthy and well developed NTFPs, gathering only those NTFPs which are abundant in the area, avoiding unnecessary damage to the plant and controlled harvesting i.e., biannual harvesting, selective harvesting (75:25) and fixed harvesting.

Here again the many younger generation NTFP collectors not aware of this knowledge or they have no knowledge because they do not collect NTFPs.

With regard to overall knowledge level of JFMC members (Table 8.1) it could be seen that, a large majority (86.20 %) of the JFMC members had high level of knowledge because they are basically forest dwellers and have traditional knowledge about forest management activities.

Knowledge of JFMC members about sustainable forest management activities was found positive and highly significant relationship with contact with extension agency, mass media participation and organizational participation. The VFC members who have frequent

extension contacts with the forest department personnel would lead to an increase in the level of knowledge of the JFMC members. Through mass media also JFMC members gained knowledge about natural resource management. Organizational participation provides opportunity to social networking and sense of belongingness. Participation of respondents in different forest management activities through VFCs results in more exposure of the JFMC members to different dimension of the management aspects leads to increase in the knowledge level of VFC members. Family size and extension participation also had positive and significant relationship with knowledge of JFMC members about sustainable forest management activities.

The knowledge of (Non-JFMC members) was also studied (Table 8) and it was seen that majority (84.05 %) of them had knowledge about environmental awareness programmes. These are common programmes conducted by the forest department which are attended by all community members. Some of them are also having knowledge about plantation management (35.34 %) and biodiversity conservation (34.91 %). Non-members are basically forest dwellers and so some have basic knowledge about plantation and biodiversity conservation activities which they have picked from traditional knowledge or heard and seen senior family members managing plantation and conserving bio diversity.

With regard to overall knowledge level of non-JFMC members (Table 9.1) about forest management activities. It could be seen that, majority (77.58 %) of them had low level of knowledge. This is because they are non-members and not involved in any of the forest management related activities conducted by the forest department.

In case of non JFMC members education had a positive and significant relationship with knowledge of non JFMC members about forest management activities. This is because education broadens the knowledge of the individuals about natural resources management. No other variables influenced the knowledge of non-JFMC members.

5.2.1 Knowledge of JFMC members about forest conservation practices.

With respect to forest conservation practices (Table 9) cent per cent of the JFMC members had knowledge about forest land preparation and planting of seedlings, necessity of planting indigenous species rather than exotic species, application of FYM at the time of planting and watering the plants as per requirements. This is because the JFMC members are actively involved by the forest department officials in selection and preparation of site, layout

for planting, digging the pits and planting the seedlings. Since they are themselves performing these activities cent per cent JFMC members have knowledge about land preparation and planting of seedlings. The JFMC members along with forest officials select local species for planting over the exotic species because local species are well suited to the climatic conditions and so better chance of survival and good yields are obtained. The JFMC members being forest dwellers also know about the knowledge of survivability of tree species for a locality. Cent per cent of the JFMC members had knowledge about application of FYM and protective irrigation. This is because JFMC members take up plantation under the supervision and guidance of the forest department officials and take care of the plants up to three years by fertilizer application and water management.

Further it was observed that, 27.58 per cent of JFMC members had knowledge about growing wind breaks in rows for afforestation and few members (7.32 %) had knowledge about soil testing before initiating forestry work. Wind breaks are trees or shrubs that are planted in such a manner as to provide shelter from the wind and to protect soil from erosion. They are commonly planted in rows around the edges of the forest. These wind breaks have other benefits like supplying wildlife with food and shelter, providing wood if the trees are harvested and beautifying the surrounding areas. The wind breaks trees like bamboo, oak and casuarina were commonly planted by the forest department either with or without the JFMC member's hence only 27.58 per cent members are knowledgeable about these aspects.

Soil testing is carried out before initiating forestry work. Analysis of soil and plant material is carried out in forest planting to assess the ability of soil to provide adequate nutrients and to know their suitability for different tree species. In forests soil, analyzed for organic matter, soil pH, nitrate and ammonia content. Ground water recharge level is checked in eucalyptus and acacia plantation after harvesting and before starting other plantation activity. Many JFMC members are not having knowledge about these aspects because these are done by forest department at the laboratory level.

The JFMC members did not have knowledge about establishment of nursery for seedling production and seed identification & collection of seeds from forest. These works directly taken up by the forest department with or without involvement of JFMC members and later raised by JFMC members and so a lesser per cent had knowledge about this aspect.

With regard to overall knowledge of JFMC members about forest conservation practices. Majority (66.38 %) of the JFMC members had medium level of knowledge. Since they are themselves performing the many of the forest conservation activities they have medium level of knowledge.

Knowledge of JFMC members about forest conservation activities was found to positive and highly significant relationship with contact with extension agency. Extension participation, mass media participation and organizational participation had positive and significant relationship with forest conservation activities. No other variables influenced knowledge about conservation activities.

5.3 Gender participation of JFMC members in forest management activities.

The approaches to gender issues in relation to the environment are ever changing and diverse. The word gender refers to the economic, cultural and political attributes associated with being a man or a woman. It is important to note that these attributes vary between and within geographical area and can change over time. Moreover gender roles are the socially defined tasks and behaviors that are considered suitable for women and men in a particular community. In order to understand the contribution of men and women in forest management institutions and more specifically in joint forest management the gender perspective needs to be included. It is important to include gender because that makes the assumption that men and women are equal, their roles are the same, there is no division of labour and there is no difference in their activities because they are male or female. Incorporating gender perspective is especially relevant in the management of resources, access and use of resources as they are linked to gender roles.

The Center for International Forestry Researchers (CIFOR) reported that income from forest activities accounts for one fifth of total household income for rural household living in or near forest; men contribute more than women because their activities like timber harvesting, honey collection and marketing of NTFP generate an income. Whereas women are more involved in subsistence activities like collection of food and fodder for family consumption. Through both men's and women's forestry activities contribute to households, there are considerable gender differentiations in their activities. Forestry has regularly been considered a sector dominated by men, making it difficult for women to participate in forest

management and decision making. Women are often excluded from decision making processes because of social and cultural barriers, rules & regulations of the governing body and male bias in the attitudes of those promoting community forest initiatives.

Involving local communities in management practices is an effort to create more inclusive and equitable management within the natural resources. It is mandatory that in JFMC committees women representation should be to the extent of three members out of 11 executive members and all adult women in the village are members of JFMC committees. This increase participation of men and women on an equal footing and guarantees that the process is fair. The principle of promoting the balanced involvement of both male and female groups in the forest management activities lies on the premise that since women are equally responsible for most of the forestry activities, improving their role and benefiting could lead to a more sustainable management of forest resources.

In the present study it was observed that all JFMC women were involved in nursery activities like pre sowing activities of preparation & filling of potting mixture and seed sowing. The participation of women JFMC members in nursery activities is on wage payment by the forest department.

In “land preparation” majority of the activities were carried out by men alone, because activities like site preparation, layout for planting and digging the pits are labour intensive and require more physical strength. Whereas planting the seedlings was carried out by both.

In “post planting activities”, activities like fencing, handling pests & disease management, fire protection, lopping, scrapping and control of illegal harvesting were considered masculine. Hence men were involved in these activities. In some of the activities like cleaning the surrounding area of plants, watering the plants, pruning, thinning, application of manure and hoeing are carried out jointly by men and women.

All though there is equal representation of men and women as per JFMC norms, it could be seen that same activities are considered men’s jobs and same as women’s. These are based on the difference of the physique of men and women. These roles are also influenced by tradition or culture which has been followed for many years as per the societal norms.

5.4 Sustainable collection, processing, utilization and income from NTFPs

Forests of Uttara Kannada are extremely rich and diverse producing a variety of leaves, fruits, flowers and medicinal plants, that are used locally or traded. Known as Minor Forest Produce (MFP) or Non timber forest products (NTFPs) this group of forest produce play an important role in the economy of the villages in and around the forests. Since ages people living in forest areas have been collecting or harvesting NTFPs for subsistence and as a sources of income for their livelihood. However over the years the NTFP base is reducing because of over exploitation and sometimes unscientific harvesting. For regeneration, protection and management of these resources, the forest department has proposed the NTFP working only JFMC members are permitted to harvest NTFPs and the rules laid down for these NTFP working circles need to be followed. According to these rules only those resources that are abundantly available and possess market demand can be harvested. Scientific methods of harvesting like: what to harvest, how much to harvest, when & what stage to harvest need to be followed to avoid over exploitation. Tenders are invited by forest department for marketing of major produce like timber and some fruits while minor produce like small fruits, wild mushroom, wild mango etc., are sold by the NTFP collectors. The important NTFPs of the Uttara Kannada division include Kokam (*Garcinia indica*), Jamun (*Syzygium cumini*), Mace (*Myristica malbarcia*), Cloves (*Syzygium aromaticum*), Cinnamomum (*Cinnamomum zeylanicum*), Uppage (*Garcinia gummigutta*), Vatehuli (*Artocarpus lacucha*), Indian gooseberry (*Phyllanthus emblica*), Wild Mango (*Mangfera indica L.*) , Soapnut (*Sapindus mukorosi*), Shigekai (*Acacia concinna*), Honey and Wild Mushroom. Each of these NTFP are discussed here under in detail.

I. Fruits :

5.4.1: Kokam (Murugalu)

1. **Local name:** Murugalu
2. **Common name:** Kokam
3. **Scientific name:** *Garcinia indica*
4. **Family:** Clusiaceae

Garcinia indica or Kokum a native of the Western Ghats in India, is found in evergreen and semi-evergreen forests. It grows in the western parts of Maharashtra,

Karnataka, Kerala and Goa. Kokum is collected from the wild, grown in home gardens and also cultivated to a limited scale as a rain fed crop, usually mixed with other fruit trees. The tree flowers during winter time and the fruits are ready for harvesting during the summer month of April to June. All Kokum fruits on a tree are not ready for harvesting at the time and hence periodical plucking is done and only the fully ripped fruits are picked by hand. The number of pickings varies between tree to tree. Generally 6 – 8 picking are required in high yielding plants to produce about 30 – 50 kg fruits per plant.

The pulp and rind of the Kokum which are bright red in color have a sweetish acid taste. This fruit is dried and used as a souring agent in traditional dishes like tambuli and for the preparation of syrup and juice. It is also substituted for tamarind juice and is considered a healthier option. The rind is known to possess medicinal value and is used for the treatment of piles, dysentry, tumors and heart diseases.

The shelf life of Kokum fruits is 4 -5 days under ambient temperature. The traditional method of processing is by sun drying. The outer skin is sun dried for 3-5 days. The juice is prepared form the outer rind of the ripe fruits. The fresh fruits are manually cut into halves and the flesh portion is used for making juice. The seed at the center is used for making Kokum butter. From the juice are prepared: Kokum syrup, salted Kokum syrup and Kokum squash. Kokum sherbet is considered a cooling drink in hot summers. The dried rind is traditionally used as a staple souring agent while cooking as an alternative to tamarind. Kokum butter extracted from seeds is a solid, stable hard butter, which is used in the preparation of chocolate. The oil also extracted from the seed is used in the preparation of cosmetics like bar soap bars and skin lotions.

The JFMC members collect and sell Kokam through at a marketing & co-operative society named Kadamba. The fruits are either sold in fresh form, dried or processed and sold by the NTFP collectors. The fruit fetches a price of 60-70 /- per kg. When kokum is available in large quantities the forest department calls for tender to sell to the highest bider. The collection of Kokam as an NTFP is more in Sirsi, Siddapur, Yellapur and Kathgal forest range.

5.4.2: Jamun:

1. Local name: Nerale

2. Common name: Jamun

3. Scientific name: *Syzygium cumini*

4. Family: Myrtceae

It is a juicy edible berry which in India is referred to as a the fruit of god. It is believed that Lord Rama used to eat this fruit when he spent his time in the forest for 14 years. This tree starts flowering from March-April and the fruits are ready for harvest by May - June.

The berries dues to their acidic nature are usually consumed with a sprinkling of salt. Jamun is considered as the most effective traditional medicine, the fruit, the bark, the seeds, the leaves are commonly used for treatments of various disorders of the body. In recent times Jamun have become very popular and in demand as a home remedy in treating diabetes to reduce increased blood sugar levels. Consumption of quarter teaspoon of the powdered seeds with one tea spoon of honey for fifty days brings about a significant change in sugar levels. The bark of the tree is used for making glasses. Water stored overnight in these glasses is supposed to control diabetes. For diarrhea the dried powder of Jamun seeds, mixed with mango seed powder and honey is consumed in small amounts twice daily.

These jamun fruits are purchased by the local village merchants from the collectors at the rate of 40 /- per kg and sold in the nearby urban market @ 120/ Kg. The jamun fruit is mainly collected in Yellapur and Siddapur range.

II. Spices:

5.4.3: Mace:

1. Local name: Rampatre

2. Common name: Mace

3. Scientific name: *Myristica malbarica*

4. Family: Myristicaceae

The species is distributed in the Western Ghats, occasionally along freshwater streams and most frequently in evergreen and semi-evergreen forests. The trees bear arillated fruits

which are harvested and used as a condiment. The tree is harvested from the wild for its seeds, for extraction of oil. Although inferior to the true nutmeg (*Myristica fragrans*) and mace, it is sometimes used to adulterate the genunite nutmeg and its products. Since M. malabarica is a close relative to *Myristica fragrans* (true nutmeg) the arils surrounding the fruits are harvested and used as a spice. The bark and leaves are used in traditional medicines to treat stomach ulcers, and cough and muscular pain. The red sap (kino), present in the bark of most species in this genus, can be used as a dye that gives a permanent brown stain. The plant has been used as a rootstock for grafting the true nutmeg, *Myristica fragrans*.

Mace is collected and sold at APMC market tenders by involving the forest department. The price of one kg of mace is 300-400 /-. It is mainly collected in Kathgal and Honnavar forest range.

5.4.4: Cloves:

1. **Local name:** Lavang
2. **Common name:** Cloves
3. **Scientific name:** *Syzygium aromaticum*
4. **Family:** Myrtaceae

Cloves are the dried, unopened aromatic flower buds of the evergreen clove tree. The flowering season is September to October in plains and December to January at high altitudes. The unopened clove buds are harvested when they start to turn into pink color. At this time, they are less than 2 cm long. Harvesting at the right stage is important because once the flowers open they are not valued. Harvesting of cloves is a delicate process and since tree is not climbable it should be done using ladder without damaging the branches. Flower buds are dried over several days in the sun. These dried flower buds are the cloves seen in the market. The spice either whole or ground is used for culinary purposes in preparing various masalas for its spicy aromatic flavor. Cloves possess medicinal properties for digestive complaints like indigestion, flatulence, nausea, vomiting, and diarrhea and also used to treat cough, infertility, warts, worms, wounds and toothache.

These are collected by VFC members of Kathgal forest range and sold at APMC market through tenders for 700/- kg.

5.4.5: Cinnamom:

1. Local name: Dalchinni

2. Common name: Cinnamomum

3. Scientific name: *Cinnamomum zeylanicum*

4. Family: Lauraceae

Cinnamom is a commonly used aromatic spice with medicinal properties. The spice is the inner bark of the tree which has a fragrant smell. The bark of the tree is collected during April-July and October-December. In India, cinnamom trees are found in the wild and also cultivated on the betta lands of the Western Ghats. This medicinal spice can be used in the treatment and prevention of many common ailments such as acne, pimples, cough, and digestive troubles. In recent times cinnamom has become popular for reducing weight and so has gained demand both the national and international markets.

Cinnamon are purchased by the local village merchants from the collectors at the rate of 100-150 /- per kg and what is further sold to whole sale/retail markets at a much higher rate of 400-500/- kg. Cinnamon is mainly collected in Yellapur and Siddapur range.

III. Souring agents:

5.4.6: Uppage

1. Local name: Uppage

2. Common name: Uppage, Gamboge

3. Scientific name: *Garcinia gummi-gutta*

4. Family: Guttiferae

Uppage is a rainforest tree, restricted to the moist forests of the Western Ghats. Uppage is an important food source for the common lion tailed macaque (LTM), langur *(Presbytus entellus),* Bonnet macaque *(Macaca radiata),* common palm civet *(Paradoxorus herma-phroditus)* and the endangered brown palm civet (P. *jerdonii).* All these animals feed on the pulp of the fruit. The seeds of uppage are consumed by two species of arboreal squirrels *(Ratufa indica* and *Funambulus palmaram).*These animals play an important role in the ecology of uppage by dispersing seeds away from parent trees, thereby increasing the

probability of survival of seeds and seedlings. Animals discard uppage rind to the ground after eating the pulp. In the wild the dried discarded rind is collected and of fresh, they are dried and stored. Since mostly the discarded rinds are collected there is no adverse impact on the ecology of uppage.

The fruits are also harvested by villagers, from reserve forests and from soppina betta. Trees set flowers from February to April and fruiting starts from July to September during the rainy season. Mature fruits are brought to the homes of the collectors where they are de-seeded and the rind is dried in a wood-fired oven, which usually comprises a metal mesh suspended over burning logs. The rind has to be dried within a day of harvest as it tends to spoil quickly in the humid climate.

The rind of the uppage fruit has been traditionally used in the coastal region of Karnataka as a culinary additive in fish curry and sambar and also used as fish preservative.

Most of the time forest department sells uppage through tender calling. The bidders purchase it from the VFC members at 70-80/- kg. Uppage is mainly collected in Honnavar, Sirsi, Siddapur and Janmane forest range.

5.4.7: Monkey Jackfruit:

1. Local name: Vatehuli

2. Common name: Monkey Jackfruit

3. Scientific name: *Artocarpus lacucha*

4. Family: Moraceae

The monkey jack fruit is a tropical evergreen tree species of the Western Ghats of Karnataka. It is commonly known as Vatehuli, the word huli means sour in kannada indicating it is a sour fruit. The plant is valued mainly for its edible fruit, which is often gathered from the wild. Fruits are available during April-June. The pulp is sour which is occasionally eaten raw and used in fish curries, chutneys and samber. The raw fruits are deseeded, dried in the sun and powered.

The vatehuli is sold in local market by to the village merchants. The prize for one kg of vatehuli Rs. 8-10 /- per kg. The prices of the fruits may vary depending on the availability and in the places in which they are sold based on demand. Alternatively the powder is also

sold at prices ranging between Rs. 85-100/- per kg. It is mainly collected in Bhatkal, Kumta, Sirsi and Yellapur. The results are in line with the findings of Sarala & Krishnamurthy (2014).

IV. Fruits for pickling:

5.4.8: Indian gooseberry:

1. **Local name:** Nellikai
2. **Common name:** Indian gooseberry
3. **Scientific name:** *Phyllanthus emblica*
4. **Family:** Phyllanthaceae

Indian gooseberry was considered as a miraculous food in the ancient Ayurveda. The abundance of vitamin C and other nutrients make it a super food and is still used in various forms for its well-known health benefits. Amla is a very sour fruit and there are many ways in which, this fruit is consumed. Chutneys, pickles, jams, marabbas, mouth fresheners and juices are prepared from amla. The sour fruit is eaten by itself with a sprinkling of salt and used in various Ayurvedic medicine herbal preparations. It is one of the important ingredient in the ayurvedic tonic "Trifala".

These fruits are purchased by the local village merchants from the collectors at the rate of 10-20 /- per kg and sold in the local market or sent to markets to nearby cities where they are sold at 60-80 /- per kg. Further processors also buy this fruit in bulk. These are mainly collected in Sirsi, Siddapur and Yellapur range.

5.4.9: Appemidi (fragrant pickle mango) and other mango varieties.

1. **Local name:** Appemidi
2. **Common name:** Wild Mango
3. **Scientific name:** *Mangifera indica*
4. **Family:** Anacardiaceae

Aromatic pickle-mango types found in the wild habitats of Western Ghats have received the Geographical Indicatior (GI) tag for being endemic to the Western Ghats. These effervescent fruit types are locally termed as 'Appemidi' and extensively collected from the wild habitats even today. It is specifically known for its typical aroma of the sap. Unlike

commercial mango, 'Appemidi' fruits are extremely sour and hence are not used as edible flesh fruits. Traditionally these tender fruits are used in household preparations such as gojju, sasve, thambuli and chutney. For a common man of this region, no meal is complete without the extraordinary effervescent taste of these 'Appemidi' pickles.

Other mango varieties found in the Western ghat region are highly valued for the tasty fruits. A wide array of products ranging from pickles, jam, jelly, leather, squash, wine, etc. are prepared using this fruit. Different stages of fruit development are used to prepare different products. One such unique preparation is pickling of highly aromatic mango types (Appemidi) in their tender and unripe stage. Currently these fruits are sought for their high quality pickle with a long shelf life of 3-4 years. Jams, jelly and leather are prepared from ripe fruits while some other products are prepared from semi ripe fruits.

Wild mangoes harvested during February to May at the tender stage and sold in local markets. They are in high demand and fetch 250-300 /- for 100 small mangoes which are not more than 2 inch long. The prices of the Appemidi is increasing over the years because of non-availability probably because of over harvesting and unscientific harvesting. It is also difficult to identify the trees and harvest the fruits, the trees of which grow along the streams. These are mainly collected in Sirsi and Siddapur.

5.4.10: Bamboo shoots (Kalale):

1. **Local name:** Kalale
2. **Common name:** Tender Bamboo Shoots
3. **Scientific name:** *Bambusa vulgaris* and *Phyllostachys edulis*
4. **Family:** Poaceae

Young bamboo shoots on the new bamboo culms that come out of the ground are edible. The bamboo shoots are cooked as a special dish during the monsoons (due to seasonal availability) in Malnad region. The shoots are normally sliced and soaked in water for two to three days, after which the water is drained and replenished each day. This is done to extricate and remove toxins. They are cooked as a vegetable or pickled Pickles are also made with these bamboo shoots.

The shots are collected only for house hold consumption by the VFC member in Sirsi, Siddapur and Yellapur.

V. Edible:

5.4.11: Honey:

1. **Local name:** Jenu
2. **Common name:** Honey
3. **Scientific name:** *Apis florea, Apis cerana indica*
4. **Family:** Apidae

Collection of honey has been a traditional occupation of the tribals and forest dwellers. There are many tribal families who engage in honey hunting for a livelihood. Honey harvesting is mainly from the nests of rock bee's. The rock bee (*Apis dorsata*) colonies are generally found on rock cliffs or on large trees.

The Siddhi tribes of Uttara Kannada district are known to specialize in honey collection. Harvesting of honey is during November - April. The Rock bees collect nectar from the flowers of forest tree species of Matthi (*Terminalia elliptica*) and Nandi (*Lagerstroemia lanceolata).*The honey from these trees is highly sought for its medicinal importance. During harvesting season for November – April Siddhis harvest about 100 comb's over a period of six months. Harvesting is done at dusk from 7pm to 2am.Since honey collecting is a group activity the method of honey hunting varies depending on the nature of support and skill from other members in the group. It also depends upon the number of colonies to be harvested whether an aggregation or single combs. There are many traditional methods that are followed in different regions for honey harvesting. Honey hunting involves climbing steep cliffs or ascending tall “bee trees” by hand-made ladders in the darkness of the night. The bees are driven away by the smoke produced by lighting fires. Fires are left at the tip of the long poles and held close to the hives. When the bees fly away due to the smoke the combs are cut from the rocks/ tree branches and honey extracted from the combs. This technique is a very strenuous, laborious, risky and demanding. It also requires skills which in recent times many people do not possess. Hence honey collection is not so popular among the forest dwellers. The forest department therefore calls for tenders for honey collection. Major companies like Dabur participate in the bidding to collect honey with specialized equipment.

The honey is mainly collected in Haliyal, Yellapur and Janmane forest range. The price of the honey varies from 200 -500 /- kg. The price varies depending on the type of flora

from which the bees have collected honey or the variety of bees that collect honey. Each bee species has specific place where they construct there combs are in rocks, tress, crevice etc.

5.4.12: Wild Mushroom:

1. **Local name:** Anabe
2. **Common name:** Wild Mushroom
3. **Scientific name:** *Morchella esculenta*
4. **Family:** Morchellaceae

The Western Ghats region of Uttara Kannada constitutes a major hotspot of diversity of wild mushrooms. Edible mushrooms are an alternative source of food against plant or animal derived food sources. Wild mushroom are usually collected in close proximity to the inhabited areas in forest and collection of mushrooms is known to the forest dwellers from their ancestors. Over the years and with trial and error they know which mushrooms are edible and which are not. Some mushrooms that grow on ant hill sand appear with the first rains are considered a delicacy. They are harvested for consumption or immediate sale. There are a variety of mushrooms and each type is considered to have a particular taste and flavor. Although availability of mushrooms is seasonal their consumption is a major component in the food culture of forest dwellers. A major population consumes mushrooms because of their easy availability, meaty taste, flavor and medicinal value. The people of Western Ghats region collect mushrooms, for their own consumption as well as to earn additional income.

Especially tribes of Sirsi, Siddapur, Yellapur and Kumta collect wild mushroom and sell in the local market. The price for mushroom varies based on availability and cost may be between 180-500/- Kg depending on the type of mushroom. Some are rare and difficult to harvest, so they are costly. The mushrooms need to be sold as soon as possible because of their short life span.

VI. Herbal products:

5.4.13: Soapnut:

1. **Local name:** Antavala
2. **Common name:** Soapnut
3. **Scientific name:** *Sapindus mukorossi*
4. **Family:** Sapindaceae

The soap nut is a berry with a small seed at the center. The hard shell when dry resembles a nut, hence the name. The berry shells contain saponin which is a natural surfactant that is released when the shell absorbs water. Considered a natural detergent, soap nuts have become a popular environmentally friendly alternative to chemical detergent. Soap nuts can be used as substitute for soaps and detergent for washing the cars or clothing. They can also be used as a base for shampoos and hand lotions or as an all-purpose cleaner around the home. Soapnut shells are also used to clean jewelers to remove tarnish.

These are collected in Sirsi, Siddapur, Yellapur forest range and sold in the local markets for as less as 20-30 per Kg. Local merchants sell them to other merchants for use in the pharmaceutical industries or for sale in the city markets where they are sold Rs 80-100/- kg.

5.4.14: Shikakai:

1. **Local name:** Shikakai
2. **Common name:** Shikakai
3. **Scientific name:** *Accacia concinna*
4. **Family:** Fabaceae

Shikakai is gathered from the forests as an important NTFP. Shikakai has been used traditionally for hair care as a natural shampoo for a long time. In order to prepare it the fruit pods, leaves and bark of the plant are dried in the sun and ground into a powder. This powder can be mixed with water and can be applied directly on hair. However this does not produce enough lather as a typical shampoo, so soap nut mentioned above gives the lathering property,

so soap nut is powdered and mixed with Shikakai. This mixture is very popular among herbal product manufactures.

These are collected in Sirsi, Siddapur, Yellapur forest range and sell in the local markets or mandies. The collectors get a very nominal price of 30-40 per Kg. The hair care product companies buy them at much higher rates from the local merchants, who in turn have purchased from NTFP collectors.

VII. Seed Collection:

5.4.15: Pongamia pinnata (Honge):

1. **Local name:** Honge
2. **Common name:** Pongamia
3. **Scientific name:** *Millettia pinnata*
4. **Family:** Fabaceae

Since ages oil extracted from the seeds has been used for lighting lamps in rural areas. In recent years bio diesel is being produced from these seeds so Pongamia seeds are a potential for oil and biodiesel production. Seeds are known to have medicinal properties and so are in demands in the ayurvedic/pharmaceutical industry.

The dried seeds that fall off the plant or collected after beating the plant are collected by JFMC members in Yellapur forest area and sold at about Rs. 100/kg in the local market.

5.4.16: Teak:

1. **Local name:** Sagawani
2. **Common name:** Teak
3. **Scientific name:** *Tectona grandis*
4. **Family:** Lamiaceae

The seeds of teak that fall off the tree on maturity and drying are collected from the JFMC member in Haliyal forest range. The collected seeds are purchased by the forest department for seedlings preparation at the rate of Rs 100-120 for 5 kg of seeds.

The results are in accordance with the findings of Sadashivappa *et al.* (2006), Toksoy *et al.* (2010), Tripti *et al.* (2015), Rawat and Chandra (2015), Paloti and Hiremath (2015), Puneeth *et al.* (2016), Rajeshwari *et al.* (2017) and Hanumantha *et al.* (2019).

5.5. To investigate and document the bio-cultural beliefs about forest and forest tress: Documentation of religious and holly trees

Many forest communities including those in the present study practice totemism. A totem is a spirit,a sacred object or symbol that serves as an emblem of a group of people. Totemism is a belief about the relationship between people and nature. According to this belief humans are said to have kinship or a mystical relationship with a sprit being an animal or plant.

Hinduism worships divinity just not in the forms of humans but also in the form of nature. Mountains, rivers, animals, plants, rocks, planets and even stars are considered divine. Trees being nature's major processors of solar energy is vital for our existence. Trees also provide humans with flowers, fruit, wood or medicine for their subsistence and so have been worshiped by the Hindus as a matter of gratitude. Hindu mythology is replete with stories of trees and their worship. Some important trees of significance in hindu mythology and more specifically to the forest dwelling communities are discussed here under

5.5.1 Peepal tree or Pipalor Scared Fig:

1. Local name: Aralimara

2. Common name: Scared tree, Peepal tree, Bodhi tree

3. Sanskrit name: Ashwattha

4. Scientific name: *Ficus Religiosa*

5. Family: Moraceae

6. Native: India

Peepal tree or Pipal (*Ficus Religiosa*) since ages has been considered to be one of the most sacred trees in Hindu culture. Known as "Ashvatta" it is purportedly the most worshipped tree in India. The plant is associated with spiritual understanding as it said that the gods hold their councils under this tree. The peepal is also sacred to Buddhists, because Buddha attained enlightenment under this tree. It is therefore called the Bodhi tree or **'**tree of enlightenment**'** and is so worship by Jains and Budhists.

Women circumambulate the peepal tree on the full moon day to be blessed with children, by tying a red thread or cloth around its trunk or on the branches. The tree is worshipped on Saturday, especially in the month of Shravana, because goddess Lakshmi is supposed to be sitting under the tree on this day. People also pray to the tree by tying a red thread around the trunk while wishing that a particular problem be solved by the deities that live in the Pipal tree.

Peepal tree is planted in the temples of Shani and Hanuman generally grown to scare Shani away. It is the tree that sheltered Sita and upon it sat Lord Hanuman observing the miseries that Sitawas going through. Hence this tree has a special place in the heart of Lord Hanuman and the worshippers of Hanuman/ Anjaneya.

According to Hindu mythology a peepal tree is planted to the east of the house or temple and after 12 years of planting, a ceremony is performed for the tree to signify that the tree is matured. A round platform is then constructed around the tree and different gods like Vasudev, Rrukmini, Narayan, Satyabhama are invoked and worshipped.

According to Ayurvedic science Peepal tree aids conception because the Peepal tree exhales maximum ozone during sunshine. The absorption of ozone helps female fertility. The scientific reason is that walking around the tree makes the lungs to work more and take in large quantities of ozone. The ozone larder fresh air strengthens the uterus and fallopian tubes to receive sperm. It is said that on a new moon day when the gravitational forces are strong more ozone is absorbed than on other day.

5.5.2 Indian fig

1. Local name: Attimara

2. Common name: Cluster fig tree, Indian fig tree

3. Sanskrit name: Udumbara

4. Scientific name: *Ficus racemosa*

5. Family: Moraceae

6. Native: India

This scared tree according to Hindu mythology was created by the force of Indra and who is considered the leader of the gods. The tree is given prominence as a means for acquiring prosperity and defeating evil forms. The tender leaves are used in rituals by hindus to sprinkle scared water. While the bark and the leaves are used as a source of fuel in homa/havanas. Another important reason for protect the tree could be that the fruits of the tree are a favorite staple of the common Indian macaque. The forest of the Western ghats are inhabited with a large number of macaque. Since forest people believe in the principle of “Live and let live”, they will not harm any animal and are particular about maintaining the biodiversity of the forest plant and animal life.

People in the forest area use the bark of the tree for healing purpose. The bark is rubbed on a stone to make paste and this paste is applied on the skin afflicted with boils and mosquito bites. It is a very good local remedy when people go into the forest and get bitten by insects.

5.5.3 Banyan tree

1. **Local name:** Aaladamara
2. **Common name:** Banyan tree, Indian banyan, Banyan fig
3. **Sanskrit name:** Vat
4. **Scientific name:** *Ficus benghalensis*
5. **Family:** Moraceae
6. **Native:** India

Banyan tree is a venerated trees in India and is one of the Kalpavriksha trees. In Hindu mythology, the tree is called Kalpavriksha, the tree that provides fulfillment of wishes and other material gains. It symbolizes Trimurti - Lord Vishnu is believed to be the bark, Lord Brahma the roots, and Lord Shiva the branches. The Banyan tree is mentioned in many scriptures as a tree of immortality.

Banyan is associated with Yama, the God of death and is planted outside of villages near crematoriums. This tree does not let even a blade of grass grow under it. That is why it is not

used for any fertility ceremonies like childbirth and marriage, as it does signify renewal or rebirth.

5.5.4 Shamee tree / Bannimara

1. Local name: Bannimara

2. Common name: Jammi, Kandi, Khejri Tree

3. Sanskrit name: Shami

4. Scientific name: *Prosopis spicigera*

5. Family: Fabaceae

6. Native: India

Every person before going into the forest offers prayer to this tree as it is believed that it would protect them from evil forces like animal attacks in the forests. Another belief is that goddess Marikamba, the local deity of Uttara Kannada district is resides under this tree. The story goes that Marikamba a goddess in Uttara Kannada because a widow by slaying her own husband who she thought had cheated her. After a weeklong fair during the month of march every year, Marikamba becomes widow on the last day. She is widowed and her wooden idol is placed under this tree. Since she lives under this tree the tree is worshipped. It is alsoa popular belief that people who worship this tree and goddess Marikamba will get rid from epidemics, which are common in forested areas during summer. This tree has special significance during the Dasara festival when members of the community exchange the leaves of the tree for prosperity.

5.5.5 Ashoka tree

1. Local name: Ashok mara, Achenge

2. Common name: Sita Ashok, Sorrowless tree

3. Sanskrit name: Sita Ashok

4. Scientific name: *Saraca indica*

5. Family: Fabaceae

6. Native: India

The Ashoka tree is a small evergreen rain-forest tree that has beautiful and fragrant red and yellow flowers. It is considered to be a sacred tree in Hinduism, Buddhism and Jainism. In Ramayana it is said Sitadevi sat under a ashoka tree.

Ashoka tree is considere scared in the cultural tradition of the Buddhists and Hindus. It is said that Buddha was born under Ashoka tree. Ashoka is considered a woman friendly tree because it is commonly used in the treatment of gynecological problems and menstrual problems in women. The dried stem, bark and flowers acts as tonic for uterine muscles and endometric controlling spasmas and abdominal pain.

5.5.6 Bael wood

1. Local name: Bilvapatri

2. Common name: Bengal quince, Wood apple Golden apple

3. Sanskrit name: Bilva, Bael

4. Scientific name: *Aegle marmelos*

5. Family: Rutaceae

6. Native: India

The fruits of these trees though gummy in nature are eaten by the forest people. The pulp is also made in to a juice. The tender leaves and small shoots are also used in raw form or cooked.

Bale is considered as a sacred tree in hindus and so is used in many rituals. Goddess Laxmi the deity of wealth and prosperity is supposed to be residing in this tree. The leaves and fruits of this tree play an important role in worshiping Shiva who is supposed to be fond of this tree.

Since the tree provides food and is used for worshiping Shiva this tree is not cut by the forest people.

5.5.7 Crown Flower

1. Local name: Yekkegida

2. Common name: Crown flower, Bowstring weed, Gaint milk weed, Gaint swallow-wort

3. Sanskrit name: Alarka, Arka, Arki

4. Scientific name: *Calotropis gigantea*

5. Family: Rutaceae

6. Native: India

The plant is a host plant for a variety of insects and butterflies. Such plants if destroyed will upset natures balance. The forest dwellers wish that all plants, animals/insects and humans live in harmony.

The flowers of this plant are supposed to be liked by Lord Shiva and so offered to him, who showers on his worshippers blessing for peace prosperity and stability. The flowers are strung into garlands for worshipping Hanuman. The plant is also one of the nine astrological trees (Navagrah tree).

5.5. 8 Dyer's rottlera

1. Local name: Kunkumada gida

2. Common name: Kaamala tree, Dyer's rottlera, Monkey face tree, Scarlet croton

3. Sanskrit name: Kampilyaka

4. Scientific name: *Mallotus philippensis*

5. Family: Euphorbiaceae

6. Native: South and South East Asia

The parts of this plants are used in the treatment of various disease. The red powder on the fruits is dusted, collected and used for healing skin problems including wounds, ulcers and hupes. The red powder on the fruits can be used for extracting a red dye.

In Hindu mythology red is the colour of was and the presence of the red dye or colour is considered by the forest dwellers to prevent the upcoming problems in life. The traditional kumkum is also believed to be auspicious. The red powder is applied on the forehead of women and is considered to be the symbol of the female energy of Parvati and Sati.

5.5.9 Neem

1. Local name: Bevu

2. Common name: Neem

3. Sanskrit name: Pakvakrita

4. Scientific name: *Azadirachta indica*

5. Family: Meliaceae

6. Native: India

Neem flowers have a special use and significance while celebrating Ugadi festival which is celebrated in the month of March–April. Neem flowers are consumed in small quantities along with other edible ingredients either in powder, paste or liquid form as it is considered to have a cooling effect. People from forest areas say that this also keeps away diseases and infection. Eating the flowers with jaggery on the day of Ugadi signifies that one should experience sweet and bitter things like joy and sorrows in life. In recent times neem seed collection has also become an NTFP activity for forest dwellers as the seeds are now used in the pesticide industry to produce safe and eco friendly pesticides.

Neem is greatly respected for its medicinal value as it has anti-bacterial, anti-viral, anti-fungal properties. It is for these properties that in Hindu culture, the tree is associated with Goddess Sitala Devi (in North India) as well as Goddess Marimman (in South India) who are both associated with giving and healing of skin ailments like small-pox.

Trees that are protected (not cut) by the local people:

Forest trees that are the links between the sky and earth, often symbolize links between the spiritual world of ancestors and people. Rituals and ceremonies which draw on forest symbols often serve to link people with their cultural heritage, as well as their ancestral past. The tree features in many myths & tales and it consistently reflects a few important symbolic images. The tree stands between heaven and earth and is associated with creation as

well as the underworld ("cosmic" tree). The tree is a maternal symbol: a protector and provider who gives fruit, other foods and medicines, provides a reservoir for water, protects against the elements and evil spirits. The tree often symbolizes human fecundity.

The trees that are protected in the forests by not cutting by the local forest dwellers is presented in table 14. Trees like Chinese salacia (*Salacia Chinensis*), Tamarind (*Tamarindus indica*), Dellenia (*Dellenia pentagyna*), Champak (*Michelia champaca*) and Camphor tree (*Vateria indica*) are not cut because the leaves, fruits, flowers and gum of these trees are used for several religion and cultural functions. Some trees that are harmful to human beings like poison nut (*Strychnos nuxvomica*) and Holageri mara cause problems if touched or handled some other trees are not cut down because they ooze out latex and it is believed that in such type of trees god is present. The latex producing trees are: Surangi (*Mammea Suriga*), White fig (*Ficus vivens*), Poonspar tree (*Calophyllum polyanthum*) and Myrobalan (*Terminalia bellarica*).

To maintain a balance in native allowing all other forms to thrive in forest areas and for religious sentiments these plants are not cut by the forest people. Moreover the trees which produce latex are not cut. Because the culture and tradition of the forest people believes that latex producing trees symbolize fertility. These are the some of the reasons why the above mentioned trees are protected and not cut.

5.6 Constraints faced by the JFMC members in forest management and collection of NTFPs

The constraints faced by the JFMC members are discussed under two heads: 1) constraints faced in forest management 2) constraints faced in NTFPs collection.

Joint Forest Management is one of the largest co-management efforts in natural resource conservation in the world. Apart from providing livelihoods to forest dependent populations, forests provide crucial subsistence needs for housing materials, food, medicine, fuel-wood, small timber and non-timber forest products. Since the colonial era, forest dwellers and traditional stakeholders including tribal populations have been deprived of forest ownership and usufruct i.e., the legal right given to a person or property to enjoy the use and advantage of another's property (forests) to drive income or benefits without destroying or wastage of its substance. They have been deprived because of exclusionary, hierarchical 'command and control' management. The JFMC members are given access to forest areas

under JFPM for collection of non-wood forest produce and a percentage share of final tree harvests under a specific usufruct-sharing mechanism between the two partners i.e., the forest dwellers and the forest department. A memorandum is jointly signed in this regard by the State and the Village Forest Committee (VFC). The VFC takes up activities recorded in a site-specific micro-plan prepared jointly by the forest department and the VFC on a 10-year scheme basis.

5.6.1 Constraints faced in forest management

The JFMC is relatively a new beginning in forest department and still a challenging task to succeed. There are various threats in the forest management.

Major constraints faced by the JFMC members in forest management is the overlapping of agriculture and JFMC activities during the months of June-July when both agriculture and forest department need to be taken up. The monsoon season is the right time taken up these activities, if one can concentrate on agriculture then JFMC activities neglected and vice versa. So this was a major constraint. It is difficult for the members to attend forest activities because they will be having pre sowing activities work in their own fields and for some members who work on wage labours in others field. So it is difficult for them to attend both the activities.

The non-availability of regular work was ranked second (II). The JFMC members get work only during plantation activities, harvesting of timber and soil & moisture conservation (SMS) works that are available in the department, otherwise they don't have any work earn wages.

Non uniformity in fixing the financial grants (sukthanidhi) for different VFCs (III) was another constraint faced by JFMC members. The sukthanidhi (1,00,000/- per VFC) is given to the VFCs which are established under JICA (Japan International Co-operation Agency) and JBIC (Japan Bank for International Co-operation) assistance, whereas the VFCs which were established under the forest development agency (FDA) are not receiving this fixed grants. Therefore the VFC members who have not received the grants are unhappy because they feel injustice has been done to them. All VFC members irrespective of old or new committees perform the same work hence they expect fair financial assistance.

Lack of emphasis on quick economic returns was ranked fourth (IV). It is because forest plantation require long gestation period before they start yielding for e.g. Kokam

plantation start fruiting after 6 years while timber from teak is ready for harvest only after 15 years. JFMC members have to wait for a minimum 5-10 years to get benefits. As majority of the members were from low income group they desire for immediate benefits is understandable.

Village politics was ranked fifth (V). The VFC executive committee members are generally politicians, influential families and of affluent status. These members along with officials take major decisions regarding forest management activities. They do not involve all the JFMC members in decision making process. They take decisions suited to their interest and not of the common forest dwellers.

There are some minor problems like destruction of plants due to forest fires. Some members expressed that forest officials do not always attend to the JFMC members complaints. This may be due to their busy schedule or indifferent attitude of government officials.

The results are in conformity with the results of Nathan and Boon (2012), Choudhary and Srivastava (2014) and Yaseen *et al.* (2018).

5.6.2 Constraints faced in NTFP collection:

Regarding NTFPs, lack of marketing facilities was ranked first followed by absence of fixed price for NTFPs (II), lack of processing units (III), ignorance of the younger generation about the availability of particular resources (IV) and outbreak of diseases (V).

Marketing is a major problem for NTFPs collectors. The forest department calls for tenders once in two years and even that is only for major NTFPs like Kokam and Uppage. For the remaining NTFPs like Shikakai, Jamun, Wild mango, and Amla there are no tenders called nor is there a fixed price. The NTFPs are collected and sold to local village merchants at the price determined by them. Same time the local merchants quote very low price and the NTFP collectors are forced to sell them at that price only as they do not have any other outlet. The local buyers therefore exploit the NTFP collectors. Lack of processing units for NTFPs, due to perishable nature NTFPs spoil quickly if not processed in time. Either the fruits go waste or they are sold at very less prices in the local market. Another constraint was ignorance of the younger generation about the availability of NTFPs. In recent days the youth are not only not aware of many NTFPs but also do not know where to look for them, how to harvest,

when to harvest. Outbreak of diseases was another constraint. This year (2017-18) many of the NTFPs were not harvested due to the spread of monkey fever. Since the monkey virus disease could spread by using the fruits infected by monkeys, it was not considered safe to harvest and sell/use the fruits.

The results are in line with the results of Puneeth *et al.* (2016).

5.7.3 Constraints faced by the forest department officials:

There are certain constraints faced by the forest department officials in managing the JFMC and VFCs.

Absence of committee members in meeting was the major constraint as expressed by forest officials. Although membership is voluntary and members have joined of their own accord men do not attend the meetings regularly, either due to lake of time work load or sheer negligence. Whereas in case of women they do not attend due to inconvenient time, household activities and family & social restrictions in attending meeting along with men.

Another constraint mentioned by the forest officials was the villager's desire for immediate benefits. The JFMC members have to wait for 10-12 years for maturity and harvesting of timber species. After harvesting the timber is sent to the timber depot. After this the forest department then invites tenders to sell the produce. This is followed by bidding, billing and cheque distribution. All these official procedures take a minimum of two years. For the poor JFMC members this is a long wait of 15-17 years. So by their the JFMC members lose interest to take up new plantation.

They also expressed some organizational problems like lack of staff, rules and regulations to be followed by the department in implementing the programmes and limited decision power of field level forest staff. Since the field level staffs are working at the grass root they understand problems better but are not in a position to take major decisions. For instance there may be between forest dwellers and forest department staff difference of opinion regarding the species of trees or medicinal plants to be planted. The final authority is the Divisional Forest Officer (DFO) and Conservator of Forests (CF) and who do not actually work at the field level. The field level workers will have to bear the brunt of both local people and higher officials.

The results are in accordance with the findings of Choudhary and Srivastava (2014).

Summary and Conclusions

6. SUMMARY AND CONCLUSIONS

Forest constitutes one of the most important natural resources of the country. Degradation of forests in India is a continuing process and degraded forests form about one third of the total forest area. The impact of loss and degradation of forests results in soil erosion, loss of biological diversity, damage to wild life habitats and degradation of quality of life. Degraded forests are unable to meet the human needs of economic and ecological services, wood based energy, forest based industries, and other enterprises besides employment generation.

The National Forest Policy, 1988 emphasized on creating massive people's movement through involvement of village communities living close to the forest in protection and development of forests. According to this policy, the government of India issued a notification in June 1990 requesting the state government to involve local communities in the management of forests. It is envisaged that the communities who participate in protection and development of forest areas, will be entitled to the share of usufructs in a manner specified by the concerned state forest departments. This has led to the development of Joint Forest Management Programme (JFM).

The success of Joint Forest Management Programme largely depends on the extent of participation of the beneficiaries. They also have different benefits, access and control over forests. In order to achieve the objectives set forth, it is important for the development administrators to have an idea that the knowledge of this would help in increasing the efficiency of the field personnel of the Department of Forest. With this background the present investigation was planned with following objectives.

Specific objectives of the study

1. To study the knowledge of Joint Forest Management Committee (JFMC) members and non-members about forest management.
2. Participation of JFMC members in sustainable utilization, collection and processing of non-timber forest products.
3. To study the relationship between socio-economic characteristics of respondents with sustainable forest management activities.
4. To investigate and document the bio-cultural beliefs about forest and forest tress.
5. To find out constraints faced by the JFMC members in forest management.

The study was conducted in the Western Ghats region of Uttara Kannada district of Northern Karnataka during the year 2018-19. By using proportionate stratified random sampling technique 70 percent of the Village Forest Committees (VFCs) in each zone were selected. Thus 4 VFCs from Coastal region, 11 VFCs from Upghat region and 7 VFCs from plain region were selected. Further from each of these VFCs 70 per cent of respondents were selected (35 % JFMC & 35 % non JFMC members). They include 96 respondents from coastal region, 252 respondents from upghat region and 116 respondents from plain region. Thus making a total sample of 464 respondents (232 JFMC and 232 Non-JFMC members).

The JFMC members knowledge, conservation practices and participation were studied as the dependent variables and the variables age, education, caste, marital status, family size, family type, land holding, annual income of the family, occupation of the family, contact with extension agency, extension participation, mass media participation and organizational participation were studied as independent variables.

A pre tested interview schedule was used to collect data from the respondents by personal interview, informal discussion and focused group discussion methods. The data collected was tabulated and analyzed using frequency, percentage, correlation and Garrett ranking.

Major findings of the study are as follows

- Majority (63.80%) of the JFMC members belonged to middle age group and 72.84 per cent of the non JFMC members belonged to young age group.
- With regard to gender equal per cent of JFMC and non JFMC members were selected for the study purpose.
- Few JFMC members (23.27 %) completed their primary school education. While 27.15 per cent of the non-JFMC members were graduated.
- The JFMC members belonged to backward caste (32.32 %) whereas non JFMC members belonged to scheduled caste (27.60 %).
- A majority (97.85%) of the JFMC members were married whereas, 55.60 per cent of the non JFMC members were unmarried.
- Majority of the JFMC and non-JFMC members (58.62 % and 62.94 % respectively) belonged to nuclear families.

- Equal per cent of the JFMC and non-JFMC members (46.99 %) belonged to small family size.
- It was noticed that 40-45 per cent of the JFMC members and non-JFMC members had marginal land holding.
- More than half of the (54.74 %) JFMC members had agriculture as main occupation whereas 44.39 per cent of the non-JFMC members were wage labors.
- About 80 per cent of the JFMC and non-JFMC members had an annual income of less than Rs. 1,32,000/- *i.e.*, low income group.
- Majority (77.58 %) of the JFMC members had medium extension contact, whereas large majority (78.02 %) of non JFMC members had low contact with extension agencies.
- Cent per cent of the JFMC members had high level of extension participation, while cent per cent of the non-JFMC members had low level of extension participation.
- Most of the JFMC and non-JFMC members (62.94 % and 51.72 % respectively) were had medium mass media participation.
- More than half (57.75 %) of the JFMC members belonged to low organizational participation whereas cent per cent of the non-JFMC members belonged to low organizational participation.
- Large majority (92.67 %) of the JFMC members attended training on plantation management followed by importance of soil & moisture conservation (77.58 %), fire management (51.72 %) and conservation of NTFPs (38.36 %).
- Cent per cent of the JFMC and non-JFMC members were using electricity and LPG as source of energy followed by firewood (80.00 %) and solar lights (75.00 %).
- Cent per cent of the JFMC members had knowledge about environmental awareness programmes, plantation management, fire management, biodiversity conservation, soil & moisture conservation and deforestation & land degradation.
- It was seen that majority (84.05%) of non JFMC members had knowledge about environmental awareness programmes. Some of them are also having knowledge about plantation management (35.34%) and biodiversity conservation (34.91%).

- A large majority (86.20 %) of the JFMC members had high level of knowledge and in case of non JFMC members, majority (77.58 %) had low level of knowledge about sustainable forest management activities.
- Majority (66.38 %) of the JFMC members had medium level of knowledge about forest conservation practices.
- Cent per cent of the JFMC members from all the three regions had knowledge about forest land preparation & planting of seedlings, necessity of planting of indigenous species rather than exotic species, application of FYM at the time of planting and watering the plants as per requirement.
- In "pre sowing treatment" all the women JFMC members were involved in pre sowing treatment activities like preparation & filling of potting mixture and seed sowing.
- In "land Preparation", majority of the activities were carried out by men alone. Site preparation, layout for planting and digging the pits were all done by men alone. Whereas, planting the seedlings was carried out by both.
- In "post planting activities", 50.00 per cent in each of all these activities like fencing, handling the pests & disease management, fire protection, lopping, scrapping and control of illegal harvesting were carried out by men. In some of the post planting activities, cent per cent of the men and women were involved in the activities like cleaning the surrounding area of plants, watering the plants, pruning, thinning, application of manure, mulching and hoeing.
- The NTFPs collected by the JFMC members are (1) Fruits: kokam, jamoon, (2) Spices: rampatre, cloves, cinnamomum, (3) Souring agents: uppage, monkey jack fruit, (4) Fruits for pickling: Indian gooseberry, chebulic, wild mango, tender bamboo shoots, (5) Edible: honey, wild mushroom, and (6) Herbal products: soapnut, shikakai.
- The main season for NTFP collection are late winters and summer season (February to May) and monsoon season (June –September).
- Collection of NTFP is done by JFMC members in group as well as individually for household consumption and commercial purpose.

- The trees mentioned by the respondents as holy trees are Peepal tree, Indian fig, Banyan tree, Shamee tree, Ashoka tree, Beli wood, Crown flower, Dyer's rottler, Neem.
- Trees like Chinese salacia, Tamarind, Dellenia, Champak and Camphor tree are not cut because the leaves, fruits, flowers and gum of these trees are used for several religion and cultural functions.
- Some trees that are harmful to human beings like poison nut (*Strychnos nuxvomica*) and Holageri mara cause problems if touched or handled.
- Some other trees are not cut down because they ooze out latex and it is believed that in such type of trees god is present. The latex producing trees are: Surangi, White fig, Poonspar tree and Myrobalan.
- The constraints faced by the JFMC members in forest management activities were overlapping of agricultural and JFMC activities was ranked first (I) followed by the non-availability of regular work (II) and non uniformity in fixing the amount for different VFCs (Sukthanidhi) (III).
- It could be seen that the important constraints in the NTFP collection were: lack of marketing facilities (I), absence of fixed price for NTFPs (II), lack of processing units (III), ignorance of people about the availability of resources (IV) and outbreak of diseases (V).
- Constraints expressed by the forest officials were absence of committee members in meeting (I), followed by villagers desire for immediate benefits (II) and lack of staff (III).

Implications of the study

Since there was a substantial delay in the flow of benefits from JFMC beneficiaries cannot wait for a longer period for benefits. This is specially true in case of small, marginal and landless labours. The JFPM programme should simultaneously provide alternative employment generation opportunities for poor farmers and other disadvantaged group farmers.

The study clearly indicates that extension contact is one of the important characteristics in bringing about desirable changes in knowledge of the JFMC members about

sustainable forest management. There is a need for intensifying educational efforts especially in the areas of management plan, monitoring and bring coordination between different development departments.

Providing more powers to VFCs and conducting regular meetings of management committee is expected to bring desired changes in the knowledge of the VFC members towards forest management.

There is a need to establish proper linkage between the Forest Department and other line Department personnel and people living in and around the forest.

Suggestions for future study

The present study was conducted on a limited area confined to few VFCs in Uttar kannada District. With a view to generalise the findings for a larger area, it is necessary to plan and to conduct similar studies in different areas where JFPM is in operation.

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Appendices

APPENDIX I

GENDER ROLES IN SUSTAINABLE FOREST MANAGEMENT

Part – I

A. General information about the village

1. Name of the village:
2. Name of the taluk:
3. Forest Range and Division :
4. Name of the Hamlet:
5. Name of the Hobali:
6. Population details of the village:

Children		Adult		Old Age	
Male	Female	Male	Female	Male	Female

7. Type of road in the village:
8. Institutions present in the village:

Sl. No	Institutions		Sl. No	Institutions	
i	Anganwadi		vii	Youth club	
ii	Primary school		viii	Forest office	
iii	High school		ix	Primary Health Center	
iv	Public distribution system		x	Veterinary hospital	
v	Co-operative society		xi	Bank	
vi	Gram panchayat		xii	Post office	
xiii	Any other institutions specify:				

9. Distance to the forest office: …….. km
10. Distance to the taluk head quarter: …… km
11. Distance to the market place: ……. km
12. Total area of the village: …… acre/ha

B. General information about Joint Forest Management Committees (JFMC)

1. Name of the Village Forest Committee (VFC) :
2. Year of VFC registration and MOU signed:
3. Total number of members in the VFC:
4. Mention categorization of members:

	General	**SC**	**ST**
a) Men			
b) Women			

5. Number of management committee meetings held:
6. Interval between the management committee meetings (last one year) :
7. Number of training programmes organized by the forest department to VFC members:

Sl. No	Name of the Training programmes	Duration
1		
2		
3		
4		
5		

8. Would you say there is fair representation of community members interests on the Board/Committees?

Part – II

A. General Information of the respondents:

1. Name of the respondent:
2. Age:
3. Gender:
4. Caste:
5. Family information:

Sl. No	Relationship	Sex	Age	Education	Occupation
1					
2					
3					
4					
5					
6					

6. Details of landholdings (Area in ha) :

Sl. No	Type of Land	Area in terms of Acres	Crops	Intercrops
1	Total Farm Size			
2	Total Size of Thota			
2a	Betta/Bena			
b	Home garden			
3	Farm area cultivated for other crops			
4	Leased land			
5	Can you rank which farm crops or livelihood activities are the most important as source of income or source of food? Include non-farm or off-farm income or livelihood activities. (Start with the activity that is most important for your household and end with the activity or crop that is least important during last 12 months)			1 2 3 4 5 6

7. Source of energy needs:

SL. No	Source of Energy	Quantity
i	Firewood	
ii	Charcoal	
iii	Kerosene	
iv	Cow Dung	
v	Electricity	
vi	LPG	
vii	Solar	
viii	Bio gas plant	

8. Employment and income from various sources:

Sl. No	Source of income	Man days (per annum)	Income (per annum)
1	NTFPs		
2	Farming		
3	Allied activities		
4	Services		
5	Others		

9. Contact with extension agency:

Sl. No	Personnel	Level of participation			
		Regularly	Occasionally	Rarely	Never
1	Range Forest Officer (RFO)				
2	Deputy Range Officer (DRO)				
3	Beat Guard (BG)				
4	Range Surveyor (RS)				
5	Forest Surveyor (FS)				
6	Forest Engineer (FE)				
7	Agricultural Officer				
8	Assistant Horticulture Officer				
9	KVK Scientist				
10	Veterinary Officer				
11	Fisheries Officer				
12	NGO/ Motivator/Facilitator/Co-ordinator				

10. Extension participation:

Sl. No	Activities	Level of participation			
		Regularly	Occasionally	Rarely	Never
1	Demonstrations				
2	Group discussion meetings				
3	Training and capacity building programmes				
4	Field/Exposure visit				
5	Vanmahostva				
6	Exhibitions				
7	Campaign				
8	Any other specify				
	a)				
	b)				

11. Mass media participation:

Sl. No	Media	Level of participation			
		Regularly	Occasionally	Rarely	Never
1	Newspaper				
2	Radio				
3	Television				
4	Magazines				
5	Mobile				
6	Internet				
7	Others				

12. Organizational participation:

Sl. No	Types	Members	Office bearer	Level of participation			
				Regularly	Occasionally	Rarely	Never
1	Gram panchayat						
2	Taluk panchayat						
3	Zilla panchayat						
4	Co-operative society						
5	Farmer producer organizations						
6	Farmers forums						
7	JFM committee						
8	Self Help Groups						
9	Others						

Objective 1: To study the knowledge of Joint Forest Management (JFM) members and Non-JFM members about forest management.

I. Knowledge regarding sustainable forest management :

Sl.No	Particulars	Yes	No
1	Environmental awareness programmes		
2	Plantation Management		
3	Fire management		
4	Biodiversity conservation		
5	Soil and moisture conservation		
6	Deforestation and land degradation		
7	Conservation of NTFPs		
8	Sustainable non timber forest products (NTFPs) harvesting techniques		

i) Knowledge of JFMC members about forest conservation practices

Sl . No	Particulars	Yes	No
1	Seed identification, collection and establishment of nursery for seedling		
2	Forest land preparation & planting activities		
3	Planting indigenous species rather than exotic species		
4	Soil testing before initiating forestry work		
5	Application of FYM at the time of planting		
6	Watering the plants as per requirement (Protective irrigation)		
7	Growing wind breaks in rows for afforestation		
8	Water catchment area conservation		
9	Fire preventive measures		

1. Biodiversity:

- Mention the different plant species?
- Mention the different animal species?
- Mention the locally endangered species?
- Reasons for extinction of biodiversity?
- Measures to control biodiversity?

2. Deforestation and Land degradation:

1. Reasons for deforestation?
   i.
   ii.
   iii.
   iv.
2. Reasons for land degradation?
   i.
   ii.
   iii.
   iv.
3. Activities followed to control deforestation?
   i.
   ii.
   iii.
   iv.
4. Activities followed to control land degradation?
   i.
   ii.
   iii.
   iv.

3. Water Conservation:

- What is water conservation?
- Mention the water conservation practices?
- Mention the benefits of water conservation?

4. Soil Conservation:

- What is soil conservation?
- Mention the soil conservation practices?
- Mention the benefits of soil conservation?

iii. Soil and Water Conservation Practices Adopted:

Sl. No	Conservation practices	Year	Status	Name of Agency
1	Bunding			
2	Contour bund			
3	Loose border checks			
4	Vegetative bund			
5	Broad bed furrow			
6	Pond			
7	Summer ploughing			
8	Dead furrow			
9	Bore well recharge pit			
10	Naala bund			
11	Check dam			

5. Lopping of tress/leaves/wood

i. What is lopping?

ii. Are there any programs in place to stop the lopping of trees?

iii. How often the trees should be cut?

iv. Who decides which ones are cut down?

a. FD b. VFC Group c. VFC Head d. Any other

v. What are the illffects of lopping of trees?

vi. What are the benefits of lopping of tress?

Objective 2: Participation of men and women in sustainable utilization, collection and processing of NTFPs.

A. Gender Participation in forest management activities

Sl. No	Activities	Men	Women	Both
A	**Preparation of Planting Material(Seedlings)**			
I	**Pre sowing treatment**			
i	Selection of seeds			
ii	Soaking seeds for 24 hours in hot/boiling water			
iii	Boiling/ soaking of seeds in hot water			
iv	Chemical treatment			

Sl. No	Activities	Men	Women	Both
v	Preparation and filling of potting mixture			
vi	Seed sowing			
II	**Land Preparation**			
i	Site preparation			
ii	Layout for planting			
iii	Digging the pits			
iv	Planting the seedlings			
III	**Post planting activities**			
i	Cleaning the surrounding area of plants			
ii	Watering the plants			
iii	Fencing			
iv	Pruning			
v	Thinning (Reducing the plant population)			
vi	Application of manure			
vii	Handling the pests & disease management			
viii	Fire protection			
ix	Mulching			
x	Lopping			
xi	Scrapping			
xii	Hoeing			
xiii	Control of illegal harvesting			

B. Sustainable collection, processing and utilization of NTFPs:

Sl. No	Activities							Men	Women	Both
I	**Collection of NTFPs**									
i	Name of the NTFP:									
ii	Plant parts collected :									
	Leaf	Fruit	Bark	Flower	Root	Seed	Lack			
iii	Edible parts:									
	Honey	Mushroom								
iv	Period of Availability:									
	Peak season:									
	Lean season:									
v	Quantity collected per season (Kg/ Qtl):									
vi	Number of hours of collection/day:									
vii	Distance travelled:									
viii	Method of collection:									
	Hand Picking	Climbing	Machine	With the help of labour	Sustainable Harvesting Techniques					
II	**Processing and Marketing**									
i	Processing									
ii	Grading									
iii	Packing									

Sl. No	Activities	Men	Women	Both
iv	Storage			
v	Transportation			
vi	Marketing			
III	**Utilization of NTFPs**			

Sl.No	Name of NTFP	Quantity Processed	Cost	End Use
1				
2				
3				
4				
5				
6				
7				

Objective 3: To investigate and document the bio-cultural beliefs about forest and forest tress.

i) Name the tress that are not cut by local people and mention reasons?

a.
b.
c.
d.

ii) Name the tree species which are used for religious practices?

a.
b.
c.
d.

Objective 4: To find out constraints faced by the forest dwellers in forest management

I. Constraints faced by community in forest management

Sl. No	Problems	
1	Forest management	
2	Collection problems	
3	Processing problems	
4	Marketing problems	

Appendix II. Description of the study site

Sl. No	District	Taluk	Range	Type of Forest	Name of the VFC	Year of establishment	Name of the Scheme	Forest area under VFC (Ha)	Sample Size (N=464)	
									JFMC Members	Non-JFMC Members
	I. Coastal Region								**(n1=96)**	
1	Uttar Kannada	Kumta	Kumta	Evergreen forest	Sri Bobrulingeshwar VFC, Masur	2008-09	KSFMBC	123	12	12
2		Gokarn	Hiregutti	Evergreen forest	Sri Bheemdev VFC, Ajjhakkal	2005-06	KSFMBC	400	12	12
3		Honnavar	Honnavar	Evergreen forest	Jankadkal VFC, Jankadkal	2007	KSFMBC	850	12	12
4		Bhatkal	Bhatkal	Evergreen forest	Hadavalli VFC, Hadavalli	1998	DFID	1468	12	12
									48	**48**
	II. Upghat Region								**(n2=252)**	
1	Uttar Kannada	Kumta	Kathgal	Evergreen forest	Shirgunjeshwar VFC,Shirgunji	1996-97	DFID	148	12	12
2		Sirsi	Sirsi	Evergreen forest	Agsal-Bommanalli VFC,	2006	JICA-KSMBCP	175	12	12
3		Sirsi	Banavasi	Evergreen forest	Gadigeri, VFC	1996	DFID	120	12	12
4		Sirsi	Janmane	Evergreen forest	Kurse, VFC	2007	JICA-KSMBCP	190	12	12
5		Sirsi	Hulekal	Evergreen forest	Shigehalli, VFC	1996	DFID	152	12	12
6		Yellapur	Idgundi	Evergreen forest	Sheerale, VFC	2005-06	JBIC-KSFMBC	130	12	12
7		Yellapur	Manchikeri	Evergreen forest	Hasanagi, VFC	2007	JBIC-KSFMBC	643.951	11	11
8		Yellapur	Yellapur	Evergreen forest	Gerala, VFC	2005	NAP-FDA	400	11	11
9		Siddapur	Siddapur	Evergreen forest	Igod, VFC	1995	DFID	550	11	11

Sl. No	District	Taluk	Range	Type of Forest	Name of the VFC	Year of establishment	Name of the Scheme	Forest area under VFC (Ha)	Sample Size (N=464)	
									JFMC Members	Non-JFMC Members
10		Siddapur	Kyadgi	Evergreen forest	Suttalmane, VFC	1996	DFID	350	11	11
11		Joida	Joida	Dry Deciduous Forest	Deriya,VFC	1996-97	NAP-FDA	220	11	11
									126	**126**
	III. Plain Region									**(n3=116)**
1	Uttar Kannada	Haliyal	Haliyal	Dry Deciduous Forest	Ajagon, VFC, Ajagon	2007	KSFMBC	300	10	10
2		Haliyal	Sambrani	Dry Deciduous Forest	Chotakansirda, VFC	2006	NAP	729	08	08
3		Joida	Virnoli	Dry Deciduous Forest	Kulgi, VFC	2003	NAP	400	08	08
4		Haliyal	Dandeli	Dry Deciduous Forest	Moulinge,VFC	2007	KSFMBC	132	08	08
5		Mundgod	Kirwatti	Dry Deciduous Forest	Thotlagundi,VFC	2002	NAP-FDA	160	08	08
6		Mundgod	Mundgod	Dry Deciduous Forest	Attiveri,VFC	2005-06	NAP-FDA	560	08	08
7		Mundgod	Katur	Dry Deciduous Forest	Onikeri,VFC	2006-07	NAP-FDA	480	08	08
									58	**58**

ROLE OF JOINT FOREST MANAGEMENT COMMITTEES (JFMC) MEMBERS IN SUSTAINABLE FOREST MANAGEMENT (SFM)

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ABSTRACT

Joint Forest Management (JFM) is an approach and programme initiated in the context of the National Forest Policy (1988), wherein the state forest department support local forest dwellers to protect and manage forests and share the costs and benefits from the forests with them. The present study on "Role of Joint Forest Management Committees (JFMC) Members in Sustainable Forest Management (SFM)" has been conducted in Uttara Kannada district. The descriptive and explorative research design was used for the study. The sample size comprised of 464 respondents who were selected by proportionate stratified random sampling technique. Data was collected with structured interview schedule through personal interview and focus group discussion. The collected data was subjected to appropriate statistical analysis. The findings revealed that a large majority (86.20 %) of the JFMC members had high level of knowledge, whereas 77.58 per cent of non JFMC members had low level of knowledge about SFM activities. Majority (66.38 %) of the JFMC members had medium level of knowledge about forest conservation practices. The NTFPs collected by the JFMC members were kokam, jamun, rampatre, cloves, cinnamom, uppage, monkey jack fruit, Indian gooseberry, wild mango, tender bamboo shoots, honey, wild mushroom, soapnut and shikakai. The holy trees listed by the respondents were *Ficus religiosa*, *Ficus racemosa*, *Ficus benghalensis* and *Prosopia spicigera*. Some trees are not cut down because they ooze out latex and it is believed that in such type of trees god is present i.e., *Mammea suriga* and *Ficus virens*. Constraints reported by the JFM members were overlapping of agricultural and JFM activities, non-uniformity in fixing the financial grants for different VFCs, lack of marketing facilities and absence of fixed price for NTFPs.