LIVELIHOOD ISSUES IN FLOOD AFFECTED FARM ECONOMY : A CASE STUDY OF DON RIVER BASIN - BIJAPUR DISTRICT

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Livelihood is not just a means of earning a living and generating an income but a pattern of asset ownership, availability of required skills and knowledge to deploy those assets into a productive process and a favourable market mechanism. It is the livelihoods, after human life that disaster prone communities strive most to protect against hazards. Macroeconomic indicators are used for assessing disaster induced damage but disruption to micro, subsistence and livelihood economies is not accounted for with the same level of detail.

Members highlighted the importance of understanding the difference between flood damage and flood loss. While flood damage is related to the physical damage of public and private assets, flood loss also refers to secondary or tertiary losses as well as intangible losses such as loss of human lives. For realistic estimates, it is important to consider flood damages as well as flood losses into account. Therefore importance of assessing potential flood losses becomes evident when policy makers and planners try to strike an optimal balance between the development needs of a particular area and the levels of flood risk community is ready to accept.

Discussants pointed out that loss of livelihood due to floods is an Omni dimensional phenomenon in the context of flood ridden states of India. They stressed on the need to see this as a Rights & Entitlement issue of the flood affected community. Increasing commitment towards proactive disaster management, members felt has opened the vistas for preparedness towards the realistic and democratic assessment of the eligibility for the Calamity Relief Fund (CRF) and National Calamity Contingency fund (NCCF) aid. The primary challenge is to strike a balance between Covert & Overt Losses at different levels – for individuals, households, community as well as widespread economy of Village, Panchayat, Blocks, Districts, States and the Country.

Livelihood assessment in a situation of Disaster can be dealt in the following Framework of Perception:-

Step 1: Validate overt livelihood loss through initial and rapid assessment at community level by collecting primary and secondary data. This will establish the Volume of NCCF & CRF application in Relief, Response, Early Recovery, Recovery and Rehabilitation.

Step 2: Verify Covert Livelihood and validate by in depth and detailed assessment at community, household as well as individual level. The output of Step 1 will decide whether to go for this step and in what order. This process will target individuals who have lost their livelihoods and will represent the losses at Primary system of Livelihood.

Discussing options to help in assessing potential livelihood or income loss quickly and effectively, members first pointed out that disasters have both direct and indirect effects. Alteration of income flows in terms of reduced income or livelihood loss is a noteworthy direct effect, whereas indirect losses are due to disruption in regular incomes which are less evident when the assessment is carried out. Therefore, members recommended assessing direct and indirect effects in monetary terms and the damage to sectors such as agriculture, fisheries, forestry *etc.*

A disaster is not a physical happening, it is a social event. It is in one sense the manifestation of vulnerabilities of social system and prime attention should be given to doing something about such vulnerabilities. Thinking disaster as social phenomena allow them to be seen as something which can be reacted to as part of ongoing policies and programmes of national and social development-which could reduce societal vulnerabilities in the first place. Activities of development nature then can be seen as an integral part of disaster prevention and mitigation.

Natural disasters have several different varieties which would include avalanches, diseases and pandemics, droughts, earthquakes, famine, floods, impacts events (such as meteors), tsunamis and volcanic eruptions among others. Of these various types of disasters, three main types account 90% of losses: floods, earthquakes and cyclones.

Floods, drought and famines are also natural calamities like earthquakes and volcanoes which man has to face. However, in the case of floods, drought and famines he is able to control them, diminish the danger and at times even completely eliminate them as in the case of famines.

Floods are caused by three factors- 1. Cloud burst, 2. Monsoon depression and 3. Tropical cyclones. Of late, deforestation and soil erosion are also causing floods. The problem has become severe now on account of deforestation and depositing of soils in the river beds. When occur they

inundate low lying areas by the sides of the river and cause huge loss of life, crop and other properties.

In India, agriculture is the mainstay of the economy. Contribution of agriculture to the economy of India can be estimated from the fact that 70% of Indian population is dependent on cultivation and agriculture contributes to 18% of the Gross Domestic Product (GDP) of India. Out of the total sown area, 60% is dependent on the rainfall, thus prone to floods and droughts. Thus flood and droughts occurring repetitively after some years have an adverse effect on our country economy.

In India major rainfall is received from southwest monsoon in the summer season. The vagaries of this monsoon are the main cause of floods/drought in our country. Floods are associated with excessive rainfall while the draughts are the result of deficient rainfall. However, other factor also plays a role in establishing the condition for these calamities including hydrology, deforestation, soil nature, erosion *etc.* At present our country is encountering the drought condition due to the deficient rainfall. While last year many regions of the country faced the situation of flood.

Since the majority of population (approximately 70%) is dependent on cultivation droughts and floods have significant economic, environmental and social consequences. Due to these natural calamities the product of farm gets damaged. The farmers who have taken huge loans to fund their operations from the private moneylender become unable to pay their debts. The quality of land gets deteriorated transforming into wasteland. Along with the current season productivity reduction next season crop also get reduced. The conditions of the marginal farmers become more vulnerable as they left with no or reduced produce of current crops and reduced land capacity for future.

Impact of drought and flood is not only limited to the farmers but felt over the entire country. Food security that is already a concern, due to prevailing poverty and huge population, in the country turns severe. Due to reduced productivity food prices rises resulting inflation. This inflation is also the result of corrupt and malpractices of middlemen. Reduced purchasing capacity of common man bring decline in demands of other products and because of demand and supply rule the industries get affected. In this view economy of the country becomes somewhat stagnant.

Electricity, which is still not available to 400 million people, is very important requirement for the growth of economy of country. During draught due to the water deficiency hydroelectric power generation having 25% share in total power generation also gets affected. With the reduced power production almost all activities related to cultivation, industries, household *etc.* get adversely affected. Thus the output get reduced which is reflected in the GDP of country.

Drought and floods adverse effect on our economy get exaggerated due existing poverty in India (still approx. 6.8 crores families are below poverty line as planning commission). The conditions of poor farmers get more deteriorated and it becomes difficult for them to earn the basic needs. The government is running many programs like Bharat Nirman, National Rural Employment Guarantee Act and Rastiriya Krishi Vikas Yoazana *etc.* for poverty alleviation and enlistment of rural life.

The population in India is growing at faster rate. As an estimate the population of India will be 1.43 billion by 2031-32. To feed this burgeoning population the challenge on the yield of farm is increasing day by day. When such a calamity occurs it pushes a large population towards hunger including the cultivator. To meet this deficiency grains has to import from other countries. This results in reduction of the foreign currency that has a direct impact on economic state of country. Recently in the wake of Deficient rainfall in this year the finance minister Shri Pranab Mukherjee announced for the import of food for 700 million population of India.

The present drought situation the country is undergoing is very serious. More than 246 districts in the country have been affected by the malady caused by deficient rainfall. The severe drought like conditions is the result of climatic imbalances caused by the failure of the monsoon.

Due the sufficient grain stock, better transportation and communication facilities and advancement of technology situation of famine will not be encountered which is the result of floods and drought in the past. But still the impact these calamities on the overall economy can be felt. Though the government is taking several measures yet all those fall short to mitigate the effect of these situations.

Measures for flood mitigation were taken from 1950 onwards. As against the total of 40 million hectares prone to floods, area of about 18.22 million hectares has been protected by construction of embankments. A number of dams and barrages have been constructed. The State Governments have been assisted to take up mitigation programs like construction of raised platforms.

Floods continue to be a menace however mainly because of the huge quantum of silt being carried by the rivers emanating from the Himalayas. As per an estimate, every year about 2/3rd of the irrigation projects pond, tanks etc become ineffective due to siltation. Thus, the maintenance of these irrigation projects is very important that is not being carried out efficiently. In UP there are 100, 000 personnel to carry out the task of maintenance but their output is nil. In between 1992 to 2004 around 200 minor and major irrigation projects were made but their capacity has left only about 3.4 hectare.

To fight with the condition of draught various projects are running Drought Prone Area Programme (DPAP), Desert Development Programme (DDP) and National Watershed Development Project for Rain fed Areas (NWDPRA), Integrated Watershed Development Project (IWDP). Water of the major rivers has to be diverted to area depleted of the rainfall. However the output of these programs is not satisfactorily. To gain the output of these programs these should be run more effectively and efficiently.

Much is being done but lot has to be done to conquer the adverse effect of Drought and floods. Along with the planned construction of new means the maintenance of existing one is also very important otherwise effect of these calamities will always remain on the economy of our country.

Floods in India

Flood is the most destructive natural disaster which extensively damages the life and property in India. It is very difficult to predict flood, because of its nature. It may be rightly stated that such natural calamities leave behind a story of death, hunger, epidemic and mass destruction. Flood is a natural phenomenon, whose roots are in monsoonal rainfall. It means that it is the result of over rainfall. Of the total annual rainfall in the country, 75 per cent is concentrated over a short monsoon season of three to four months. As a result, there is a large amount of discharge from the rivers during the monsoon period causing floods. Flood hazards are precisely called natural since they are the result from a set of natural phenomena, connected directly with the atmosphere and surviving topographical structure.

It has been seen in India that most parts of north eastern India are more frequently hit by the severe floods. This entire region is ecologically fragile with respect to flood because of the large river system of the country with its hundreds of tributaries. Floods are increasing in India with respect to intensity, magnitude and frequency. If we plot the data of floods on a hydrograph, it will be quite clear to us that the intensity of floods is increasing every year and they are caused by a large number of managerial problems in the country.

India is the most flood affected nation in the world after Bangladesh. It accounts for one-fifth of global deaths due to floods and on an average thirty million people are evacuated every year. So floods in India are not a new phenomenon. “Unprecedented floods” take place every in one state or another of the country. India has been traditionally affected by flood. The vulnerability of the states of India due to floods was not observed severely in the past due to low developmental activities and lack of population interest. However, in the present time, modern population and the high rate of developmental activities has forced of houses the occupation on flood plains and this makes the society highly vulnerable to flood losses.

India is one of the richest countries in the world with regard to its water resources and it is continuously affected by this natural resource in the form of floods. India receives 75 per cent of its total annual rainfall in just 100 hours of four months of the rainy season. In monsoon seasons, all rivers flow with large amounts of water. These rivers bring floods to the plain areas because of the low slopes and the fast flow of the water. In the last few decades in India the magnitude and the intensity of flood occurrence has increased tremendously. According to the CSE (Centre for Science and Environment), in the present time floods are not only a research issue but have now become a critical topic to think about for environmentalist, Hydrologist, Geographers and for other disciplines also. Now the need for proper management of water has been felt due to the floods.

Types of floods

Flash floods: Such floods occur within six hours during heavy rainfall and usually are associated with towering cumulus clouds, severe thunderstorms, tropical cyclones or during the passage of cold weather fronts. This type of flooding requires rapid localized warnings and immediate response by affected communities. Other causes of floods include Dam failure or other river obstructions.

River floods: Such floods are caused by precipitation over large catchment areas or by the melting of snow or sometimes both. They take place in river systems with tributaries that may cover or drain

large geographical areas and encompass many independent river basins. These floods normally built up slowly or seasonally and may continue for days or weeks as compared with flash floods. Factors like ground conditions like moisture, vegetation cover, depth of snow *etc.* And the sizes of the catchment basin govern the amount of flooding.

Coastal floods: Some floods are associated with the cyclonic activities like Hurricanes, Tropical cyclones *etc.,* Catastrophic flooding from rainwater is often aggravated by wind-induced storm surges along the coast. As in river floods, intense rain falling over a large geographical area will produce extreme flooding in coastal river basins.

Effects of floods

Precisely, the flood hazards have the following impacts on the various anthropogenic activities including two major sectors *i.e.*, agriculture and socio-economic conditions of society:

- Every year millions of people become homeless, rendered for shelter for many days and force to stay under the open sky.
- Millions of houses and settlements have been damaged and large number of them collapsed.
- Hundreds of people fled away in the flood water and equally numbers have been died either due to lack of food availability or epidemics.
- Millions of tonnes of agricultural land come under the deep flood water and not in the condition for further cultivation.
- Millions of tonnes of fertile top soil have been eroded by several major rivers and their tributaries in the country and ultimately they have been deposited in the sea.
- Thousands of hectares of land have been converted into waste land/barren land resulting in problems where a lot of salinity and alkalinity including water logging, originate.
- Production of certain agricultural crops including cash crops are either drastically gone down or have lost their quality and quantity.
- Due to the standing of large quantities of flood water at certain places for long time, various types of water borne diseases and groundwater tables, suddenly rise up.
- Thousands of livestock have either fled away in flood water or have died in the wake of a fodder shortage.
- Landslides followed by incessant rains during floods are very common phenomena. Flood-producing rains can trigger catastrophic debris slides.
- National and state highways including other associated link roads have been submerged in flood water. Consequently the failure of traffic for several weeks or so results in a heavy disruption of economic and commercial activities.
- Due to the submergence of railway tracks in flood water in several rail route sections, rail services are either cancelled or badly disrupted and the result is that villages remain cut-off from the main land until the flood subsides.
- The power supply has been totally damaged both with water and electricity because almost all electric poles are at times uprooted, especially in coastal areas by the speedy winds accompanied by heavy rains.
- The telecommunication networks system has also been hit on a large scale.
- The rural economy has been severely affected and the land destabilized.

Impact of flooding and drought on agriculture

The four variables related to flooding that appear to have the most influence on agricultural are: the geographic area hit and the total area submerged; rainfall intensity (the amount of rainfall over a period of time) ; the time of year when flooding occurs and impedes or delays critical farming operations; and the scope and severity of non-agricultural infrastructure damage that distracts the labour force from farming and undermine labour productivity in the fields. In the past two decades, when intense rainfall occurred within a narrow time frame in the main crop producing areas, it devastated staple crops as well as homes, roads and other infrastructure.

Agriculture is one of the sectors where the direct impacts of the drought are experienced. A significant fall in the food production is often noticed with the increased intensity and extended duration of droughts in the country. It has resulted in serious crop losses of different magnitudes depending upon their geographic incidence, intensity and duration. The impacts of drought not only affect the production at the farm level but also the national economy and the overall food security as well.

During 1987, the country witnessed a severe drought where in the food production was reduced by seven million tones. Similarly in 2000, the food production fell short by nine million tones. In 2002, the delay in the onset of monsoon in several parts of the country severely affected agricultural activities in 12 states. Farmers were unable to sow their crops due to acute deficiency of moisture in soil. 524 districts in the country faced moderate to serious water deficit. The effects of droughts have been more prominent on fodder availability in contrast to the food grains. Another serious concern during drought years has been the scarcity of drinking water for both human as well as livestock population.

Change in precipitation pattern will impact agricultural productivity and hence impact on food and livelihood security. Case studies at the community level highlighted large discrepancies in adaptive capacity across villages, across communities in villages and specifically across individuals depending on land holding size, education *etc.* It was also observed that large farmers were able to benefit from government subsidies, formal bank credit and crop insurance while smaller farmers were having less access to benefits caused due to lack of information and dependence on local merchants for credit.

During 2011, due to the dry spells, 22.36 lakh hectare of agricultural crop and 0.69 lakh hectare of horticultural crop in *kharif* season and 12.11 lakh hectare of agriculture crop in Rabi season suffered losses. In the usual course, the productions of food grains have come down by 50% due to drought conditions.

In North Karnataka over 229 people lost their lives and thousands are now seeking shelter in relief camps. The Karnataka government sources say that 6.55 lakh houses have collapsed, 7, 882 livestock perished, 4, 292 villages have been affected in 75 taluks across 14 districts, of which 346 villages need complete rehabilitation. In all, 400 schools and 1, 050 anganwadis have washed away and 3, 000 more schools severely damaged.

According to the Karnataka Agriculture Department it was a double whammy as some parts of the north Karnataka was reeling under drought prior to the floods and sowing could not be undertaken in 1.66 lakh hectares (only 69.68 lakh was sown as against 71034 lakh hectares last year). Now, the region has lost standing crops in 22 lakh hectares of land to the floods. As far sugarcane, one of the main crop of the area, the loss is estimated to be worth at-least ₹ 500 crores.

As an emergency relief measures soon after the floods, the state government announced 25 kgs of rice, 10 kgs of wheat, 2 kgs of pulses and 5 kgs of sugar and five liters of kerosene and edible oil to each affected family and also promised to relocate the 346 submerged villages to safer places.

Heavy rains due to depression in the Bay of Bengal and low pressure in the Arabian Sea form September 29 to October 2, 2009 caused flash floods.

The floods, of Karnataka and Andhra Pradesh states, were described as the worst floods in 100 years, have displaced thousands of people resulting in loss of lives, livelihood, livestock and caused extensive damage to crops, accumulation of silt on agricultural land, loss of animals, fishermen losing nets and boats, weavers affected by inundation of handloom pits and damages to looms and yarn. The crops affected include paddy, cotton, sugarcane, sunflower, groundnut, red gram, castor, maize and other pulses. In addition to this about 45, 209 tons of dry fodder has either been soaked or washed away. About 101 Veterinary institutions buildings have been damaged.

The total loss estimated by the government of India was ₹ 220 billion. The worth of floods have left 55 dead, affecting 1610250 people in 87 mandals consisting 571 villages and 126 families have lost their tools like fishing nets, ice boxes and got their boats damaged/lost, consequently affecting their livelihood options of fishing.

Flood loss in Bijapur

Bijapur: The flood-related loss in Bijapur district during 2009 has been estimated to be up to ₹ 850.15 crore, according to a report of a preliminary survey conducted by the district-level officers (Bijapur.nic.in).

Sources in the district administration told The district received 3500 mm of rainfall till the end of September, Agriculture crops worth ₹ 166.85 crore, horticulture crops worth ₹ 294.10, minor irrigation tanks worth ₹ 4.91 crore, zilla panchayat roads and tanks worth ₹ 57 crore, Electrical power supply (Hescom) lines worth ₹ 1.59 crore were damaged in the flood waters.

The damages of national highways have been put at ₹ 2.5 crore and that of city roads have been put at ₹ 54.98 crore. In the floods, Health Department medicines worth ₹ 40 lakh and Veterinary Department medicines worth ₹ 30 lakh were damaged.

The Don is a small tributary of the Krishna River in the southern peninsula of India. It originates at Khojanawadi village of Sangli district in Maharashtra and runs for only about 15 km in the state before entering Karnataka at Bannur village of Belgaum district. it travels about 13 km in the Belgaum district and then enters Bijapur district near Honawad village. It runs for a distance of about 141 km in Bijapur district and finally drains into the Krishana River at chaya Bhagavathi in Gulbarga district about 7 km below the Narayanpur Dam. Ti has a total catchment area of 3217 Sq.km, 67 Sq. km in Maharashtra and 3150 Sq.km in Karnataka.

In view of the above facts and information the need for study of the livelihood issues in flood affected farm economy was taken up with the following specific objectives.

1. To study socio-economic profile of the affected households in Don River basin.
2. To assess bio-physical effects of floods on the households.
3. To analyze the impact of damages on the livelihood on households.
4. To document relief and rehabilitation measures and their implications for livelihood.

Hypotheses

1. The socio economic profile of the affected households in Don River basin is poor.
2. The bio physical affects is sever in flood affected area.
3. The damages by flood on the livelihood of the households are very high.

Scope of the study

The impacts of flood and natural disaster coming to public discussion widely due to fast communication network and government have become sensitive to such events. Although many such natural disasters keep happening but most of the polices focus on adopt measures. These events need scientific base for long term planning. In Bijapur and Don-river the floods have been happened for many decades, no measures have been taken. The findings of such study may provide some inputs to policy makers to take up preventive and adaptive measures.

Limitations of the study

The present investigation has limitation of time and physical facilities faced by a student researcher. In spite of all these limitation, efforts were made by the researcher to keep the study as objective as possible by following all norms of scientific research, well-structured schedule and objective measurement.

Besides these limitations, this study also suffered from availability of published literature, since previous research studies available in this area are very less. Despite of all these constraints, every care has been taken to make the study as objective as possible.

REVIEW OF LITERATURE

In this chapter, with a view to evaluate the objectives of the study, findings of some of the earlier research studies have been reviewed. This would enable the researcher to collect information and subject them to sound reasoning and meaningful interpretation. It was hoped that such review of literature would provide a basis for either confirming the earlier results or contradicting them and there by suggesting the points for further improvement.

Keeping in view the objectives of the study, the reviews are presented under the following headings;

2.1 Concept and definition of livelihood

2.2 Socio economic profile of the affected households

2.3 Bio physical effects of floods in the study area

2.4 Impact of damages on livelihoods of households

2.5 Relief and Rehabilitation Measures

2.1 Concept and definition of livelihood

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. Livelihood becomes sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1992).

The concept of livelihoods has gained wide acceptance as valuable means of understanding the factors that influence people's lives and well being particularly those of the poor in the developing world (Davies, 1996).

The risk of a livelihood failure determines the level of vulnerability of a household to income, food, health and nutritional insecurity. Therefore livelihood are secure when households have secure ownership of, or access to resources and income earning activities including reserves and assets, to offset risks, ease shocks and meet contingencies. Sustainable livelihood creation basically translates into the creation of livelihoods that empower individuals to earn enough money to provide for basic amenities such as food, clothing and shelter. It also enables people to lead a life of dignity in a sustainable manner. Livelihoods are way of keeping one self meaningfully occupied by using ones endowments (human and material) to generate adequate resources to meet the requirements of the household in a suitable manner.

Ellis (2000) stated that "A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household". A livelihood intervention (livelihood promotion) is a conscious effort by an agency or an organization to promote and support livelihood opportunities usually for a large number of people. A livelihood intervention is more than income enhancement. It is facilitating asset creation, capacity building and access to opportunities.

Conceptually, 'Livelihoods' denotes the means, activities, entitlements and assets by which people make a living. Assets are defined as: natural/ biological (*i.e.*, land, water, common property resources, flora, fauna), social (*i.e.*, community, family, social networks), political (*i.e.*, participation, empowerment- sometimes included in the social category), human (*i.e.*, education, labour, health, nutrition), physical (*i.e.*, roads, clinics, markets, schools, bridges) and economic (*i.e.*, jobs, saving, credit). The sustainability of livelihoods becomes a function of how men and women utilize asset port folios on both short and long-term basis. Sustainable livelihoods are those that are able to cope with and recover from shocks and stresses such as drought, civil war, policy failure through adaptive and coping strategies (Jirli *et al.,* 2008).

One can describe a 'livelihood' as a combination of the capabilities and resources people have (including social, human, financial, natural and material assets) and the activities they undertake in order to make a living and to attain their goals and aspirations (Bhuvaneshwari, 2008).

The sustainable livelihoods approach is a way of thinking about the objectives, scope and priorities for development work. The approach puts people at the center of development work and it

attempts to understand socio-economic development and resource management from this human perspective. The Development Alternatives (DA) approach encompasses activities intended to help economically disadvantaged members of society to meet their daily subsistence needs in a manner that is dignified, locally appropriate and environmentally sustainable.

2.2 Socio economic profile of the affected households

Carlo de ninno and John (1998) conducted a study on the nutrition status of children in household was more severely deteriorated due to the worst floods in the summer of 1988 (carlo D) used three round panel data set to investigate which households were better protected from longer term nutritional crisis whether the health of flood exposed children recovered to the level of those who were not exposed to flood. The evidence suggested that children exposed to flood were adversely affected by shock of their health and did not recover within the survey period. The results also suggested that ex ante government programmes were effective than ex post interventions to protect the health of children from impact of flood

Lalitha and Sharadha (1998) conducted a study on the socio economic and living condition of farm labour with an objective to examine various socio economic factors which reflect the living condition of farm labourers. Thirty families were interviewed for obtaining the information expenditure pattern, living condition, health and hygienic practices. The results revealed that these families were not entirely depending on various higher standard of living consequently the keeping of the dairy cattle or poultry should be encouraged.

Sing and Singh (2001) conducted a study on socio economic profile of migrant rural labourers in Agra district of Uttar Pradesh and reported that large majority (72.00%) were literates belonging to labour class and the remaining (28.00%) were illiterates.

Kashif Hameed (2001) conducted a study on gender issues in livelihood and flood disaster case studies of Kamra and Kort villages, Jhang district, Punjab with an objective to study the impacts of floods in relation to health, nutrition, literacy, education economic and political participation. The findings of the study revealed that existing flood mitigation strategies in Punjab need to be community participation including gender sensitive, roles and responsibilities for agencies and organisations within the socio cultural values and norms.

Choudhury *et al.* (2004) conducted a study on socio economic perspective of water related vulnerability to climate change based upon the data collected from the selected hydrological unit (SHU) through questionnaire survey supported by PAR and interview with key informants. The SHU which is situated in the northern part of Bangladesh on the left bank river Brahmaputra (locally named as Jamuna) is highly vulnerable to floods. The analysis of the past climate of Bangladesh shows that the average temperature increased at the rate of 0.16 degree Celsius per decade. The pre monsoon and monsoon rainfall increased by about 20 per cent during the previous thirty years. The hydrological observations show that the frequency and intensity of severe floods have increased during the previous three decades. The scenarios of climate change as obtained through the analysis of the outputs of HadRM2 regional climate model shows that the annual mean temperature over the region of the SHU is expected to rise by 1.5 and 2.8 degree Celsius by 2020 and 2050, respectively relative to 1990. Similarly, the annual precipitation is expected to rise by 9.1 and 22.7 per cent for the above two time levels. The pre monsoon precipitation would increase by 27 and 70 per cent. The monsoon precipitation is expected to increase by 4.2 per cent and 9.7 per cent for the above two times levels.

Lopamudra (2005) conducted a study on effects of flood on agricultural wage formation in Bangladesh. The researcher used the district wise monthly data over the period 1979-2000 to model real agricultural wages in Bangladesh as a dynamic process and to estimate the significance of floods in explaining fluctuations in the series. The study revealed that floods as a phenomenon have an overall positive effect on agricultural wages in Bangladesh, even though they caused decline in wages in the districts that were inundated. The wages in general tend to be higher in a frequently flooded districts compared to a less flood prone districts. Extreme floods cause a less dramatic decline in wages when the frequently flooded districts were inundated. The impact of floods on agricultural wages were generated through the flood impacts on agricultural productivity and relative price of crops, accordingly favourable demand condition in agriculture labour market would mitigate the negative impacts of floods on agricultural wages.

Roy *et al.* (2006) conducted a study on socio economic vulnerability and adaptation to environmental risk in Bangladesh with an objective to study household community vulnerability and

adaptive coping mechanism. Seven hundred flood plain respondents living without any flood protection along the river Meghna were interviewed. The results revealed that households with lower income and less access to productive assets faced higher exposure to risk of flooding. Disparity in income and assets distribution at community level further tended to be at higher risk exposure levels implying that individually vulnerable households are also collectively more vulnerable.

Pradhan *et al.* (2007) studied risk of flood related mortality in Sarlahi district of Nepal. Perspective research data base was used to verify residence prior to the flood and to confirm vital status afterwards. The result revealed that flood related fatality rates for children were six times higher than mortality rates in the same village a year before the flood.

Tapsell and Tunstall (2007) studied the relationship between place and the health impacts from flooding with an objective to examine how place both as a physical location within the flood plain and in terms of social places may impact upon the health of those affected. The results revealed that even relatively small localized flood events may seriously disrupt the people's lives and have significant impact upon their physical and particularly their mental health and well being.

Paul and Edmund (2008) conducted a study on impact of floods and flood protection with an objective to study the major investment in flood protection embankments. The study revealed that vulnerability to losses and low income still remain in years of usual floods, due to higher input cost for agriculture, drainage congestion and the risk of embankment breaches.

2.3 Bio physical effects of floods in the study area

Bimal Kanti Pal and Harun Rasid (1993) conducted a study on flood damage to rice crop in Bangladesh. Temporal and spatial pattern of damage to rice crop in Bangladesh resulting from river flooding were analysed countrywide for the period 1962 to 1988 and at the district level from 1967 to 1988. Floods annually damage approximately four per cent of total rice production. But districts varied markedly in flood related crop losses. Absolute magnitude of these losses over time may not justify expensive and controversial flood control initiative currently being implemented in Bangladesh.

Murthy (1994) studied the impact of likely global weather and associated changes in temperature, drought spell, flooding and carbon dioxide on tropical rice. His analysis showed that favourable influence on photosynthesis by 1.5 to 2.0 fold increase in carbon dioxide and other gases may not outweigh the unfavourable effects of rising temperature. The increase in temperature of 2-4 degree Celsius in tropical rice areas may reduce net photosynthesis due to high photo respiration and dark respiration. The average temperature during the wet season may exceed the optimum of 30 degree Celsius for various growth processes. Increase in temperature especially night temperature during reproductive and ripening stages of rice was detrimental for spikelet production and sink potential.

Nagaratna and Sridhar (2003) studied the consequences of drought in Karnataka in 2002-03 with particular reference to livestock and fodder. Three districts of Karnataka (Chamrajnagar, Gadag, Gulbarga) were purposively selected each belonging to severely, moderately and less affected categories through multistage random sampling method. The results revealed that the annual income of household reduced to half in drought year. The reduction was more in case of crops followed by livestock and labour, there was significant difference in number of farmers purchasing fodder during normal and drought year. In drought year 17.34 per cent households resorted to distress selling of livestock and average herd size reduced from 4.15 ACU to 3.85 ACU.

Stein and Okal (2005) conducted a study on speed and size of the Sumatra earthquake. The study revealed that tsunami waves generated by the earthquake were responsible for over 250, 000 dead and missing and left millions homeless and displaced in areas bordering the Indian Ocean.

Samuel *et al.* (2007) conducted study on the rising costs of floods, examining the impact of planning and development decisions on property damage in Florida with an objective to study the non-hurricane flood events in Florida countries between 1997 and 2001. The results revealed that alteration of naturally occurring wetlands significantly increased the property damage caused by floods.

Anonymous (2007) an analysis of data in different states for the period of 1953 to 1997 reveals that the average annual damage to crops, houses and public utilities in the country was around ₹ 9,380 million. On an average, an area of about 8 million hectares (19.6 million acres) was flooded, of which, an average crop area affected was of the order of 3.7 million hectares (9.14 million

acres). The floods claim on an average 1532 human lives and 10, 000 heads of dead cattle every year.

Nizamiddin (2007) conducted study on livelihood at stake as flood affected areas struggle to recover with an objective to estimate rice loss by Sindh flood water. The results revealed that rice was hardest hit with an estimated 3.05 million metric tonnes of produce damage. The researcher reported that in 2007 about 4.41 million metric tonnes of rice, cotton and sugarcane crop worth about ₹ 62.8 million were destroyed.

Ghulamhabbi and Zakir hussain (2008) conducted a preliminary rapid damage assessment of agriculture sector in the flood affected areas Pakistan. About 105, 042 livestock heads and 739, 429 poultry perished in the flood while 739, 249 farm animals were indirectly affected. The indirect losses were more which badly affected the livelihood of inhabitants.

Bradshaw *et al.* (2009) conducted a study on forest-flood relation still tenuous comment on global evidence that deforestation amplifies flood risk and severity in the developing world with an objective to analyse country statistics on flood characteristics land cover, land cover change and deforestation amplifies flood risk and severity in the developing world. The result revealed that population density alone explains up to 83 per cent of the variation is reported flood occurrences considerably more than forest cover or deforestation.

Anonymous (2011), revealed that about 0.15 million of animals and 0.8 million of poultry have been perished in the terrible waves of monsoon floods led to the huge losses to human belongings. This flood has badly affected in Khyber paktunkhwa, after the flood quick response to save the stranded feed deprived and disease prone animals was of almost improve by the emergency response is followed. Rehabilitation in the areas in which interventions have identified for implementation. The focus has being given on the quality of animals keeping rather than quantity. The rehabilitation phase is followed by reconstruction where the areas focus were the development of enterprises and entrepreneurship

2.4 Impact of damages on livelihoods of households

Roger Few (2000) conducted a study on flooding, vulnerability and coping strategies, local responses to a global threat. The results revealed that the importance of research and interventions work aimed at strengthening local capacity to cope with flooding, especially for the poor in developing countries recent theoretical and applied research on vulnerability and adaptative capacity of household community in flood prone area.

Sylvia Tunstall *et al.* (2006) conducted a study on the health effect of flooding in England and Wales: Social research results from England and Wales with an interview survey data by social scientists using established health measures on the health effects of flooding for residents in 30 locations. The study examined the extent to which flooded residents reported suffering physical and psychological health effects during and after the event. It also if explored the issue of whether these effects were long lasting by comparisons with the general population and with those at risk but not flood. The study examined that some flood victims suffered long term mental health effects as a result of their experience of flooding and the influence of a wide range of factors: Characteristics of the flood event type of property and socio demographic and the intervening factors such as the extent of family or community support that may explain the health effects of flooding. It finds that having adequate flood insurance cover are important factors in the stress experienced by flood victims.

Palanivelu (2006) studied the ground water quality in the Tsunami affected costal areas of Chennai. They have studied the TDS values and observed that at a few locations away from the sea TDS increased from May to September 2005. The increase may be due to insufficient rain fall in Chennai during the period till September, which in turn showed that the southern part of the costal Chennai was highly contaminated compared to the northern part. TDS levels observed after tsunami were within the range as observed during September 2004. Thus, the study revealed that the recorded TDS values over time indicated that there was no major impact of the tsunami on water quality.

David Sanderson (2009) conducted a study on impact of recent disasters in urban areas and their contribution to poverty, urban development planning. The results described CARE Internationals household livelihood security (HLS) allows an urban livelihood approach to integrating measures for reducing risk from disasters and it pays particular attention to supporting low income groups and community organisation in building and diversifying their basis.

Sujith and Niharranjam (2010) conducted a study on vulnerability and adaptation analysis in flood affected areas of Orissa with an objective to study the ex ante and ex post adaption responses to weather risk for rural farm households of Orissa and examine how poor rural families adapt with the changing pattern of livelihood. The results revealed that people's preferences were a shift in cropping pattern and insurance which were the most important strategies to adopt with flood and once a proper understanding was achieved the current strategies can be rearranged according to the economy of the area which is subjected to that particular event. This rearrangement can be done with proper consultation with the climate specialist, government, non government organisation, community and involvement PRI.

Federick *et al.* (2010) conducted a study on impact of floods on livelihood and vulnerability of natural resources dependent communities in Northern Ghana. Simplified causal loop diagrams were used to conceptualise flood induced coping strategies in the study area. The results revealed that both in case of seasonal variations in agricultural output and floods, individuals were effectively diversified their livelihood both occupationally and geographically are less sensitive than individuals who mainly achieve entitlement to food via crop cultivation.

Stephen *et al.* (2010) conducted a study on the potential of using agroforestry as a win-win solution to climate mitigation adaptation and meeting food security challenges in southern Africa with on objective to study some of the most profound and direct impact of climate change in southern Africa over years have been droughts, fluctuations in annual rainfall, extreme temperatures and floods. These resulted in low and unstable food production, especially maize which was the staple food in most Southern African countries. Furthermore, research suggested that 30 per cent of threatened plant species would be critically endangered or extinct due to drought, thus further worsening food availability, accessibility and stability in the region. Drought is therefore is assumed to be the major obstacle to the achievement of food security in Southern Africa. Agro forestry is emerging as the promising option to sustain agricultural productivity and livelihoods of farmers.

Nanik Ram and Khushik (2011) conducted a study on impact of flood on the peasant households in Sindh and Balochistan provinces of Pakistan. Two hundred flood affected households are selected randomly and analysed using suitable techniques. The results revealed that the women and children were particularly impacted and there was an increase in mental suffering and irritation in the children.

2.5 Relief and Rehabilitation Measures

Emdad (1997) conducted a study on atmospheric hazards preparedness in Bangladesh with an objective to study the most crucial academic and planning issues identified in the 1991 study (in particular), the natural and characteristics of the cyclone preparedness of the costal inhabitants. The result revealed that hazard mitigation policies should be integrated with national economic development plans and programmes specifically the cyclone warning system should incorporate the human response to warning as its constituent part.

Howard *et al.* (2000) conducted a study on the financial management of catastrophic flood risks in emerging economy countries (Poland) with an objective to study the potential of pre and post disaster instruments for funding disaster response and recovery and for creating incentives for flood loss mitigation. The study revealed that hedging instruments which are instruments for transferring the risk to investors either through insurance or capital market based securities. The hedging instruments can be designed to create incentives for the mitigation of damage to public infrastructure using flood proofing of water treatment plant. The hedging instruments can be an attractive, alternative to financing instruments that have been traditionally used in the poorer, emerging economy countries to fund disaster recovery.

Sujatha *et al.* (2003) conducted a study on economics of flood protection in India with an objective to study the efficacy of flood protection measures through structural and non-structural measures (non-structural measures like flood forecasting and structural measures like construction of embankments, dams, drainage channels and reservoirs) that prevent flood waters based on simple regression. The results revealed that flood protection measures have been inadequate in controlling losses and reducing vulnerability and level of protection is an insufficient explanatory variable in explaining the number of people affected by floods.

Frank and Hanna (2004) conducted a study on disaster preparedness and the cyclone of 1999 in Orissa, India with an objective to study the individuals and communities living in the regions where natural hazards are a part of daily life and develop strategies to cope with and adopt the impact

of extreme events. The results revealed that large loss of life occurred and looks at measures taken to initiate comprehensive disaster preparedness programmes and to construct more cyclone shelters and assessments of disaster preparedness during cyclone at community level awareness was high.

Rajib (2006) conducted study on flood disaster risk reduction in Asia with an objective to study critical issues of community based flood mitigation. The results revealed that river flooding is regarded as a chronic disaster in many part of Asia. A combination of soft and hard measures was required for flood mitigation, although due to resource constrain the efforts are mostly restricted to soft measure. Community based initiatives are found to be more effective in most of the developing countries in Asia, with specific focus on empowerment of local communities and link the community based activities to local development policies.

Ianr Calder and Bruce Aylward (2006) conducted a study on moving to an evidence based approach to watershed and integrated flood management with an objective to study the growing disparity between public perception and scientific evidence relating to the cause of floods. The study revealed that the structural engineering interventions, although in the short term providing protection to flood affected communities in one area may have the effect of transferring the problem downstream and may also introduce other unforeseen adverse environmental and economic impacts. An improved approach to watershed and flood management is proposed that integrates watershed and land use management in the highlands with land use planning, engineering measures, flood preparedness and emergency management in the affected lowlands while taking into account the social and economic needs of communities in both lowlands and highland.

Van Ogtrop *et al.* (2007) conducted the study on flood management in the lower incomati river basin, Mozambique: Two alternatives with an objective to compare two use of flood management. The traditional path way has widely been adopted in developed countries floodwaters by means of dams and dikes. The alternative pathway tends towards a policy where by society lives with the floods by being prepared and having the right damage reduction measure in place. The preliminary results suggested that both pathways were feasible however considering recent hydrological extremes such as 2010 flood, the resilient pathway may ultimately be appealing flood management.

Hirokazu Tatano and Subhajyoti Samaddar (2010) conducted a study on flood risk reduction in livelihood risks: Thoughts and insights from Mumbai with an objective to study the poorest section who are forced to live in the most vulnerable parts of the city affected by 2005 flood. The results revealed local community flood risks were very much related with their livelihood issues and impacts of flood on the livelihood risks of the slum dwellers of Mumbai and also it shows how the existing livelihood risks impinge the disaster risks of the people.

Mpanjilwa Mulwanda (2012) conducted a study on the need for new approaches to disaster management in Lusaka, Zambia. The study focused on consideration of inadequacies in the official responses to floods for those living in squatter settlements. The study revealed that relief operations generally fail to address the priorities of those most affected by disasters and argued for the integration of mitigation and re construction activities into development programmes.

METHODOLOGY

This chapter deals with characteristics of area selected for the study, the methods adopted in selection of samples, nature and sources of data and various statistical tools and techniques employed in analyzing the data.

The methodology is presented under the following headings:

3.1 Description of the study area

3.2 Sampling procedure

3.3 Nature and sources of data

3.4 Analysis of data

3.5 Definitions of terms and concepts used

3.1 Description of the study area

Karnataka is the eighth largest state in India with an area of 190 lakh hectares. It is situated between 11.5° & 19.0° N latitude and between 74° and 78° E longitude in the southern plateau. The State receives an average annual rainfall of about 1139 mm both from southwest and north-east monsoons. Important crops grown in the state are jowar, ragi, maize, bajra and wheat among cereals; red gram, green gram, tur and Bengal gram among pulses; groundnut, sunflower and safflower among oilseed crops and cotton, sugarcane and tobacco among commercial crops.

Karnataka comprises of 29 districts, of which 12 districts are located in Northern part of the state, Bijapur district in Northern Karnataka was chosen for the study purposively based on the quantum of flood affected by farm economy in Don river basin.

Total geographical area of Bijapur district is 10.53 lakh hectares comprising 1, 977 hectares under forest, 8.39 1akh hectares net area under cultivation and remaining is not available for cultivation. It could be noted that, 1.89 lakh hectares out of 8.39 lakh hectares of net cultivated area is utilized for cultivation more than once. Net area irrigated in the District accounts for 27% of net area under cultivation (District at glance 2010-11).

Bijapur district derives its name from its headquarters town, Bijapur. It is also called as Vijapur in Kannada which means city of victory and also considered as Punjab of Karnataka since five rivers flow in this district. Don River which is in consideration is also one among five rivers.

Bijapur district is situated in the Northern part of Karnataka. It is bound on the North by Sholapur district (Maharastra) and on North West by Sangali district (Maharastra). The other sides are bounded by Gulbarga, Bagalkot and Belgaum district of Karnataka state.

The river Don originates at Khojonawadi village in Jatta Taluk (Maharastra). It enters Karnataka at Bonnur village of Athani taluka (Belgaum dist). It runs about 13 KM in Belgaum district. Then it enters Bijapur dist at Honawad village and travels a distance of 158 Km in district. Finally it enters Gulbarga district and travels a distance of about 23 KM and joins Krishna River at downstream of Narayanapur Dam. The total length of Don River is 194 KM. The total catchment of the river is 3797 Sq KM.

Location

Geologically the Don river catchment area is located between 15^0 58' 17 " to 16^0 59' 26" longitude and 75^0 12' 24" to 76^0 25'30" latitude. The area is covered by 47 P and 56D Toposheets of Survey of India with topographical scale of 1: 2, 50, 000.

Physiographic and drainage

The physiographic on the whole is gently sloping slope range from 2% to 5%. The ridges have excessive slope. The plains have normal and valleys have sub-normal relief.

The Don River basin directly drains into river Krishna at Chaya Bhagavathi fall 7 KM down stream the Narayanpur Dam. The drainage pattern in the catchment is sub parallel in the east whereas it is parallel towards west. The drainage density is almost similar throughout the catchment

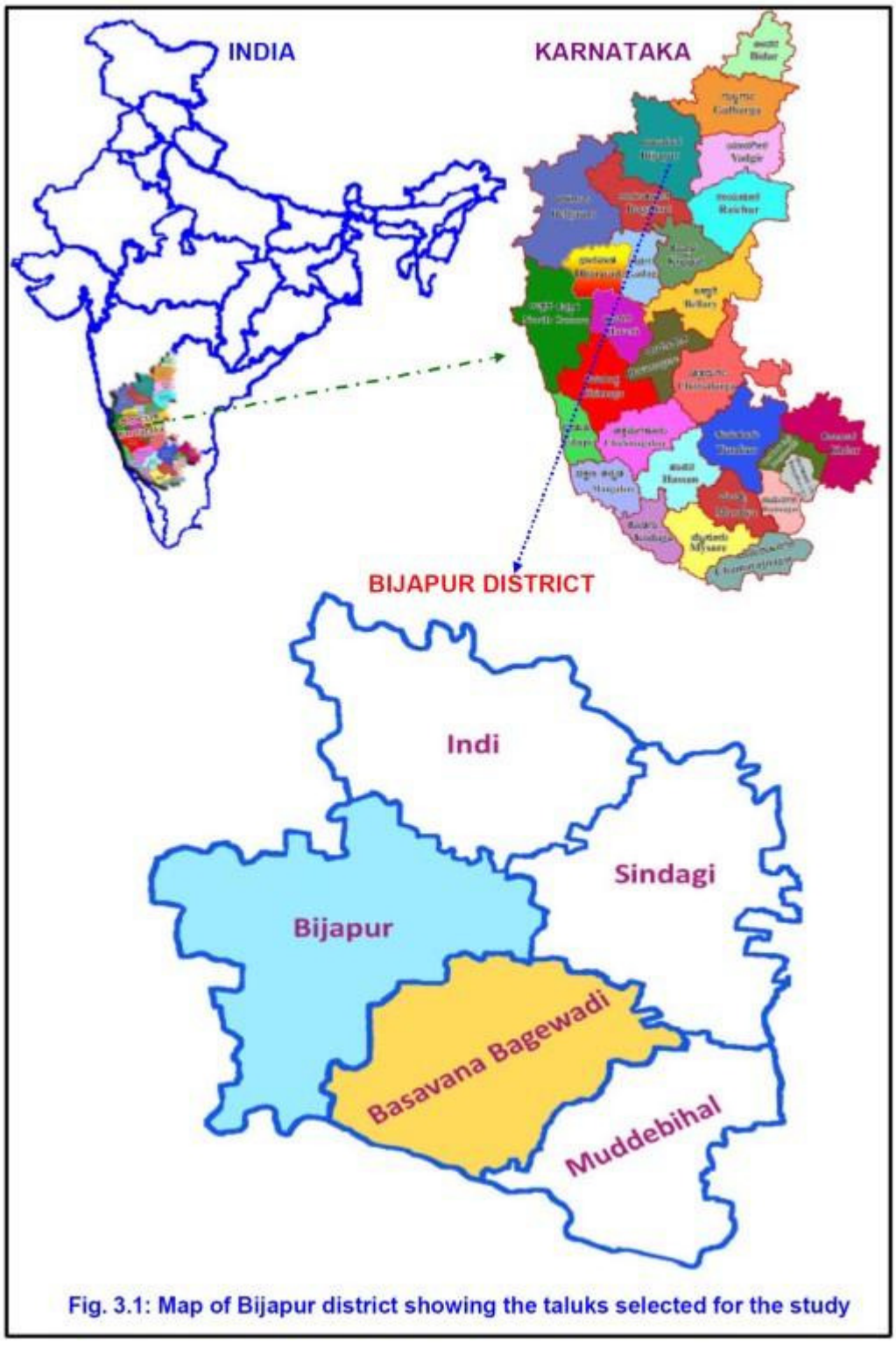

Fig. 3.1: Map of Bijapur district showing the taluks selected for the study

Plate 3.1 Map of Bijapur district showing the taluks selected for the study

Shape and size

The catchment looks like horizontal balloon kite. It is wider in the east gradually elongated and narrow spreading from east to west.

Geology

Majority of the area is dominated by Basalt and other trap intrusions. Granite and grano-diorite followed by lime stones, flat elevated beddings rising steep from, otherwise very gently undulating grano-diorite are observed. Schists occur as random paths within the grano-diorite landscape. Shale's and sand stone patch occur as intermittent belts interspersed between the meta sediments and grandiosities. They give rise to deep clay profiles mostly qualifying for Vertisols. Again critical analysis of consecutive five yearly rainfall indicated that of five years, one year was found to be the worst, one year bad, moving average of two years moderate and one year the best. However, the occurrence of these years did follow any definite pattern.

Because of very low rainfall with higher co-efficient of variation (30.8%) desiccating wind velocity, high potential evaporation and less stored soil moisture crops frequently experience severe moisture stress.

Climate

Climatically the Don River basin has been classified as semi aired, but its aridity index is 65. And it is very close to the aridity index of 66.6. The analysis of historical rainfall 1901-1997 distribution pattern of Don River basin nearly shows that out of 97 years 14 years received less than 400 mm of rainfall, 47 years received between 400 mm to 600 mm of rain fall and more then 600 mm of rain fall was received during 36 years. In general there is increase in trend in the annual avg. rain fall. Out of 97 years 1916, 1964 & 1996 received very abnormal rainfall.

Depth of water stream of the river has been very much reduced due to siltation. Because of deposition of silt, the water all along the run of the river flows extremely slow. It over flows on the cultivable lands temporarily submerging them and making them unfit for cultivation.

There is reduction in the velocity of River due to siltation, non-clearing of obstructions, improper dismantling in old cause ways, floating and stuck up of uprooted shrubs and trees. All these have resulted in plentiful growth of obnoxious weeds like Typha (*Typha aungustata*) and *Prosophis juliflora*.

In order to restore the sustained productivity in the problematic soils of Don River catchment, there is an urgent need to address the problems through well defined objectives.

3.2 Sampling procedure

Bijapur district was selected purposively for the study as based on the quantum of flood affected by farm economy in Don River basin in Bijapur and B.Bagewadi- taluks in Bijapur district.

3.2.2 Selection of the sample respondents

Flood affected households were selected purposively in the left and right bank with severely affected villages of Don River basin in the district. Further, in the left and right bank of the river of Bijapur Taluk 60 affected households and also 60 affected households in Basavana Bagewadi Taluk with 40 large farmers, 40 small farmers and 40 landess laborers were selected randomly. Thus, total size of the sample selected for the study was 120.

3.3 Nature and sources of data

3.3.1 Primary data

Data needed for the study were collected from respondents by personal interview method using pre-tested schedule. Majority of the respondents did not maintain records of the loss to them by flood. Hence, data collected were based on memory of the respondents. At the time of interview, personal bias of the sample farmers was minimized by convincing them about the genuiness of the purpose for which the data were collected. Each one of them interviewed separately to collect necessary information.

The data pertaining to (a) general characteristics of the farm family such as age, occupation, education qualification, size of the family, distribution of land holding and its utilization and source of

irrigation (b) Bio-physical effects of floods *i.e.* crop loss, livestock dead, building damaged, employment pattern and household items (c) Impact of damages *i.e.* constraints faced by households during floods and (d) Relief and Rehabilitations for affected households.

3.3.2 Secondary data

Secondary data pertaining to the extent of crop loss, flood affected area, relief and rehabilitations measures will be collected from Agricultural office, Department of Economics and Statistics and Regional Agricultural Research Station of Bijapur.

3.4 Analytical tools and techniques employed

To fulfill the specific objectives of the study, based on the nature and extent of data, the following analytical tools and techniques were adopted.

1. Tabular presentation
2. Garrett's ranking technique

3.4.1 Tabular presentation

The data collected were presented in tabular form to facilitate easy comparison. Tabular presentation was adopted to compile general characteristics of the sample farmers,

Data regarding number of farmers' affected, total area covered and quantum of relief and rehabilitation work done were analyzed by tabular analysis.

Tabular analysis was adopted also for analyzing the distribution of land holding and its utilization and source of irrigation, crop loss, livestock dead, building damaged employment pattern and household items. Simple statistical tools like averages and percentages were used to compare, contrast and interpret results properly.

3.4.2 Garrett's ranking technique

To find out the most significant factor which influences the respondent, Garrett's ranking technique was used. As per the method, respondents have been asked the rank for all factors and the outcome of such ranking have been converted in to scores value with the help of the following formula:

$$\text{Per cent position} = \frac{100\ (Rij - 0.5)}{Nji}$$

Where

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

Nj = Number of variable ranked by j^{th} respondents

With the help of Garrett's Table, the per cent postion estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor.

3.5 Definitions of terms and concepts used

1. Livelihood

Livelihood is sustainable when people cope with and recover from shocks and crisis (e.g., seasonal, environmental and economic) and can maintain or enhance their capability and assets both now and in the future, while not undermining the natural resource base.

2. Floods

Floods are sudden and temporary inundation of a large area as an overflowing of rivers or reservoirs.

3. Drought

Drought is an event that results from lower than normal expected rainfall over a season or period.

4. Earthquake

It is a sudden release of energy accumulated in deformed rocks of earth crust causing the ground to tremble or shake.

5. Cyclone

Cyclones are violent storms, often of vast extent, characterized by strong and high winds rotating about a calm center of low atmospheric pressure.

6. Habitat

The place or type of site where an organism or population naturally occurs.

7. Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

8. Vulnerability

An intrinsic feature of people at risk. It is a function of exposure, sensitivity to impact of the specific, unit exposed and the ability or inability to cope or adapt.

9. Preparedness

Measures to ensure that communities and services are capable of coping with the effect of disaster.

10. Response

Measures taken in anticipation of, during and immediately after a disaster for minimizing its adverse impact.

11. Recovery

Measures are initiated to undertake reconstruction of physical infrastructure and restoration of economic and emotional well being.

12. Prevention

Measures to eliminate or reduce the incidence of severity.

13. Relief

The feeling that comes when something burdensome is removed or reduced; as he heard the news he was suddenly flooded with relief.

14. Rehabilitation

Restoration of an entity to its normal or near-normal functional capabilities after the occurrence of a disabling event.

15. Embankment

The newly constructed embankment was credited for saving the town against extreme water damage during the latest flood.

16. Severe flood

The farmer, who losts his farm, buildings, livestock and crops is known as severe flood affected.

17. Moderate flood

The farmer, who losts his crops and livestock is known as moderate flood affected.

18. Slight flood

The farmer, who losts only his crops is called slight flood affected.

RESULTS

Data collected for the study from various sources were analyzed using appropriate techniques and the results of analysis are presented in this chapter under the following headings.

4.1 Socio-economic characteristics of sample farmers in Don River basin.

4.2 Bio-physical effects of flood on households.

4.3 Impact of damages on the livelihoods of households.

4.4 Relief and rehabilitations measures and their implications for livelihood.

4.5 Hardships faced by the households during floods.

4.1 Socio-economic characteristics of sample farmers in Don river basin

An understanding of general characteristics of sample farmers is expected to provide a bird's eye view of the general features prevailing in the study area. Therefore, an attempt has been made in the study to analyze some of the important characteristics of sample farmers and the same are presented in Table 4.1.

4.1.1 Age and education status of the sample farmers

It is apparent from Table 4.1 that, 42.25 per cent of the respondents belonged to younger age category followed by 35.25 per cent and 20.5 per cent of respondents belonging to middle age and old age categories, respectively.

It could be observed from Table 4.1 that 32.5 per cent of respondents studied up to primary level, while a large percentage of farmers 30 per cent remained illiterate. 20 per cent up to college level and 17.5 per cent up to secondary school level among large farmers. Among the small farmers 37.5 per cent of respondents were literate up to primary level, 10 per cent up to secondary school level and 7.5 per cent up to college level and 45 per cent remained illiterate. Among landless category, 50 per cent of respondents were illiterate followed by 32.5 per cent up to primary level, 17.5 per cent up to secondary school level and 0 per cent up to college level.

4.1.2 Family type, marital status and occupation of sample farmers

It could be observed from Table 4.2 that 42.5 per cent, 62.5 per cent and 92.5 per cent of the sample farmers belonged to nuclear family type while the remaining 57.5 per cent, 37.5 per cent and 7.5 per cent of the sample farmers were belonged to joint family type in case of large farmers, small farmers and landless laborers, respectively.

It could be observed from table that 87.5 per cent, 90 per cent and 95 per cent of the sample respondents were married and 12.5 per cent, 10 per cent and 5 per cent of the sample respondents were unmarried in case of large farmers, small farmers and landless laborers, respectively.

Regarding occupation of sample farmers, majority of large farmers 92.5 per cent and small farmers 87.5 per cent were actual cultivators, while the remaining percentage of farmers belonged to non- agricultural category. The landless laborers depended on manual farm job.

4.1.3 Income pattern of the sample farmers

Table 4.3 depicts income pattern of sample households. The average annual income of large farmers was . 2,21,600 per household followed by . 1,82,525 per household of small farmers and . 69, 370 per household of landless laborers.

The percentage share of farm income was 72.04 per cent among large farmers followed by 68.35 per cent among small farmers and 0 per cent among landless laborers.

The non- farm income sources were petty business, salaries and labor wages. Other sources of included fruit, nut, eatables and vegetable vending.

4.1.4 Expenditure pattern of sample farmers

Table 4.4 presents an overview of family expenditures. The average expenditure per household was . 81,016, followed by that of small farmers . 56,273 and land less laborers . 35,675.

Table 4.1: Age and Education Status of Sample Respondents

Sl. No.	Particulars	Large Farmers		Small Farmers		Land Less labors	
		Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1.	**Age**						
a.	Young (<35 yrs)	11	27.5	20	50	17	42.5
b.	Middle (36 to 50 yrs)	14	35	14	35	16	40
c.	Old (>50 yrs)	15	37.5	6	15	7	17.5
	Total	**40**	**100**	**40**	**100**	**40**	**100**
2	**Education**						
a.	Illiterate (0)	12	30	18	45	20	50
b.	Primary (1-7)	13	32.5	15	37.5	13	32.5
c.	Secondary School (8-10)	7	17.5	4	10	7	17.5
d.	College (>10)	8	20	3	7.5	0	0
	Total	**40**	**100**	**40**	**100**	**40**	**100**

Table 4.2: Family type, Marital Status and OCCUPATION of Sample Respondents

Sl. No.	Particulars	Large Farmers		Small Farmers		Land Less labors	
		Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1.	**Family Type**						
a.	Nuclear	17	42.5	25	62.5	37	92.5
b.	Joint	23	57.5	15	37.5	3	7.5
	Total	**40**	**100**	**40**	**100**	**40**	**100**
2	**Marital Status**						
a.	Married	35	87.5	36	90	38	95
b.	Unmarried	5	12.5	4	10	2	5
	Total	**40**	**100**	**40**	**100**	**40**	**100**
3	**Occupation**						
a.	Agriculture	37	92.5	35	87.5	0	0
b.	Non-Agriculture	3	7.5	5	12.5	40	100
	Total	**40**	**100**	**40**	**100**	**40**	**100**

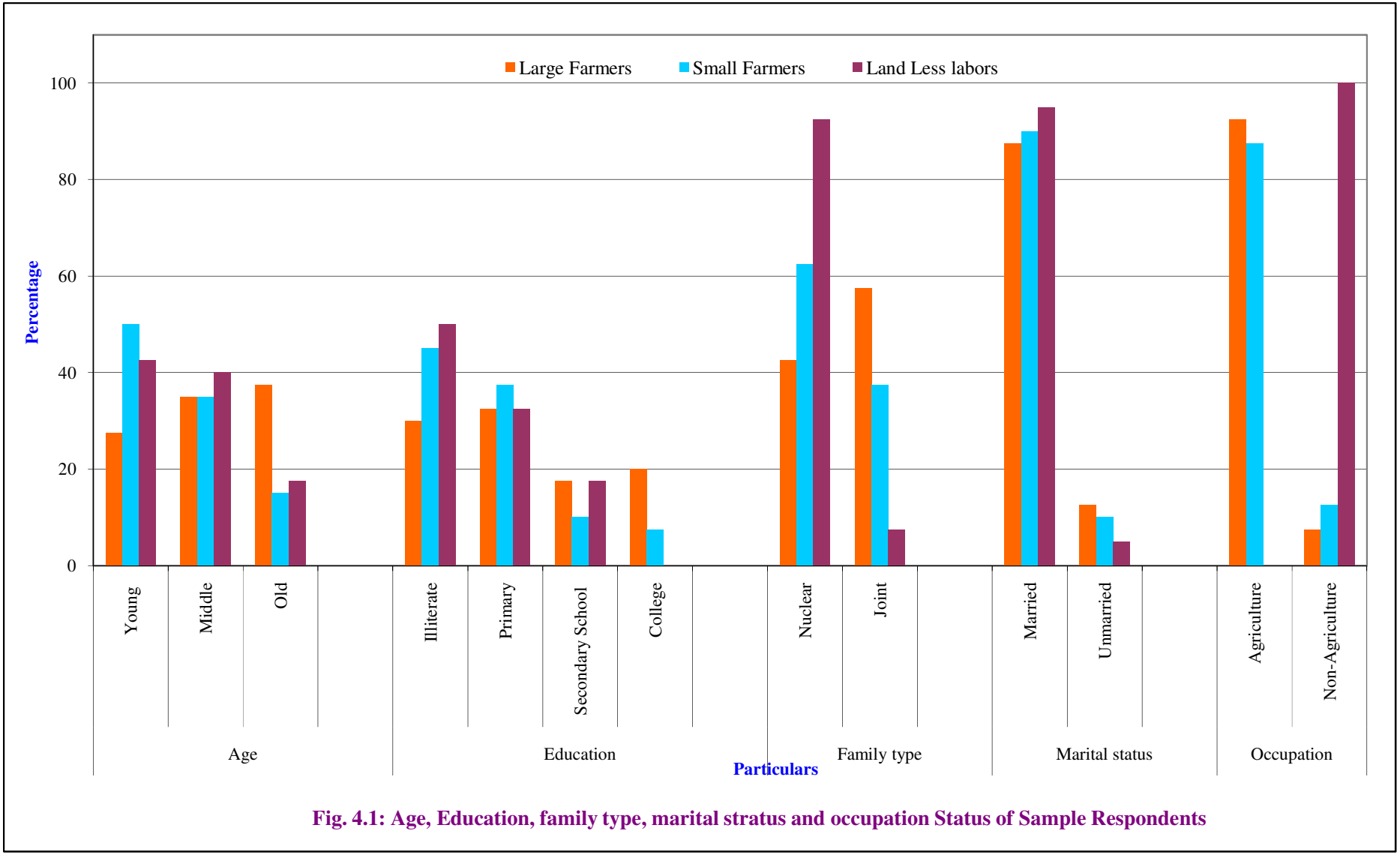

Fig. 4.1: Age, Education, family type, marital stratus and occupation Status of Sample Respondents

Table 4.3: Income Pattern of Sample Respondents (Amt in Rs.)

Sl. No.	Particulars	Large Farmers (n=40)	Small Farmers (n=40)	Land Less labors (n=40)
1	**Farm**			
a.	Agriculture and Allied	159625 (72.04)	124750 (68.35)	0
2	**Non-Farm**			
a.	Business	12375 (5.59)	3250 (1.79)	0
b.	Salaried Occupation	45350 (20.47)	23500 (12.88)	4850 (6.99)
c.	Agriculture Wages	2500 (1.13)	31000 (16.98)	51570 (74.35)
d.	Others	1750 (0.79)	1825 (0.99)	13390 (19.31)
.	**Total**	**221600** **(100)**	**182525** **(100)**	**69370** **(100)**

Figures in parentheses indicate percentage to total

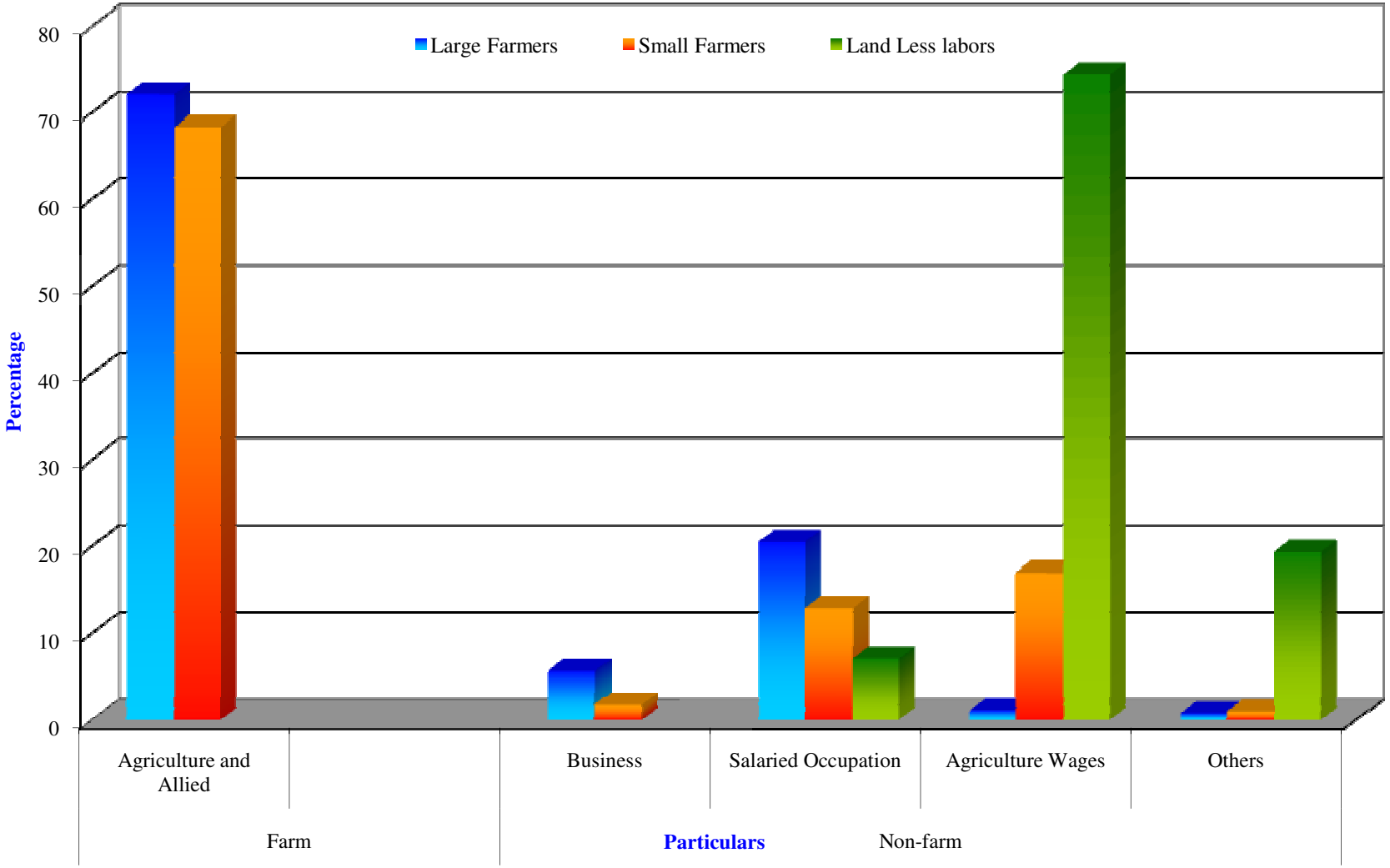

Fig. 4.2: Income Pattern of Sample Respondents (Amount in ₹)

Table 4.4: Annual Expenditure Pattern of Sample Respondents (Amt in Rs.)

Sl. No.	Particulars	Large Farmers (n=40)	Small Farmers (n=40)	Land Less labors (n=40)
1.	Food	18700 (23.09)	24450 (43.45)	19788 (55.45)
2.	Clothing	12500 (15.43)	6912 (12.29)	5887 (16.50)
3.	Education	18625 (22.99)	6225 (11.07)	3650 (10.22)
4.	Health	8650 (10.68)	3975 (7.17)	2850 (7.98)
5.	Ceremonies	7475 (9.23)	3625 (6.45)	2837 (7.96)
6.	Life Insurance	3612 (4.46)	422 (0.85)	237 (0.67)
7.	Vehicle Maintenance	2375 (2.94)	987 (1.76)	437 (1.23)
8.	Miscellaneous	9075 (11.21)	9075 (16.13)	187 (0.53)
	Total	**81016** **(100)**	**56273** **(100)**	**35675** **(100)**

Figures in parentheses indicate percentage to total

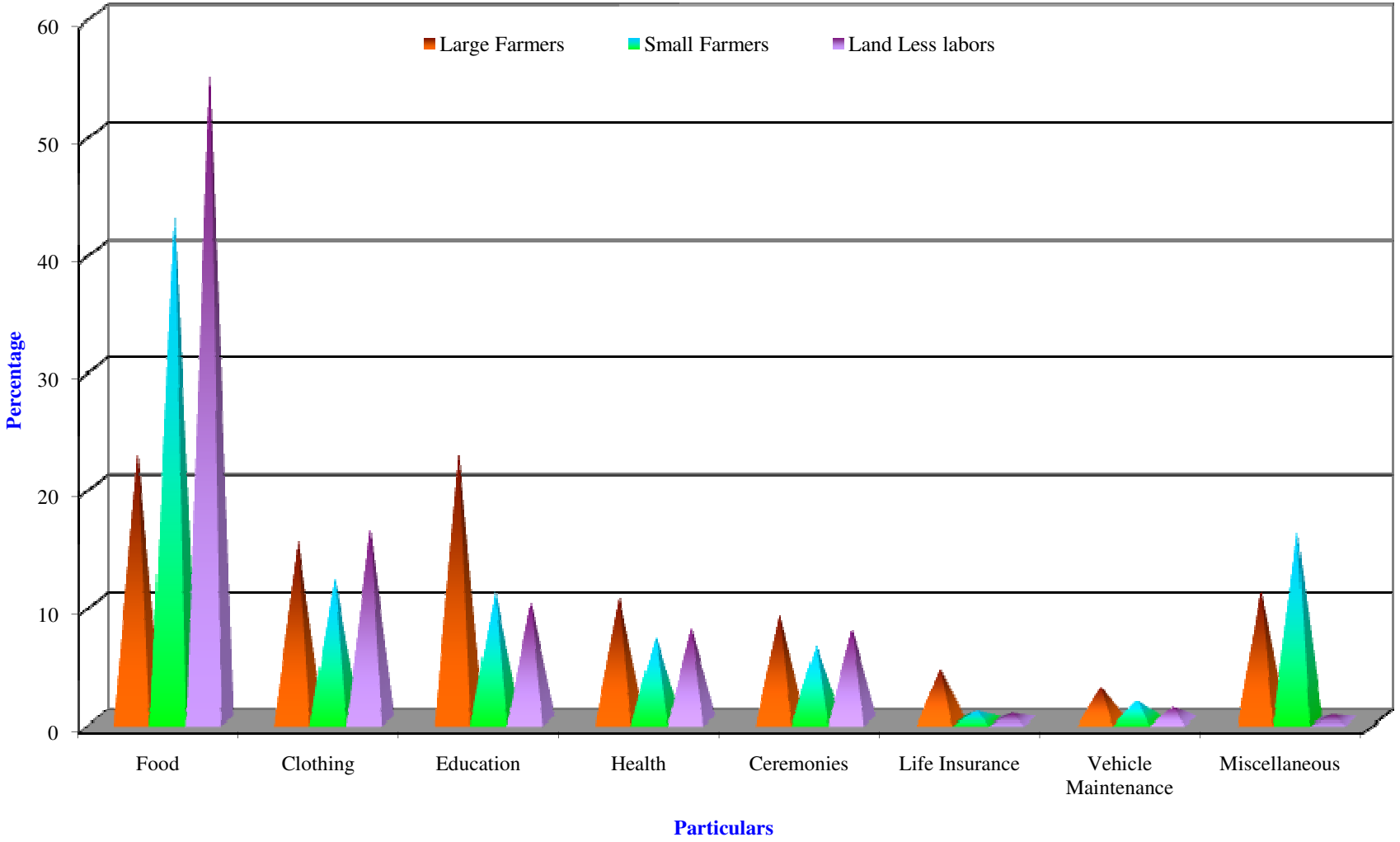

Fig. 4.3: Annual Expenditure Pattern of Sample Respondents (Amount in ₹)

4.1.5 Land holding pattern of sample farmers

Table 4.5 presents the average land holding pattern of sample farmers. The average holding of large farmers was 3.10 ha and while that of small farmers was 1.34 ha. Among large farmers the percentage of irrigated land was more at about 72 per cent while it was only about 38 per cent among small farmers.

Among large farmers field crops occupied a large portion of land 97 per cent, while horticultural crops occupied the remaining 3.23 per cent of land. Among the small farmer, 91 per cent of land was occupied by field crops while the remaining 8.96 per cent land was under horticultural crops. Thus the predominant cropping pattern was cultivation of field crops.

4.1.6 Irrigation pattern of sample farmers

Table 4.6 depicts the situation of irrigation pattern of sample households. The percentage share of irrigation was 79.50 per cent (1.76 ha) by tube wells, 1.98 per cent (0.04 ha) by river and 18.54 per cent (0.41 ha) by other sources among large farmers followed by 52.39 per cent (0.27 ha) by tube wells and 47.68 per cent (0.24 ha) by other sources among small farmers.

4.1.7 Asset position of sample farmers

It can be observed from Table 4.7 that the total value of assets of farmers declined from large farmers . 35.56 lakhs to small farmers . 8.78 lakhs to landless laborers . 1.47 lakhs.

4.2 Bio-physical damages of flood on households

4.2.1 Loss of building due to flooding

It could be observed from the Table 4.8 that the important bio-physical damages considered in the study area were damages to dwelling houses, livestock sheds and irrigation pump sets.

The large farmers suffered various degrees of loss to dwelling houses. It was severe in 40 per cent of cases, moderate in about 33 per cent cases and slight in about 27 per cent of cases. The average loss of value per household dwelling house was to the extent of . 67,437 for large farmers.

The loss in livestock shed was severe in 45 per cent cases followed by moderate in 35 per cent cases and slight in 20 per cent of cases. The average loss per household was to the extent of . 49,725.

The loss in irrigation pump sets was severe in 42.5 per cent cases followed by moderate in 30 per cent cases and slight in 27.5 per cent of cases. The average loss per household was to the extent of . 26,325.

In case of small farmers, loss to dwelling houses was severe in 52.5 per cent of cases, moderate in about 30 per cent cases and slight in about 17.5 per cent of cases. The average loss of value per household dwelling house was to the extent of . 74,150 for small farmers.

The loss in livestock shed was severe in 42.5 per cent cases followed by moderate in 32.5 per cent cases and slight in 25 per cent of cases. The average loss per household was to the extent of . 48,725 and highest being . 66,176 per household in severe cases.

The loss in irrigation pump sets was severe in 22.5 per cent cases followed by moderate in 42.5 per cent cases and slight in 12.5 per cent of cases. The average loss per household was to the extent of . 20,075.

The landless laborers suffered varied degrees of loss to dwelling houses. It was severe in 57.5 per cent of cases, moderate in about 17.5 per cent cases and slight in about 25 per cent of cases. The average loss of value per household dwelling house was to the extent of . 72,625 for landless laborers.

The loss in livestock shed was severe in 15 per cent cases followed by moderate in 27.5 per cent cases and slight in 20 per cent of cases. The average loss per household was to the extent of . 25,825 and average loss in severe cases was to the extent of . 65,666 per household.

While no loss was reported in irrigation pump sets in case of landless laborers.

Table 4.5: Land Holding Pattern of Sample Respondents (Area in ha)

Sl. No.	Particulars	Large Farmers (n=40)		Small Farmers (n=40)	
		Area	Per cent	Area	Per cent
1.	Irrigated	2.22	71.61	0.51	38.06
2.	Un irrigated	0.88	28.52	0.83	61.94
3.	Owned	3.10	100.00	1.34	100.00
4.	Cultivable	3.10	100.00	1.34	100.00
5.	Field Crops	3.00	96.77	1.22	91.04
6.	Horticulture Crops	0.10	3.23	0.12	8.96

Table 4.6: Irrigation Pattern of Sample Respondents (Area in ha)

Sl. No.	Particulars	Large Farmers (n=40)	Small Farmers (n=40)
1.	Canal	0	0
2.	Tube Well	1.76 (79.50)	0.27 (52.39)
3.	River	0.04 (1.98)	0
4.	Others	0.41 (18.54)	0.24 (47.68)
	Total	**2.22** **(100)**	**0.51** **(100)**

Figures in parentheses indicate percentage to total

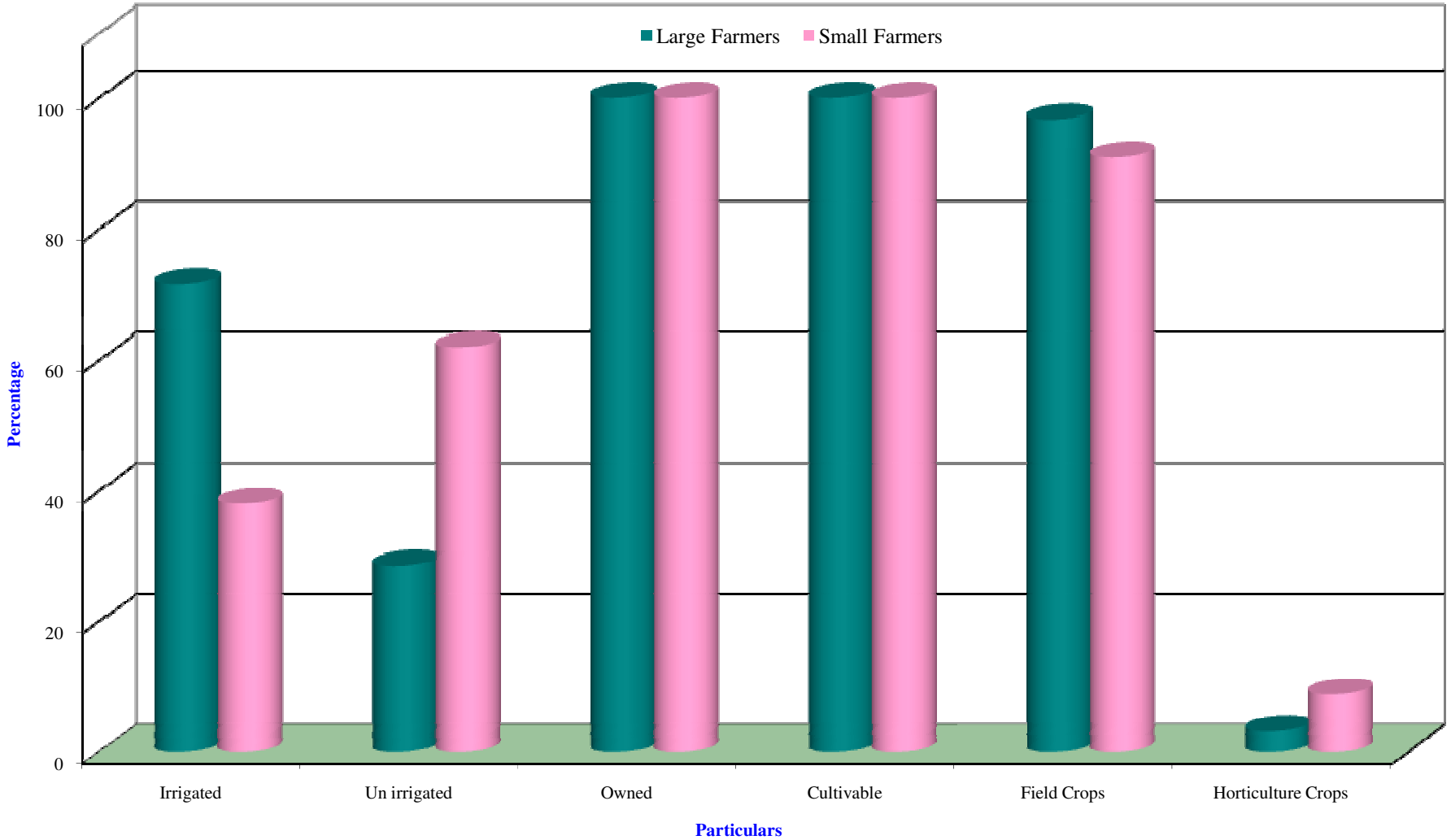

Fig. 4.4: Land Holding Pattern of Sample Respondents (Area in ha)

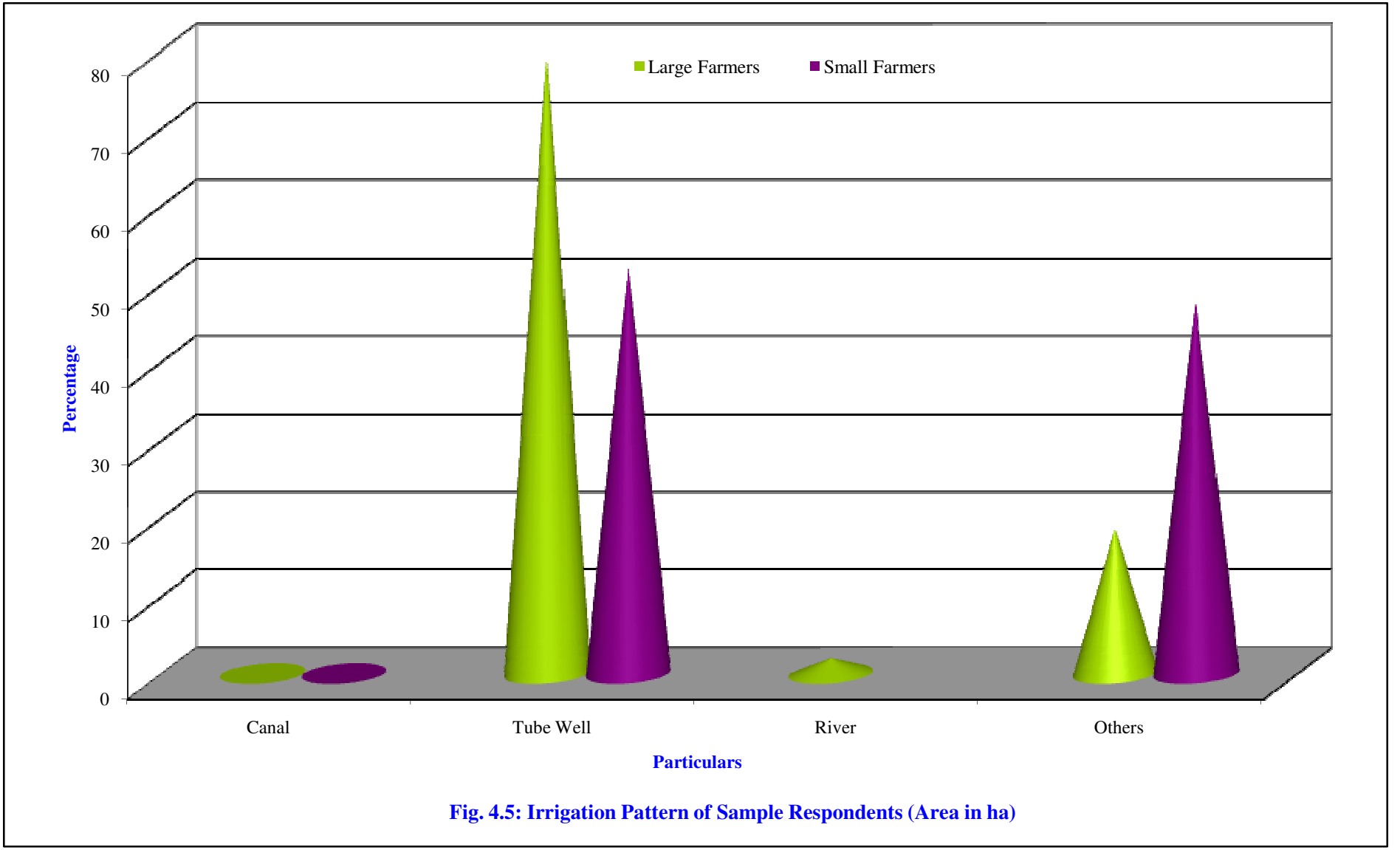

Fig. 4.5: Irrigation Pattern of Sample Respondents (Area in ha)

Table 4.7: Farm Asset Position of Sample Respondents (Amt in Rs.)

Sl. No.	Particulars	Large Farmers (n=40)	Small Farmers (n=40)	Land Less labours (n=40)
I	**Immovable**			
a.	Land	3296675 (92.71)	703125 (80.10)	0 (0.00)
b.	Building	121625 (3.42)	96875 (11.04)	87250 (76.08)
II	**Movable**			
a.	Tractor	35000 (0.98)	0 (0.00)	0 (0.00)
b.	Car/Two wheelers	19875 (0.56)	9000 (1.03)	6000 (5.23)
c.	Sprayers	2750 (0.08)	0 (0.00)	0 (0.00)
d.	Bullock Cart	9475 (0.27)	3975 (0.45)	750 (0.65)
e.	Harrows	550 (0.02)	0 (0.00)	0 (0.00)
f.	Ploughs	600 (0.02)	0 (0.00)	0 (0.00)
g.	Baskets/Sickels/other tools	6537 (0.18)	3662 (0.42)	2125 (1.85)
III	**Livestock**			
a.	Bullocks	26875 (0.76)	23925 (2.73)	5000 (4.36)
b.	Baffaloes	17750 (0.50)	17237 (1.96)	3850 (3.63)
c.	Sheep & Goat	18000 (0.51)	20020 (2.28)	9700 (8.46)
	Total	**3555712 (100)**	**877819 (100)**	**114675 (100)**

Figures in parentheses indicate percentage to total

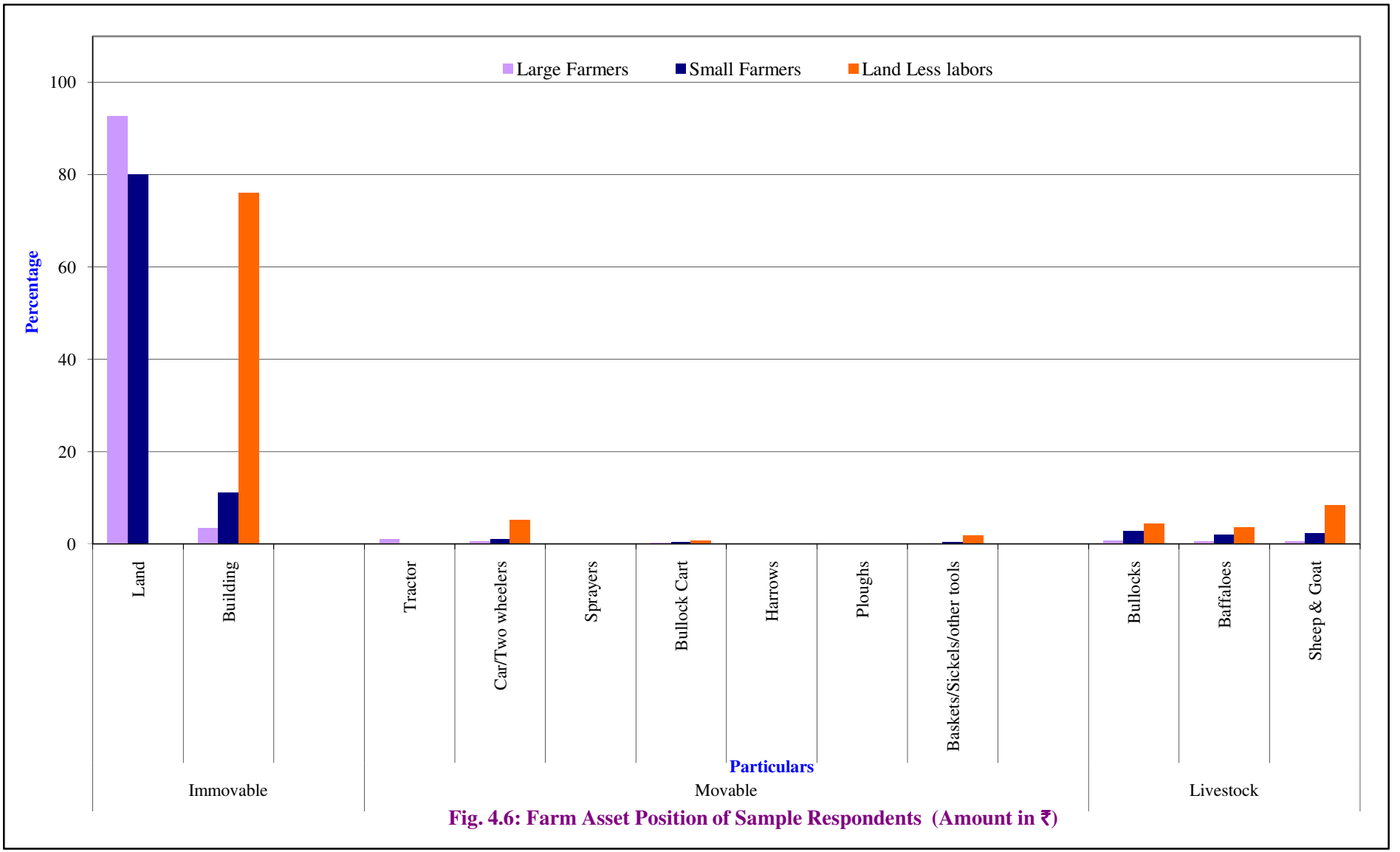

Fig. 4.6: Farm Asset Position of Sample Respondents (Amount in ₹)

Table 4.8: Degree of Bio-Physical Damages due to Flooding

Sl. No.	Farmers category	Particulars	Severe			Moderate			Slight			Average (`/HH)
			No	Percentage	Value (`/HH)	No	Percentage	Value (`/HH)	No	Percentage	Value (`/HH)	
1.	Large Farmers	Dwelling House	16	40	89531	13	32.5	61615	11	27.5	42181	67437.5
		Livestock Shed	18	45	66611	14	35	42214	8	20	24875	49725
		IP Pump house	17	42.5	34352	12	30	24250	11	27.5	16281	26325
2.	Small Farmers	Dwelling House	21	52.5	88142	12	30	67666	7	17.5	43285	74150
		Livestock Shed	17	42.5	66176	13	32.5	44230	10	25	24900	48725
		IP Pump house	9	22.5	33666	17	42.5	25000	5	12.5	15000	20075
3.	Landless laborers	Dwelling House	23	57.5	89173	7	17.5	65714	10	25	39400	72625
		Livestock Shed	6	15	65666	11	27.5	40545	8	20	24125	25825
		IP Pump house	0	0	0	0	0	0	0	0	0	0

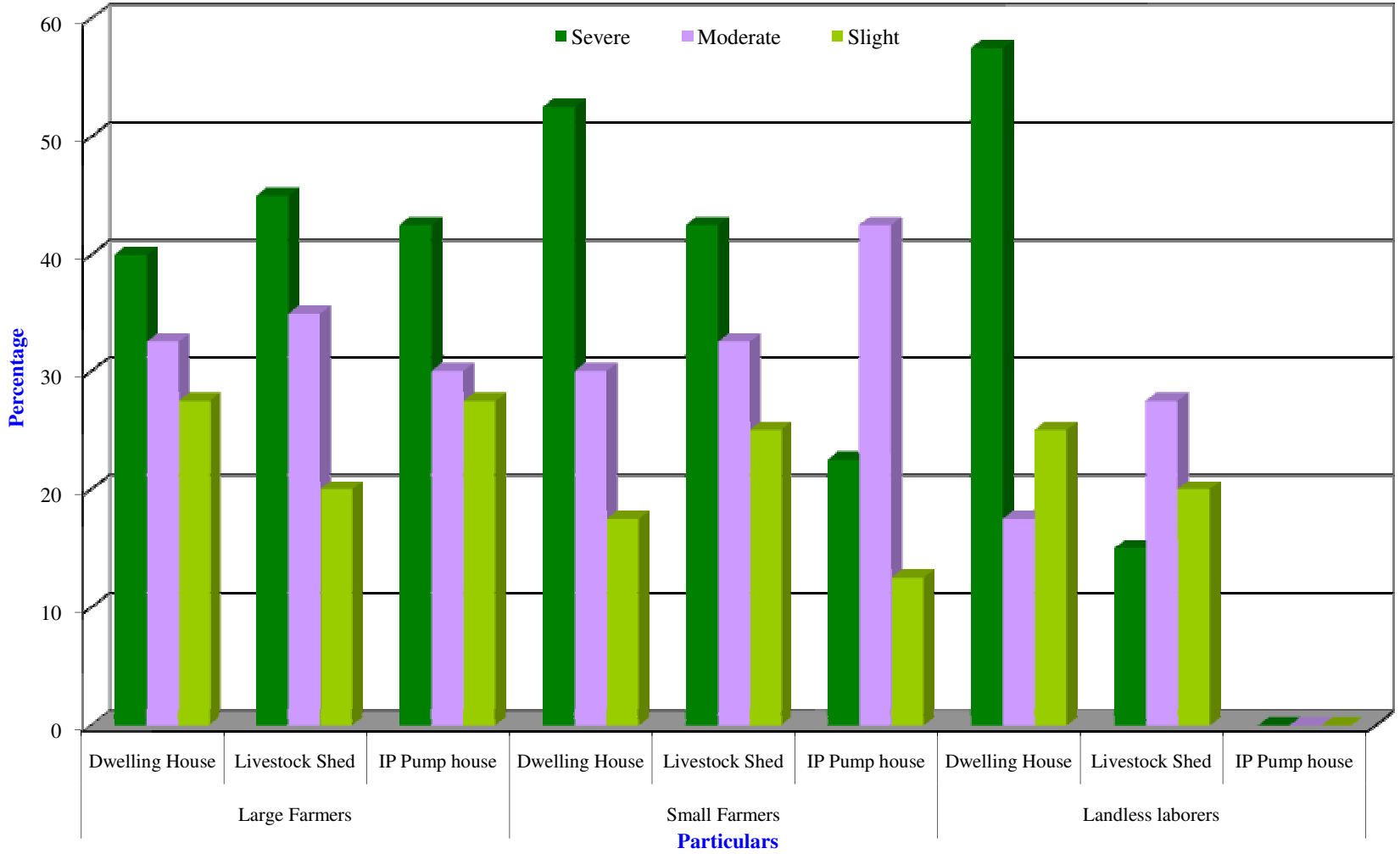

Fig. 4.7: Degree of Bio-Physical Damages due to Flooding

4.2.2 Loss of livestock due to flooding

It could be observed from Table 4.9 that cattle, goat and sheep were the important livestock lost due to flooding. Regarding loss in livestock due to floods in the affected area, the total value of cattle loss suffered by large farmers was to the extent of (₹ 9.50 lakhs) per household. Out of this the loss in value due to lost cattle was (₹ 4.4 lakhs) followed by dead cattle at ₹ 4.59 lakhs and diseased/handicapped cattle were ₹ 0.49 lakhs.

In case of goat, total loss was ₹ 2.35 lakhs in which the share of lost animals was (₹ 0.91 lakhs) followed by death of animals (₹ 0.84 lakhs) and diseased/handicapped (₹ 0.60 lakhs).

In case of sheep, the total loss was to the extent of ₹ 0.98 lakhs. The loss due to lost of animals was (₹ 0.27 lakhs) followed by death of animals at ₹ 0.59 lakhs and diseased/handicapped at ₹ 0.12 lakhs.

The total cattle loss suffered by small farmers was to the extent of ₹ 7.89 lakhs, in which loss due to lost cattle was ₹ 2.29 lakhs followed by dead cattle (₹ 3.40 lakhs) and diseased/handicapped cattle (₹ 1.60 lakhs).

In case of goat, total loss was ₹ 8.20 lakhs, in which the share of lost animals was ₹ 4.06 lakhs followed by death of animals (₹ 2.94 lakhs) and diseased/handicapped (₹ 1.20 lakhs).

In case of sheep, the total loss was to the extent of ₹ 4.33 lakhs. The loss due to lost of animals was ₹ 1.26 lakhs followed by death of animals (₹ 2.39 lakhs) and diseased/handicapped (₹ 0.68 lakhs).

The total cattle loss suffered by landless laborers was to the extent of ₹ 3.21 lakhs, in which loss due to lost cattle was ₹ 0.51 lakhs followed by death of cattle (₹ 2.21 lakhs) and diseased/handicapped cattle (₹ 0.49 lakhs).

In case of goat, total loss was ₹ 2.69 lakhs, in which the share of lost animals was ₹ 0.84 lakhs followed by death of animals (₹ 1.19 lakhs) and diseased/handicapped (₹ 0.66 lakhs).

In case of sheep, the total loss was to the extent of ₹ 2.08 lakhs. The loss due to lost of animals was ₹ 0.32 lakhs followed by death of animals (₹ 1.44 lakhs) and diseased/handicapped (₹ 0.32 lakhs) respectively.

4.2.3 Loss to infrastructure due to flood and heavy rains

Table 4.10 presents a picture of loss in public infrastructure. The total loss assessed by the district administration was to the value of about . 2,889.75 lakhs.

The major infrastructure facilities affected were roads, bridges/culverts, watershed/irrigation structures and water supply and electricity facilities.

The total length of various types of roads damaged was about 577 kms estimated to be worth of . 1,614 lakhs.

The total number of bridges and culverts damaged was 168 estimated at . 454 lakhs. Damage to bridges and culverts cuts off supply of food and medicine to the people in crisis.

The total number of water sheds/ irrigation structures damaged was 523 worth at . 502 lakhs. Damage to watershed and irrigation structures inflicts long term losses on farm economy.

About 27 water supply systems were affected which accounted for a loss of about . 210 lakhs. During floods, although people severely affected by excess of water, they also suffer from lack of safe drinking water as water supply systems like bore wells, pump sets, pipelines are damaged. Lack of safe drinking water leads to several waterborne diseases, which often break into epidemics. Other important public utilities affected were electricity (KPTCL) transformers were 38 and electrical poles were 385, the damage was estimated at . 70 lakhs. Damage to power supply puts off many farm and non-farm activities of gear.

4.3 Impact of damages on the livelihood of households

It is evident from Table 4.11, that in Bijapur district maize, sorghum, bajra and wheat were the major food crops grown. Greengram, redgram and bengalgram were pulses. Groundnut and sunflower were oil seeds and onion was seasonal horticultural crop grown in different seasons. Crops

Table 4.9: Loss of Livestock due to Flooding

Sl. No.	Farmers Category	Particulars	Total No affected	Lost		Dead		Diseased/Handicapped		Total Value
				No	Value	No	Value	No	Value	
1.	Large Farmers	Cattle	60	26	442000	27	459000	7	49000	950000
		Goat	35	13	91000	12	84000	10	60000	235000
		Sheep	22	6	27000	13	58500	3	12000	97500
2.	Small Farmers	Cattle	57	17	289000	20	340000	20	160000	789000
		Goat	120	58	406000	42	294000	20	120000	820000
		Sheep	98	28	126000	53	238500	17	68000	432500
3.	Landless laborers	Cattle	53	3	51000	13	221000	7	49000	321000
		Goat	40	12	84000	17	119000	11	66000	269000
		Sheep	47	7	31500	32	144000	8	32000	207500

Table 4.10: Estimated Infrastructure Loss due to Flood and Heavy Rains

Sl. No.	Sector/Area	Damages	Amount of loss (` in lakhs)
1.	Rural Roads in kms	284 (495 kms)	869
2.	State Roads in kms	83 (21.73 kms)	465
3.	CMC/TMC Roads & WS	60 kms	280
3.	Rural Bridges/Culverts	112	294
4.	State Bridges/ Culverts	56	160
5.	Watershed damages	449	218
6.	Irrigation Tanks	74	284
7.	Rural Water Supply	21	34.75
8.	Urban Water Supply	6	175
9.	Transformer/KPTCL Loss	38 (385 poles)	70
10.	Others	13	40
	Total		**2889.75**

Source: District Administrative -Bijapur.

were grown all three seasons as well as perennial crops by large farmers, but only during *kharif* and Rabi by small farmers.

4.3.1 Cropping and production pattern (Normal year)

In any normal year crops are taken up in all the three seasons of the year namely *kharif*, Rabi and summer in case of large farmers and only during *kharif* and Rabi in case of small farmers (Table 4.11). Cropping pattern of large farmers included maize, greengram, groundnut, onion, sunflower, sorghum, bajra and other crops during *kharif*. Among these crops the area under maize was found to be highest (0.88 ha). Groundnut, sunflower, bajra, greengram and others occupied an average area of 0.2, 0.36, 0.54, 0.24 and 0.88 ha, respectively, with a production of 56.32, 4, 4.32, 22.68, 2.64 and 12.32 Qtls/ha. The value of produce during the season was worth . 2.42 lakhs. While in case of small farmers also, the cropping pattern was same with variation in area under each crop. Among these crops the area under bajara was found to be occupying highest area (0.51 ha), groundnut, sunflower, maize, greengram and others occupied an average area of 0.02, 0.02, 0.35, 0.08 and 0.35 ha, respectively, with an production of 22.95, 0.53, 0.26, 21.70, 0.96 and 5.25 Qtls/ha. Total value of crop was worth . 2.45 lakhs.

During *rabi,* sorghum, wheat, bengalgram and other crops were grown by large and small farmers. The large farmers grew sorghum, wheat, bengalgram and other crops on an average area of 0.48, 0.56, 0.32 and 0.6 ha, respectively, with an production of 13.44, 8.96, 8, 9 Qtls/ha. The value of produce was . 1.15 lakhs. And small farmers grew same crops on an average area of 0.13, 0.13, 0.03 and 0.07 ha, respectively, with a production of 4.89, 4.89, 0.31, 1.22 Qtls/ha. The value produce was worth . 1.2 lakhs.

During *summer,* crops like groundnut, maize, sunflower and other crops were grown by only large farmers. The average area under these crops was 0.2, 0.12, 0.08 and 0.52 ha, respectively, with an production of 13.2, 2.16, 0.8, 7.8 Qntls/ha. The value of produce was estimated to be . 1.49 lakhs. And also perennial crops like grape, lime and other horticulture crops were grown by the large farmers. The average area under these crops was 0.036, 0.032 and 0.016 ha, respectively with a production of 1.08, 0.75 and 0.33 tones/ha. The value of produce from perennial crops was worked out to be . 1.36 lakhs.

4.3.2 Crop yield loss due to flooding

During *kharif* season cropping pattern of large farmers included maize, greengram, groundnut, onion, sunflower, sorghum, bajra and others. Among these crops the yield in normal year under maize was found to be (64 Quintals), Groundnut, sunflower, bajra, greengram and others occupied an yield of 20, 12, 42, 11 and 14 Qtls/ha, similarly the yield in affected year was 10, 08, 03, 16, 2 and 4 Quintals respectively, the yield loss between normal year and affected year was 54, 12, 9, 26, 9 and 10 Quintals. While in case of small farmers also, the cropping pattern was same with variation in yield under each crop. Among these crops the yield under bajara was found to be (45 Quintals), groundnut, sunflower, maize, greengram and others occupied an yield of 22, 11, 62, 12 and 15 Quintals, similarly the yield in affected year was 15, 08, 03, 15, 03 and 05 Quintals respectively, the yield loss between normal year and affected year was 30, 14, 08, 47, 9 and 10 Qtls/ha (Table 4.12).

During *rabi,* Jowar, wheat, bengalgram and other crops were grown by large farmers. Among these crops the yield in normal year under jowar was found to be (28 Quintals), wheat, bengalgram and others occupied an yield of 16, 25 and 15 Quintals, similarly the yield in affected year was 0, 4, 4 and 2 Quintals respectively, the yield loss between normal year and affected year was 28, 12, 21 and 13 Quintals. While in case of small farmers also, the cropping pattern was same with variation in yield under each crop. Among these crops the yield under jowar was found to be (30 Quintals), Wheat, bengalgram and others occupied an yield of 15, 27 and 16 Quintals, similarly the yield in affected year was 4, 4, 2 and 2 Quintals respectively, the yield loss between normal year and affected year was 26, 11, 25 and 14 Quintals.

During *summer,* maize, groundnut, sunflower and other crops were grown. Among these crops the yield in normal year under maize was found to be (66 Quintals), groundnut, sunflower and others occupied an yield of 18, 10 and 15 Quintals, similarly the yield in affected year was 16, 5, 02 and 4 Quintals respectively, the yield loss between normal year and affected year was 50, 13, 8 and 11 Quintals. And also perennial crops like grape, lime and other horticulture crops were grown. Among these crops the yield in normal year under grape was found to be (30.12 tones), lime and others occupied an yield of 23.5 and 20.4 tones, similarly the yield in affected year was 28.5, 22.5 and

Table 4.11: Cropping and Production Pattern (Normal year)

Sl. No.	Particulars	Large Farmers (n=40)			Small Farmers (n=40)		
		Area (ha)	Percentage	Production	Area (ha)	Percentage	Production
I.	***Kharif* season**						
1.	Maize	0.88	28.39	56.32	0.35	26.16	21.70
2.	Groundnut	0.2	6.45	4.00	0.02	1.79	0.53
3.	Bajra	0.54	17.42	22.68	0.51	38.12	22.95
4.	Green gram	0.24	7.74	2.64	0.08	5.98	0.96
5.	Sunflower	0.36	11.61	4.32	0.02	1.79	0.26
6.	Others	0.88	28.39	12.32	0.35	26.16	5.25
	Total	**3.1**	**100.00**		**1.34**	**100.00**	
II.	***Rabi* season**						
1.	Jowar	0.48	24.49	13.44	0.04	36.36	4.04
2.	Wheat	0.56	28.57	8.96	0.04	36.36	2.02
3.	Bengal gram	0.32	16.33	8	0.01	9.09	0.91
4.	Others	0.6	30.61	9	0.02	18.18	1.08
	Total	**1.96**	**100.00**		**0.11**	**100.00**	
III.	***Summer* season**						
1.	Maize	0.2	21.74	13.2	-	-	
2.	Groundnut	0.12	13.04	2.16	-	-	
3.	Sunflower	0.08	8.70	0.8	-	-	
4.	Others	0.52	56.52	7.8	-	-	
	Total	**0.92**	**100.00**		**-**	**-**	
IV.	**Perennial crops (Yield in Tones)**						
1.	Grape	0.036	42.86	1.08	-	-	
2.	Lime	0.032	38.10	0.75	-	-	
3.	Others	0.016	19.05	0.33	-	-	
	Total	**0.084**	**100.00**		**-**	**-**	

Table 4.12: Crop Yield Loss due to Flooding

Sl. No.	Particulars	Large Farmers				Net loss in value	Small Farmers				Net loss in value
		Normal year		Affected Year			Normal year		Affected Year		
		Yield (Qt/ha)	Value (`)	Yield (Qt/ha)	Value (`)		Yield (Qt/ha)	Value (`)	Yield (Qt/ha)	Value (`)	
I.	***Kharif* season**										
1.	Maize	64	112640	10	17600	95040	62	109120	15	26400	82720
2.	Groundnut	20	19500	8	7800	11700	22	21450	8	7800	13650
3.	Bajra	42	36855	16	14040	22815	45	39487.5	15	13163	26325
4.	Green gram	11	28545	2	5190	23355	12	31140	3	7785	23355
5.	Sunflower	12	21492	3	5373	16119	11	19701	3	5373	14328
6.	Others	14	22862	4	6532	16330	15	24495	5	8165	16330
	Total		**241894**		**56535**	**185359**		**245393.5**		**68686**	**176708**
II.	***Rabi* season**										
1.	Jowar	28	26880	0	0	26800	30	28800	4	3840	24960
2.	Wheat	16	33600	4	8400	25200	15	31500	4	8400	23100
3.	Bengal gram	25	42000	4	6720	35280	27	45360	2	3360	42000
4.	Others	15	13500	2	1800	11700	16	14400	2	1800	12600
	Total		**115900**		**16920**	**98980**		**120060**		**17400**	**102660**
III.	***Summer* season**										
1.	Maize	66	101640	16	24640	77000	-				
2.	Groundnut	18	14850	5	4125	10725	-				
3.	Sunflower	10	18100	2	3620	14500	-				
4.	Others	15	14625	4	3900	10725	-				
	Total		149215		**36285**	**44345**	-				
IV.	**Perennial crops (Yield in tones)**										
1.	Grape	30.12	88101	28.5	83362.5	4738.5	-				
2.	Lime	23.5	34855.2	22.5	33372	1483.2	-				
3.	Others	20.4	13464	19.5	12870	594	-				
	Total		**136420**		**129605**	**6815.7**	-				

19.5 tones respectively, the yield loss between normal year and affected year was 1.62, 1 and 0.9 tones by large farmers respectively.

4.3.3 Crop value loss due to flooding

The value in normal year under maize was found to be (. 11,2640), Groundnut, sunflower, bajra, greengram and others occupied an value of . 19,500, 21,492, 36,855, 28,545 and . 22,862, similarly the value in affected year was . 17,600, 7,800, 5,373, 14,040, 5,190 and . 6,532 respectively, the value loss between normal year and affected year was . 95,040, 11,700, 16,119, 22,815, 22,355 and . 16,330. While in case of small farmers the value under bajara was found to be (. 39,487.5), groundnut, sunflower, maize, greengram and others occupied an value of . 21,450, 19,701, 10,9120, 31,140 and . 24,495, similarly the value in affected year was . 13,162.5, 7,800, 5,373, 26,400, 7,785 and . 8,165 respectively, the value loss between normal year and affected year was . 26,325, 13,650, 14,328, 82,720, 23,355 and . 16,330 (Table 4.13).

The value in normal year under jowar was found to be (.26,880), wheat, bengalgram and others occupied an value of . 33,600, 42,000 and . 13,500, similarly the value in affected year was . 0, 8400, 6720 and . 1800 respectively, the value loss between normal year and affected year was . 26.800, 25.200, 35.280 and . 11.700. While in case of small farmers the value under jowar was found to be (. 28.800), wheat, bengalgram and others occupied an value of . 31,500, 45,360 and . 14,400, similarly the value in affected year was . 3840, 8400, 3360 and . 1800 respectively, the value loss between normal year and affected year was . 24960, 23100, 42000 and . 12,600.

The value in normal year under maize was found to be (. 10,1640), groundnut, sunflower and others occupied an value of . 14,850, 18,100 and . 14,625, similarly the value in affected year was . 24,640, 4,125, 3,620 and . 3,900 respectively, the value loss between normal year and affected year was . 77000, 10725, 14500 and . 10725. The value in normal year under grape was found to be (. 88101), lime and others occupied an value of . 34,855 and . 13,464, similarly the value in affected year was . 83362, 33372 and . 12870 respectively, the value loss between normal year and affected year was . 4738, 1483 and . 594.

4.3.4 Loss in milk yield due to flooding

Table 4.14 presents loss in farmer's income due to reduction in milk yield due to floods.

The milk yield of large farmers declined by about 52 per cent in affected year when compared to that in normal year. In case of small farmers also, the milk yield reduction was to the extent of about 52 per cent. The extent of milk yield loss was at a higher level of about 67 per cent in case of landless laborers. Reduction in milk yield affected the income and livelihood of farmers during the floods.

4.3.5 Loss in grains, farm inputs and household items due to flooding

Table 4.15 that the flood caused damage to grains, farm inputs and household items. Major items affected were fertilizers, seeds, food grains, fodder *etc.*

The extent of loss in fertilizers was about . 10,450 per household among large farmers followed by . 5,967 per household among small farmers, while no loss was reported in case of landless laborers.

The extent of loss per household in seeds was at . 10,800 in case of large farmers followed by . 9,525 in case of small farmers and . 5,225 in case of landless laborers.

Loss in food grains was reported at . 27,700 in case of large farmers followed by . 16,375 in case of small farmers and . 5,550 per household among landless laborers.

Loss in fodder was reported at . 2,850 per household in case of large farmers as well as small farmers and . 962.5 per household among landless laborers.

Other important items which were either lost or damaged were utensils, bedding etc, which were worth . 4000 per household in case of large farmers followed by . 5437.5 per household in case of small farmers and . 2925 per household in case of landless laborers.

Table 4.13: Loss in Crop Value due to Flooding

Sl. No.	Particulars	Large Farmers		Net loss in value (`)	Small Farmers		Net loss in value (`)
		Normal year	Affected Year		Normal year	Affected Year	
		Value (`)	Value (`)		Value (`)	Value (`)	
I.	***Kharif* season**						
1.	Maize	112640	17600	95040	109120	26400	82720
2.	Groundnut	19500	7800	11700	21450	7800	13650
3.	Bajra	36855	14040	22815	39487.5	13162.5	26325
4.	Green gram	28545	5190	23355	31140	7785	23355
5.	Sunflower	21492	5373	16119	19701	5373	14328
6.	Others	22862	6532	16330	24495	8165	16330
	Total	**241894**	**56535**	**185359**	**245393.5**	**68685.5**	**176708**
II.	***Rabi* season**						
1.	Jowar	26880	0	26800	28800	3840	24960
2.	Wheat	33600	8400	25200	31500	8400	23100
3.	Bengal gram	42000	6720	35280	45360	3360	42000
4.	Others	13500	1800	11700	14400	1800	12600
	Total	**115900**	**16920**	**98980**	**120060**	**17400**	**102660**
III.	***Summer* season**						
1.	Maize	101640	24640	77000			
2.	Groundnut	14850	4125	10725			
3.	Sunflower	18100	3620	14500			
4.	Others	14625	3900	10725			
	Total	149215	**36285**	**44345**			
IV.	**Perennial crops (Yield in tones)**						
1.	Grape	88101	83362.5	4738.5			
2.	Lime	34855.2	33372	1483.2			
3.	Others	13464	12870	594			
	Total	**136420.2**	**129604.5**	**6815.7**			

Table 4.14: Loss in Milk Yield due to Flooding per Farmer

Sl. No.	Farmers Group	Normal year (Ltrs/Yr)	Affected Year (Ltrs/Yr)	Percentage Loss	Value Loss (In `)
1.	Large Farmers	7386.55	3808.75	51.56	57244.8
2.	Small Farmers	8161.25	4283.3	52.48	62047.2
3.	Landless laborers	4218.75	2838.1	67.27	22090.14

Table 4.15: Loss in Grains, Inputs and Household Items due to Flooding per Farmer

Sl. No.	Items	Large Farmer	Small farmer	Land Less Labor
1.	Fertilizer	10450	5967.5	0
2.	Seeds	10800	9525	5225
3.	Food grains	27700	16375	5550
4.	Fodder	2850	2850	962.5
5.	Others	4000	5437.5	2925

4.4 Relief and Rehabilitation measures and their implications on the livelihood of households

4.4.1 Crop compensation released to flood affected farmers in Don River

Table 4.16 presents a picture of crop compensation to farmers affected due to floods. The total number of farmers covered under compensation in Basavan Bagewadi and Bijapur taluks in the district was 10, 996. The total crop area affected was about 19, 578 ha. It also depicts season wise and crop wise area affected in two taluks. In *kharif* the major crops affected were Red gram (4910.28 ha), Maize (3058.8 ha), Groundnut (713.62 ha) and Bajara (485.3 ha).

In Rabi major crops affected were Rabi Jowar (7808.13 ha), Sunflower (7746.67 ha), Bengal gram (786.2 ha) and Safflower (90.33 ha). The total amount of compensation for both taluks was . 2.02 crores. The per hectare average compensation given in both taluks worked out to be about . 1007 and the per household compensation worked out to be about . 1842.

4.4.2 Details of the villages being rehabilitated

Table 4.17 depicts the picture of rehabilitated villages which were affected by floods in both the taluks. In total seven villages have been completely and one village would be partially rehabilitated. In total 3014 number of families has been rehabilitated.

4.5 Hardships faced by households during floods

Present investigation elicited opinion of farmer regarding constraints faced by households during floods.

The major constraints expressed by the households during floods were classified into three categories, namely human, farm and livestock problems are presented in Table 4.18.

4.5.1 Human problems

Among the Human problems, Non availability of drinking water was the major problem which accounted for about 92.05 per cent as expressed by the respondents followed by Non availability of food (89.36%), problem with electricity (84.89%), closure of schools (82.02%), problem with dwelling (74.28%), lack of medical facilities (58.20%) and inadequate of transportation facilities (52.67%).

4.5.2 Farm problems

Crop loss was the major problem among the farm problems which accounted for about 92.22 per cent of the responses, followed by loss of farm soils (85.89%), non availability of labor (83.16%), non availability of inputs (71.21%), field inundation (68.12%) and increase in incidence of pest attack (52.17%).

4.5.3 Livestock problems

Shortage of dry fodder was the major problem among the livestock problems which accounted for about 85.01 per cent of the responses followed by shortage of green fodder (80.58%), loss of livestock (lost/death) (78.33%) and non-availability of concentrate (74.78%).

Table 4.16: Crop Compensation Released to Flood affected Farmers in Don River Basin

Taluk	Total Farmers Covered	Crop Loss (ha)									Amount Released (`)	Amount (`/ Ha)	Average Amount (`/Person)
		Kharif Crops				*Rabi* Crops							
		Red Gram	bajara	Maize	GN	*Rabi* Jowar	Bengal Gram	Sun Flower	Saf flower	Total			
Bijapur	7411	1757.2	219.7	1966.3	547.4	1707.2	320.55	4400.93	66.3	10985.58	13535020	1232.08	1826.35
BB	3585	3153.08	265.6	1092.5	166.22	6100.93	466.1	3345.74	24.03	8591.98	6717880	781.88	1873.89
Total	**10996**	**4910.28**	**485.3**	**3058.8**	**713.62**	**7808.13**	**786.65**	**7746.67**	**90.33**	**19577.56**	**20252900**	**1006.5**	**1841.84**

Source: Department of Agriculture-Bijapur

Table 4.17: Details of Villages being Rehabilitated

Sl. No.	Village	Taluk	Complete/ Partial	No. of families	Name of the agency taking up the construction work
1.	Kotyal	Bijapur	Complete	477	Mysore Citizen Forum
2.	Dasyal	Bijapur	Complete	342	RGRHCL
3.	Danyal	Bijapur	Complete	358	RGRHCL
4.	Tonsyal	Bijapur	Complete	568	KHB
5.	Ukumnal	Bijapur	Complete	251	Seva Bharati
6.	Donur	Basavan Bagewadi	Partial	623	RGRHCL
7.	Satihal	Basavan Bagewadi	Complete	229	KRIDL
8.	Nagaral Don	Basavan Bagewadi	Complete	166	KHB

Source: Minor irrigation department-Bijapur.

Table 4.18: Hardships Faced by the Household during Floods

Sl. No.	Particulars	Garrett Mean Score	Rank
A	**Human**		
1.	Problem with dwelling	74.28	V
2.	Non availability of food	89.36	II
3.	Non availability of drinking water	92.05	I
4.	Lack/Inadequate of Medical Facilities	58.2	VI
5.	Lack/Inadequate of transportation Facilities	52.67	VII
6.	Closure of schools	82.02	IV
7.	Problem with lighting/electricity	84.89	III
B	**Farm**		
1.	Crop loss	92.22	I
2.	Field Inundation	68.12	V
3.	Loss of farm soil	85.89	II
4.	Increase in incidence of pest attack	52.17	VI
5.	Non-availability of inputs	71.21	IV
6.	Non-availability of labour	83.16	III
C	**Livestock**		
1.	Loss of Livestock (Lost/Death)	78.33	III
2.	Shortage of dry fodder	85.01	I
3.	Shortage of green fodder	80.58	II
4.	Non-availabilities of concentrate	74.78	IV

DISCUSSION

Results of investigation presented in the preceding chapter are discussed in detail in this chapter. Main focus here is to throw light on possible causes for the results in the study and their likely impact on policy to be adopted by the farmers and policy makers. Keeping specific objectives of the study in view, the results are discussed under following heads;

5.1 Socio-economic characteristics of sample farmers in Don River basin.

5.2 Bio-physical effects of flood on households.

5.3 Impact of damages on livelihoods of households.

5.4 Relief and Rehabilitations measures and their implications for livelihood.

5.5 Hardships faced by the households during floods.

5.1 Socio-economic characteristics of sample farmers in Don River basin

The impact assessment of flash flood will be easily smoothed if the socio-economic indicators of the selected respondents of large, small and landless farmers are homogenous. If there is heterogeneity, the information on the differences that exists help in drawing meaning full interpretation from the results with this view the socio-economic profile of the sample respondents are analyzed and discussed here under with detailed perspectives.

5.1.1 Age and education status of sample farmers

The general characteristics of sample farmers in the study area are presented in Table 4.1. From this table it could be observed that, the average age of the large farmers, small and landless farmers were about 39.54.

Age and Education are the main features for an alternative thinking and to cope up with the flood situation. Regarding education concerned, it was witnessed that the illiteracy was higher in land less laborers about (50%) and in case of small farmers it was 45 per cent followed by lower level of education among large farmers (30%). About (37.5%) of small farmers and 32.5% of landless laborers and large farmers were educated up to primary school level. The secondary school education was exactly of same proportion in case of large and landless farmers (17.5%) followed by small farmers (10%).

20% of large farmers and only 7.5% of small farmers were educated up to college level and above. No body could get to college level or beyond among the landless laborers which could be due to socio- economic constraints.

5.1.2 Family type, marital status and occupation of sample farmers

Majority of the respondents in large farmers (57.5%) were living jointly and (42.5%) of respondents is nuclear type family. In case of small farmers 62.5% were joint families the remaining belonged to nuclear families and joint family type of respondents noticed in the study. Where as landless laborers about (92.5%) of respondents living as nuclear families and only (7.5%) of respondents living as joint family type (Table 4.2). It could be clearly indicate that majority of the families were nuclear type only.

So far as Marital status was concerned it was noticed that (88-90%) sample respondents were married and only (10-12%) of them remained unmarried in all three categories of the sample farmers.

Regarding occupation of sample respondents, it was seen that most of the large farmers (92.5%) had agriculture as their occupation for their livelihood and dependency on non- agriculture oriented activity was about only (7.5%). In case of small farmers (87.5%) were engaged in agriculture and (12.5%) of depended on non- agriculture activities. All landless laborers were dependent on manual farm job because of the lack of economic land holding for their cultivation.

5.1.3 Income pattern of the sample farmers

The results depict that (Table 4.3) average income per household of large farmers was ₹ 2,21,600 out of which about 72.04 per cent was from agriculture and allied activities and the remaining (28%) came from non-farm activities.

Average income per household of small farmers was ₹ 1,82,525 out of which about 68.35 per cent was earned from agriculture and allied activities and the remaining (31%) of income was earned from non-farm activities. Average per household income of landless laborers was ₹ 69,370, all of which was income earned from non-farm activities like fruit, nut, eatables and vegetable vending.

5.1.4 Expenditure pattern of sample farmers

Average expenditure per household (Table 4.4) in the study area was ₹ 81,016 (percentage share includes food 23.09, clothing 15.43, education 22.99, health 10.68, ceremonies 9.23, life insurance 4.46 vehicle maintenance 2.94 and miscellaneous 11.21) higher among large farmers compared to small and landless farmers with a expenditure of ₹ 56,273 (percentage share includes food 43.45, clothing 12.29, education 11.07, health 7.17, ceremonies 6.45, life insurance 0.85 vehicle maintenance 1.76 and miscellaneous 16.13) and ₹ 35,675 (percentage share includes food 55.45, clothing 16.50, education 10.22, health 7.98, ceremonies 7.96, life insurance 0.67 vehicle maintenance 1.23 and miscellaneous 0.53) respectively. The expenditure on basic needs was higher in small and landless compared to large farmers.

5.1.5 Land holding pattern of the sample farmers

The average land holding of large farmers was 3.10 ha while that of small farmers was 1.34 ha. On an average 71.62 per cent of land was irrigated and remaining 28.52 per cent was un irrigated among large farmers. In case of small farmers about 62 per cent of cultivable land was under rain fed and only 38 per cent was under irrigation with different sources of irrigation.

All the available land was put to cultivation among both small and large farmers. Of the cultivated land, about 97 per cent among large farmers and 91 per cent among the small farmers was under field crops and percentage of horticultural crops was very meager.

The cropping pattern of large farmers was mainly annual based field crops than the horticultural crops. The average cropping pattern of horticultural crops about 8.96 per cent in small farmers compare to 3.23 per cent among large farmers due to dependency on the rainfall throughout the year.

5.1.6 Irrigation pattern of the sample farmers

It was already been observed, about 72 per cent among large farmers and about 38 per cent of cultivated land among small farmers was irrigated from different sources of irrigation. Among different sources, tube wells formed major source of irrigation water, 80 per cent in case of large farmers and 52 per cent among small farmers. River formed source of about only 2 per cent of irrigation among large farmers only. That means Don River was not the major sources of irrigation in the study area. Other sources like tank irrigation open well and jack well irrigation formed about 19 per cent and 48 per cent of source of irrigation water among large and small farmers, respectively.

5.1.7 Asset position of the sample farmers

So far assets position was concerned (Table 4.7), the average asset value of large farmers was ₹ 35.56 lakhs which was higher than that of small farmers and landless labourers with an asset value of 8.78 lakhs and 1.47 lakhs, respectively.

The large farmers investing more on fixed assets due to requirement of mechanization for their daily farm cultivation activities.

The small and landless labourers were lower due to because of their small economic holding and investment on machinery was negligible. The availability of human resource (family labour) was substitute for mechanization leads to less investment and asset position.

5.2 Bio-physical damages of flood on households

5.2.1 Loss of building due to flooding

Table 4.8 shows the important bio- physical damages caused to on dwelling houses, livestock shed and irrigation pump sets. In large farmers the degree of loss was sever with 40 per cent cases, moderate in about 33 per cent and slightly 27 per cent of cases. The average loss of value per household to dwelling house was worth about ₹ 67,437 in case of large farmers.

The loss to livestock shed was severe in 45 per cent cases, moderate in 35 per cent cases and slightly in 20 per cent of households.

The average loss was ₹ 49,725 per household, the highest being in the case of severe damage ₹ 66,611 per household. Similarly loss in livestock shed affects the safety and security of animals and there by their productivity too.

The loss in irrigation pump sets was severe in 22.5 per cent cases followed by moderate in 42.5 per cent cases and slight in 12.5 per cent of cases. The average loss per household was to the extent of ₹ 20,075.

It could be observed from the results that the loss in dwelling was more in case of the most vulnerable section namely the landless farmers. Loss in dwelling at once adversely affects the livelihood of households. This in turn affects employment, farm productivity and rural economy at large and will have cascading effects. Two mitigate the misery in damage to residential property, the government does undertake relief and rescue measures and they are only ado. Hence, there is a need for permanent solution to the problems caused by flash floods in Don River. Even though the government has provided alternate and residential arrangement, the affected people hesitate to occupy as there are other attendant socio-physiological concerns.

5.2.2 Loss of livestock due to flooding

Table 4.9 depicted the loss to livestock due to flash flood in the Don River. Three types of livestock namely cattle, goat and sheep suffered loss due to missing, death or disease. Livestock is an important subsidiary activity to sustain livelihood of farmers in Don River basin.

The damage was more severe among small farmers as in total loss due to all the livestock was to the extent of about ₹ 20 lakhs, followed by that among large farmers at about ₹ 12.83 lakhs and among land less laborers at about 8 lakhs in view of the absence of alternate sources of income, it becomes difficult to the farmers to sustain these losses, there is a need to provide adequate compensation especially in terms of lost livestock to restore livelihoods of affected farmers. There was difference in the value of cattle, owned and lost by large farmers and landless labours, because there was no land holdings and shortage of fodder for livestock to landless labours.

Ghulamhabbi and Zakir Hussain (2008) and Anonymous (2011) in similar studies noticed losses in physical terms.

5.2.3 Loss to infrastructure due flood and heavy rains

Table 4.10 presents total loss to public infrastructure due to flood and heavy rains. It assessed by district administration of Bijapur. The major public infrastructures affected by flood were roads, bridges, irrigation structures, water supply units and electricity supply transformers and others. The total loss occurred in all type infrastructure was worth about ₹ 2890 lakhs. The damage to all types of roads (577 KMs) was worth ₹ 1614 lakhs. Around 168 different bridges and culverts were damaged to the extent of ₹ 454 lakhs.

Damage to bridges and culverts cuts off supply of food and medicine to the people in crisis.

The total number of water sheds/ irrigation structures damaged was 523 worth at ₹ 502 lakhs. Damage to watershed and irrigation structures inflicts long term losses on farm economy.

About 27 water supply systems were affected which accounted for a loss of about ₹ 210 lakhs. During floods, although people severely affected by excess of water, they also suffer from lack of safe deinking water as water supply systems like bore wells, pump sets, pipelines are damaged. Lack of safe drinking water leads to several waterborne diseases, which often break into epidemics. Other important public utilities affected were electricity (KPTCL) transformers were 38 and electrical

poles were 385, the damage was estimated at ₹ 70 lakhs. Damage to power supply puts off many farm and non farm activities of gear.

5.3 Impact of damages on the livelihood of households

It is evident from the Table 4.11, that in the Bijapur district maize, sorghum, bajra and wheat were the major food crops grown. Greengram, redgram and bengalgram were pulses. Groundnut and sunflower were oil seeds and onion was seasonal horticultural crop grown in different seasons.

5.3.1 Cropping and production pattern (Normal year)

In any normal year crops are taken up in all the three seasons of the year namely *kharif*, Rabi and summer. In the present case large farmers cultivated crops in all three seasons along with some perennial crops. But, small farmers took up only in *kharif* and *rabi* season.

Thus, in any normal year the value of crop produce was more among large farmers compared to that of small farmers.

The major crops were grown during *kharif* season by large farmers. Cropping pattern of large farmers included maize, greengram, groundnut, onion, sunflower, sorghum, bajra and other crops. Among these crops the area under maize was found to be highest (0.88 ha). Groundnut, sunflower, bajra, greengram and others occupied an average area of 0.2, 0.36, 0.54, 0.24 and 0.88 ha, respectively, with a production/yield of 56.32, 4, 4.32, 22.68, 2.64 and 12.32 Quintals. While in case of small farmers also, the cropping pattern was same with variation in area under each crop. Among these crops the area under bajara was found to be occupying highest area (0.51 ha), groundnut, sunflower, maize, greengram and others occupied an average area of 0.02, 0.02, 0.35, 0.08 and 0.35 ha, respectively, with a production/yield of 22.95, 0.26, 0.53, 21.70, 0.96 and 5.25 Quintals.

During *rabi,* sorghum, wheat, bengalgram and other crops were grown by large and small farmers. The large farmers grew sorghum, wheat, bengalgram and other cropson an average area of 0.48, 0.56, 0.32 and 0.6 ha, respectively, with a production/yield of 13.44, 8.96, 8, 9 Quintals. And small farmers grew same crops on an average area of 0.13, 0.13, 0.03 and 0.07 ha, respectively, with a production/yield of 4.89, 4.89, 0.31, 1.22 Quintals.

During *summer,* groundnut, maize, sunflower and other crops were grown. The average area under these crops was 0.12, 0.2, 0.08 and 0.52 ha, respectively, with a production/yield of 2.16, 13.2, 0.8, 7.8 Quintals. And also perennial crops like grape, lime and other horticulture crops were grown. The average area under these crops was 0.036, 0.032 and 0.016 ha, by large farmers respectively, with a production/yield of 1.08, 0.75 and 0.33 tones.

5.3.2 Crop yield loss due to flooding

Table 4.12 presented a picture of crop yield loss suffered by the farmers during floods. Calculated as differences in actual yield in the affected year over the normal year all the crops suffered varying degree of yield loss. Among large farmers the physical yield loss in crops in *kharif* season ranged from a lowest of 9 quintals in case of green gram and sunflower to a highest of 54 quintals in case of maize.

In *rabi* jowar crop 28 q/ha suffered heavy losses as compared to wheat 12 q/ha or Bengal gram 21 q/ha and others 13 q/ha.

In summer the loss was to the extent of 50 q/ha in case of maize, 13 q/ha in ground nut, 11 q/ha in other crops and 8 q/ha in sunflower.

The perennial crops also grown by large farmers suffered by yield losses, the yield losses were 1.62 tones/ha in grapes, 1 tone/ha in lime and 0.9 tones/ha in others.

The extent of crop yield loss suffered by small farmer presented in table 4.12. During *kharif* season, net loss in maize was 47 q/ha followed by that of bajra 30 q/ha, ground nut 14 q/ha and green gram 9 q/ha.

During *rabi,* the yield loss in crops were 26 q/ha in jowar, 25 q/ha in Bengal gram, 11 q/ha in wheat and 14 q/ha in others.

These were the severe losses to farming community as their income and livelihoods depends upon crop production. Losses in fodder crops like *rabi* sorghum or jowar not only affects farmer income in terms of grain yield but also the livestock due to shortage of dry fodder. Most of the farmers

cultivate their land to their maximum extent available in the *kharif* season based on rainfall, whereas in *rabi* and summer the farmers having irrigation facility were only cultivate the land still upto the level of irrigation water availability.

5.3.2 Loss in crop value due to flooding

Table 4.13 presented a picture of crop value loss suffered by the farmers during floods. Calculated as differences in actual value in the affected year over the normal year all the crops suffered varying degree of value loss. Among large farmers the value loss in crops in *kharif* season ranged from a lowest of ₹ 11,700 in case of ground nut and maize to a highest of ₹ 95,040.

In *rabi* Bengal gram crop ₹ 35,280 suffered heavy value losses as compared to jowar ₹ 26800 or wheat ₹ 25200 and others ₹ 11,700.

In summer the value loss was to the extent of ₹ 77,000 in case of maize, ₹ 14,500 in sunflower, ₹ 10,725 in ground nut and other crops and 8 q/ha in sunflower.

The perennial crops also grown by large farmers suffered by value losses, the value losses were ₹ 4,738.50 in grapes, ₹ 1,483 in lime and ₹ 594 in others.

The extent of crop yield loss suffered by small farmer presented in table 4.13. During *kharif* season, net value loss in maize was ₹ 82,720 followed by that of bajra ₹ 26,325, green gram ₹ 23,355 other crops ₹ 16,330, sunflower ₹ 14,328 and Ground nut ₹ 13,650.

During *rabi,* the net value loss in Bengal gram was highest ₹ 42,000 followed by that of jowar ₹ 24,960, Wheat ₹ 23,100 and other crops by ₹ 12,600.

5.3.4 Loss in milk yield due to flooding

The average milk yield declined by about 52 per cent both large as well as small farmers compared to that in normal year due to loss, death and diseased or handicapped animals (Table 4.14).

The extent of financial loss per household was ₹ 57,244 in case of large farmers and ₹ 62,047 in case of small farmers.

In case of landless laborers main source of income depended on non-farm, livestock and allied activities for livelihood. During the floods the extent of milk yield loss among them was to the extent of 67 per cent, which accounted for a loss of about ₹ 22,000 per house hold.

Loss in income from livestock in addition to crop loss aggregates the precacious livelihood situation of farmers during floods.

5.3.5 Loss in grains, farm inputs and household items due to flooding

It is evident from the Table 4.15 that major loss occurred to grains, farm inputs and household items include seeds, fertilizers, food grains and fodder. In case of large farmers the extent of loss in terms of value damaged to fertilizer ₹ 10,450, seeds ₹ 10, 800, food grains ₹ 27,700 and fodder and other items noticed with a worth of ₹ 6,850.

In case of small farmers the extent of loss in terms of value damaged to fertilizer ₹ 5,968, seeds ₹ 9,525, food grains ₹ 16,375 and fodder and other items noticed with a worth of ₹ 8,287.5.

In case of landless laborers the extent of loss in terms of value damaged to fertilizer ₹ 0 seeds ₹ 5,225, food grains ₹ 5,550 and fodder and other items noticed with a worth of ₹ 3,887.5 respectively.

5.4 Relief and Rehabilitation measures and their implications on the livelihood of households

5.4.1 Crop compensation released to flood affected farmers in Don River

Table 4.16 shows the extent of Government intervention in crop compensation to the flood affected farmers in Don River basin in Bijapur and Basavana Bagewadi taluks of Bijapur district. The average compensation released per farm was ₹ 1,842 on the basis of land holding compensation was ₹ 1,006 per ha.

The major crops affected during *kharif* season were red gram, maize, groundnut and bajara with an area of 19577 ha. Among these, red gram was severely affected with an area of (4910 ha)

followed by maize (3058.8 ha) and damaged was slight to groundnut (713.62 ha) and bajra (485.3 ha).

During *rabi* season jowar, bengal gram, sunflower, safflower were major crops damaged. Among these, jowar was severely affected with an area of (7808.13 ha) followed by sunflower (7746.67 ha) and slightly damage to Bengal gram (786.65 ha) and safflower (90.33 ha).

The total amount of ₹ 2.02 crores was released as crop loss compensation for the 2 taluks, in which major share was givrn to Bijapur taaluk (65%) and the remaining (35%) went to farmers of Basavana bagewadi taluk. The average per hectare compensation worked for 2 taluks was only ₹ 1007, which could be considered as meager, when compared to the extent of losses. Therefore, to restore normal livelihood of farmers the existing norms of compensation should be modified to enhance the per unit compensation given to affected farmers. Further, it was also noticed during field survey that the full amount of compensation was not deliver to the extended beneficiary and also the compensation was also not timely. To overcome these difficulties the entire process of compensation should made transparent.

5.4.2 Details of the villages being rehabilitated

It is evident from Table 4.17 that extent of rehabilitation, number of villages and families in flood affected taluks of Don River. Among severely affected villages seven villages have been completely rehabilitated and only one village rehabilitated partially. The total 3014 families has been rehabilitated. Various agencies were involved in rehabilitation to the affected families these were Mysore Citizen Forum, Rajiv Gandhi Rural Housing Corporation Limited, Karnataka Housing Board, Seva Bharati. Karnataka Rural Infrastructure Development Ltd.

It was a common observation that while people vociferously demanded immediate and permanent rehabilitation during the crisis but, when actual rehabilitation in terms of new dwelling houses, was provided the people were reluctant to occupy the same. This was due to failure of the authorities to engage the community in planning rehabilitation. Therefore, in future, rehabilitation guidelines the Government should provide for inclusion of community rescue and rehabilitation works.

5.5 Hardships faced by households during floods

Present investigation elicited opinion regarding constraints faced by households during floods.

The major constraints expressed by the households during floods were classified into three categories, namely human, farm and livestock problems are presented in Table 4.18.

Among the human problems, non-availability of drinking water was the major problem which accounted for about 92.05 per cent as expressed by the respondents followed by Non availability of food (89.36%), problem with electricity (84.89%), closure of schools (82.02%), problem with dwelling (74.28%), lack of medical facilities (58.20%) and inadequate of transportation facilities (52.67%).

Crop loss was the major problem among the farm problems which accounted for about 92.22 per cent of the responses, followed by loss of farm soils (85.89%), non availability of labor (83.16%), non availability of inputs (71.21%), field inundation (68.12%) and increase in incidence of pest attack (52.17%).

Shortage of dry fodder was the major problem among the livestock problems which accounted for about 85.01 per cent of the responses followed by shortage of green fodder (80.58%), loss of livestock (lost/death) (78.33%) and non-availability of concentrate (74.78%).

These hardships faced by the affected people lead to loss in livelihoods and social productivity. Crisis like floods though impact once inflict long term the debilities. Lack of food and health facilities especially for the children and women of weaker sections can have long term effects. Therefore, there is need to priorities relief operations to ameliorate the miseries of people at the margin.

SUMMARY AND POLICY IMPLICATIONS

Livelihood is not just a means of earning a living and generating an income but a pattern of asset ownership, availability of required skills and knowledge to deploy those assets into a productive process and a favourable market mechanism. It is the livelihoods, after human life that disaster prone communities strive most to protect against hazards. Macroeconomic indicators are used for assessing disaster induced damage but disruption to micro, subsistence and livelihood economies is not accounted for with the same level of detail.

A disaster is not a physical happening, it is a social event. It is in one sense the manifestation of vulnerabilities of social system and prime attention should be given to doing something about such vulnerabilities. Thinking disaster as social phenomena allow them to be seen as something which can be reacted to as part of ongoing policies and programmes of national and social development-which could reduce societal vulnerabilities in the first place. Activities of development nature then can be seen as an integral part of disaster prevention and mitigation.

Natural disasters have several different varieties which would include avalanches, diseases and pandemics, droughts, earthquakes, famine, floods, impacts events (such as meteors), tsunamis and volcanic eruptions among others. Of these various types of disasters, three main types account 90% of losses: floods, earthquakes and cyclones.

Floods, drought and famines are also natural calamities like earthquakes and volcanoes which man has to face. However, in the case of floods, drought and famines man can able to control them, diminish the danger and at times even completely eliminate them as in the case of famines.

Floods are caused by three factors- 1. Cloud burst, 2. Monsoon depression and 3. Tropical cyclones. Of late, deforestation and soil erosion are also causing floods. The problem has become sever now on account of deforestation and depositing of soils in the river beds. When occur they inundate low lying areas by the sides of the river and cause huge loss of life, crop and other properties.

Impact of flooding and Drought on agriculture

The four variables related to flooding that appear to have the most influence on agricultural are: the geographic area hit and the total area submerged; rainfall intensity (the amount of rainfall over a period of time) ; the time of year when flooding occurs and impedes or delays critical farming operations; and the scope and severity of non-agricultural infrastructure damage that distracts the labour force from farming and undermine labour productivity in the fields. In the past two decades, when intense rainfall occurred within a narrow time frame in the main crop producing areas, it devastated staple crops as well as homes, roads and other infrastructure.

Flood loss in Bijapur.

Bijapur: The flood-related loss in Bijapur district during 2009 has been estimated to be up to ₹ 850.15 crore, according to a report of a preliminary survey conducted by the district-level officers (Bijapur.nic.in).

Sources in the district administration told The district received 3500 mm of rainfall till the end of September, Agriculture crops worth ₹ 166.85 crore, horticulture crops worth ₹ 294.10, minor irrigation tanks worth ₹ 4.91 crore, zilla panchayat roads and tanks worth ₹ 57 crore, Electrical power supply (Hescom) lines worth ₹ 1.59 crore were damaged in the flood waters.

The damages of national highways have been put at ₹ 2.5 crore and that of city roads have been put at ₹ 54.98 crore. In the floods, Health Department medicines worth ₹ 40 lakh and Veterinary Department medicines worth ₹ 30 lakh were damaged.

The Don is a small tributary of the Krishna River in the southern peninsula of India. It originates at Khojanawadi village of Sangli district in Maharashtra and runs for only about 15 km in the state before entering Karnataka at Bannur village of Belgaum district. it travels about 13 km in the Belgaum district and then enters Bijapur district near Honawad village. It runs for a distance of about 141 km in Bijapur district and finally drains into the Krishana River at chaya Bhagavathi in Gulbarga district about 7 km below the Narayanpur Dam. Ti has a total catchment area of 3217 Sq.km, 67 Sq. km in Maharashtra and 3150 Sq.km in Karnataka.

6.1 Specific objectives of the study

1. Socio-economic characteristics of the sample farmers in Don River basin.
2. Bio-physical effects of flood on households.
3. Impact of damages on the livelihoods of households.
4. Relief and Rehabilitations measures and their implications for livelihood.

6.2 Hypotheses

1. The socio economic profile of the affected households in Don River basin is poor.
2. The bio physical affects is sever in flood affected area.
3. The damages by flood on the livelihood of the households are very high.

6.3 Methodology

The study was undertaken in Bijapur district of Karnataka during the agriculture year 2012-13. The district falls under the Agro Climatic Zone III- (Northern Dry Zone) of Karnataka. The data relating to socio-economic profile, asset position, cropping pattern, bio-physical effects, crop loss and area affected with flood, relief measures and problems faced by flood affected farmers were collected.

6.3.1 Sampling

Bijapur district was selected purposively for the study as based on the quantum of flood affected by farm economy in Don river basin in Bijapur and B.Bagewadi- taluks in Bijapur district. Flood affected households were selected purposively in the left and right bank with severely affected villages of Don river basin in the district. Further, in the left and right bank of the river of Bijapur Taluk, 60 affected households and also 60 affected households in B.Bagewadi Taluk were selected randomly. Thus, total size of the sample selected for the study was 120.

6.3.2 Sources of data

6.3.2.1 Primary data

Data needed for the study were collected from respondents by personal interview method using pre-tested schedule. The data relating to socio-economic profile, asset position, cropping pattern, bio-physical effects, crop loss and area affected with flood problems faced by flood affected farmers were collected.

6.3.2.2 Secondary data

Secondary data pertaining to the extent of crop loss, flood affected area, relief and rehabilitations measures will be collected from Agricultural office, Department of Economics and Statistics and Regional Agricultural Research Station of Bijapur.

6.3.3 Analytical tools employed

Tabular presentation was adopted to compile general characteristics of the sample farmers, number of farmers' affected, total area covered and quantum of relief and rehabilitation work done were analyzed by tabular analysis.

Tabular analysis was adopted also for analyzing the distribution of land holding and its utilization and source of irrigation, crop loss, livestock dead, building damaged employment pattern and household items. Simple statistical tools like averages and percentages were used to compare, contrast and interpret results properly.

To find out the most significant factor which influences the respondent, Garrett's ranking technique was used.

6.4 Major findings of the study

Main findings of the study are as follows.

1. On an average the loss of dwelling house was ₹ 67,437, livestock shed was ₹ 49,725 and IP pump shed was ₹ 26,325 for large farmers, for small farmers average loss in dwelling house

was ₹ 74,150, livestock shed was ₹ 48,725 and IP pump shed was ₹ 20,075 and for landless farmers average the loss of dwelling house was ₹ 72,625, livestock shed was ₹ 25,825 and there is no loss in IP pump shed for landless farmers as there is no land holdings. In case of large farmers livestock shed was severely affected with 18 in number and 14 moderately and both dwelling house and IP pump house slightly affected with 11 in number. In case of small farmers dwelling house was severely affected with 21 in number and 17 IP pump house moderately and livestock shed slightly affected with 10 in number. In case of landless farmers dwelling house was severely affected with 23 in number and 11 moderately and slightly affected with 10 in number.

2. On an average of livestock loss *i.e.* cattle, sheep, goat was ₹ 9,50,000, ₹ 23,5000, ₹ 97,500 in large farmers, ₹ 7,89,000, ₹ 8,20,000, ₹ 4,325,00 in small farmers and ₹ 3,21,000, ₹ 2,69,000, ₹ 2,07,500 in case of landless farmers. In case of large farmers cattle was lost with 26 in number and 27 dead and 10 goats were diseased or handicapped. In case of small farmers goats was lost with 58 in numbers and 53 sheep's were dead and cattle and goats were diseased or handicapped with 20 in number. In case of landless farmers goats were lost with 12 in numbers and 32 sheep's were dead and 11 goats were diseased or handicapped.

3. With regard to infrastructure loss due to flood and heavy rains was more in case of rural roads with the value of ₹ 869 lakhs, followed by state roads with ₹ 465 lakhs, rural bridges with ₹ 294 lakhs, irrigation tanks with ₹ 284 lakhs, water shed damage with ₹ 218 lakhs, CMC/TMC roads with ₹ 280 lakhs, Urban water supply with ₹ 175 lakhs, KPTCL loss with 70 lakhs, and rural water supply with ₹ 34.75 lakhs.

4. The cropping pattern of the sample farmers in included maize, sorghum, bajra and wheat as food crops. Greengram, redgram and bengalgram were pulses while groundnut and sunflower were oil seeds. Grape, lime, pomegranate and banana were horticulture crops grown in different seasons. It was noticed that the among these crops the area under maize was found to be highest (0.88 ha). Groundnut, sunflower, bajra, greengram and others occupied an average area of 0.2, 0.36, 0.54, 0.24 and 0.88 ha. While in case of small farmers also, the cropping pattern was same with variation in area under each crop. Among these crops the area under bajara was found to be occupying highest area (0.51 ha), groundnut, sunflower, maize, greengram and others occupied an average area of 0.02, 0.02, 0.35, 0.08 and 0.35 ha.

5. During *rabi,* sorghum, wheat, bengalgram and other crops were grown by large and small farmers. The large farmers grew sorghum, wheat, bengalgram and other crops on an average area of 0.48, 0.56, 0.32 and 0.6 ha. And small farmers grew same crops on an average area of 0.13, 0.13, 0.03 and 0.07 ha,

6. During *summer,* groundnut, maize, sunflower and other crops were grown. The average area under these crops was 0.12, 0.2, 0.08 and 0.52 ha. And also perennial crops like grape, lime and other horticulture crops were grown. The average area under these crops was 0.036, 0.032 and 0.016 ha, by large farmers.

7. In estimating the economic losses arising from crop failure during normal year and affected year data on actual yield as well as the affected yield was collected from the respondents in the flood affected area of bijapur district. When comparison was made with the yields of normal and affected years there was reduce in the yields for each and every crop grown due to flooding and the crops grown in all seasons were maize, sorghum, bajra and wheat as food crops. Greengram, redgram and bengalgram were pulses while groundnut and sunflower were oil seeds. Grape, lime, pomegranate and banana were horticulture crops grown. And there was also a change in the value of crops with season to season and the price or value for each crop per quintals was calculated by taking the prices of the affected year as the base.

8. The loss in the milk yield was also compared with normal and affected year, the loss was more in case of small farmers with 52.48 per cent and value loss was 62,047.2 ₹, large farmers with 51.56 per cent and value loss was 57,244.8 ₹ and landless farmers with 67.27 per cent and value loss was 22,090.14 ₹ Mainly the price per liter was calculated by taking the prices of the affected year as the base.

9. The loss in stored grains, inputs and household items due to flooding was more in case of large farmers followed by other two categories of farmers. Here food grains loss was more in case of in all three categories of farmers because they store for consumption purpose.
10. The compensation provided towards crop loss due to Don River flooding was high in Bijapur taluk *i.e.* ₹ 1,35,35,020 and in Basavana Bagewadi taluk was ₹ 67,17,880 for both *kharif* and *rabi* seasons which include crops like Red Gram, Sajja, Go Jowar, Groundnut, Jowar, Gram, sun flower and Kusube. And compensation received per farmer and per ha was ₹ 1,826 and ₹ 1,232 in Bijapur taluk and in Basavana Bagewadi taluk was ₹ 1,873 and ₹ 781.
11. The details of villages rehabilitated in Bijapur taluk was 5 in number with total families of 1996 that to completely and Basavana Bagewadi taluk was 3 in number with total families of 1018 where 2 villages were completely and 1 village partially by different agency.
12. An opinion survey conducted to know the constraints faced by farmer- beneficiaries in the study informed that delay in Non availability of drinking, Non availability of food, problem with electricity, closure of schools, problem with dwelling, lack of medical facilities, inadequate of transportation facilities. Crop loss, loss of farm soils, non availability of labor, non availability of inputs, field inundation, increase in incidence of pest attack. Problems in Shortage of dry fodder, shortage of green fodder, loss of livestock (lost/death) and non-availability of concentrate were other problems faced by farmers in the study area.

6.5 Policy implications

Based on findings of the study following policies can be suggested.

1. Norm for compensation should be modified to enhance the compensation to the affected people.
2. Community approach should be followed for assessment of loss.
3. District level natural disaster management unit should be strengthened with skilled manpower, advanced knowledge and logistic facilities.
4. Long term measures for total rehabilitation should be taken upto avoid huge socio-economic losses. Although, engineering measures have been developed by the State Irrigation Department, but a comprehensive DPR to rehabilitate Don River with community participation can be a permanent solution.
5. Param Shivavaih committee report can be submitted to the Government of India by providing the extent of socio-economic damage caused by floods in Don River.

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LIVELIHOOD ISSUES IN FLOOD AFFECTED FARM ECONOMY : A CASE STUDY OF DON RIVER BASIN - BIJAPUR DISTRICT

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ABSTRACT

Impacts of natural disasters like flood are focused widely into public debate due to fast communication and sensitivity of Governments. These events need scientific analysis for long term policy and planning. The study was taken up to analyse the bio-physical and social impacts of floods in Don River in Bijapur district, Karnataka during 2012 on rural livelihoods and to document relief and rehabilitation measures. Flood and heavy rains caused loss to cultivated land, rural roads, bridges, irrigation tanks, water shed structures, urban and rural water supply systems. A comparison of crop yields of flood hit year with normal years revealed a reduction in yields of major crops. Floods caused loss in farm inputs, milk yields, stored grains and household items including food grains. Compensation was provided by the Government towards crop loss due to flooding in the district, which was not found adequate. Major challenges faced by farmers during floods were non availability of drinking water and food, lack of electricity and medical facilities, closure of schools, problem with dwelling houses, inadequate transportation facilities. Non availability of labourers and farm inputs, field inundation, increased incidence of pest attack, shortage of dry and green fodder and concentrates were other problems faced by farmers. The study highlighted socio-economic losses and their implications for rural livelihoods due floods. As a long term policy, study suggests a rehabilitation programme for Don River with community participation. Strengthening existing District Natural Disaster Management Cell with advance logistic facilities would help in planning and managing the disaster situation effectively. As a short term measure, compensation norms for relief need to be more comprehensive and relief itself need to be more targeted.