A comprehensive and systematic review of the past relevant literature is essential for scientific research. A reference to the past studies provides guideline not only with respect to objectives and methodology, but also suggests operational definition of concepts providing a basis for interpretation of findings. Review of literature has been incorporated in the relevant parts of this dissertation in order to make the results more meaningful. But unfortunately, the present investigation is almost new in its field. There is hardly any study available in Orissa in the field of extension education directly related to the present one. So the present study would serve as a stepping stone. So far as research on integration of social forestry into agriculture for the welfare of the farming community is concerned the present one would be of first of its kind in the state. An attempt has been made to present the past literatures having a bearing on the present study as direct or indirect references. These have been presented under the following heads.

I. Socio-economic characteristics of social forestry adopted farmers.

II. Knowledge and awareness about social forestry programme along with attitude towards it.
III. Farming system in relation to social forestry.

IV. Social forestry in relation to environment.

2.1 Socio-economic characteristics of Social forestry adopted farmers

Social forestry is not a new concept. It has been practised by the farmers since the inception of civilisation. But mainly due to environmental degradation, population pressure as well as to fulfill the various needs of the farmers from an unit of land, thrust has been given in a new dimension. Farmers desire change but they will accept those issues which will meet their needs and socio-economic conditions. The system approach to bring about changes in socio-economic situation essentially needs a deep analysis of their socio-economic situation.

Singh (1985) in his study on effectiveness of social forestry programme reported that majority of the beneficiaries belonged to middle age group followed by old age group, majority of the social forestry adopted farmers were literates and nonparticipants in formal organisations. Besides, majority of the beneficiaries of social forestry programme belonged to medium income group having a medium extension contact and mass media exposure with high degree of urban contact.

Rao (1986) in his study 'effectiveness of social forestry programme on tribal farmers of Andhra Pradesh' concluded that majority of the tribal farmers belonged to middle age group,
illiterate having low level of social participation in formal organisations with medium level of annual income followed by low income group. He further reported that majority of the respondents had low extension contact and low mass media exposure having an average urban contact.

Peddaiah (1987) in his study on social forestry in Kurnool district of Andhra Pradesh reported that majority of farmers belonged to middle age group, literate and also belonged to medium income group category. He also observed that majority of the beneficiaries were having average extension contact, medium mass media exposure and urban contact.

According to Rao (1990) in his study of 'critical analysis of social forestry programme in Nalgonda district of Andhra Pradesh' revealed that majority of the small farmers were from middle age group, literate, belonged to medium annual income category with medium social participation, mass media exposure, information seeking behaviour, cosmopoliteness and low input accessibility.

Therefore, all the studies reveal that a large majority of marginal farmers belonged to middle age group, mostly illiterate, low annual income, medium extension contact, low social participation, medium mass media exposure, information seeking behaviour, cosmopoliteness and low input accessibility.

2.2 Knowledge and awareness about social forestry programme along with attitude towards it

Sanger (1977) reported that during 1970 there has been increased awareness of the role of trees in tropical ecologies.
The fact was emphasized by the droughts that swept the Sahelian region of Africa, where human and cattle population perished or fled from their famine ravaged homeland.

Maghembe and Kariuki (1982) presented a paper on 'The Need and Level of Agroforestry Education' in Agroforestry Education Workshop in December 1982 held at, Nairobi Kenya. They suggested that agroforestry is a multidisciplinary subject among others covering the fields of agriculture, forestry, animal husbandry, biology, sociology, economics, regional planning and other allied sciences. Education in this field should, therefore, encompass all those facts and should be offered at master degree level with possibilities of doctoral and post doctoral research.

Manandhar, Pelinck and Gecolea (1982) studied the massive campaign of reforestation in the hills of Nepal and indicated that both the training itself and the communication aids provided, have improved the competency, confidence and morale of the field staff implementing Nepal's Community Forestry Development Programme.

Mathaya (1982) reported that social forestry will not only help in meeting the requirements of fuel, fodder and timber but also help in restoring the ecological balance. To spread this knowledge, the voluntary organisations which are working in the rural areas should secure the people's participation.
In this connection Chand et al. (1983) stated that social forestry in Himachal Pradesh could not effectively mobilise people for participation due to limitations in the programmes delivery and awareness of people about the programme.

Muniswani (1983) observed that social forestry is aimed to create an awareness among the people about the importance and significance of trees and also to prevent the society to deplete the resources of the forest which are intended more to maintain the ecosystem.

According to Fort Mann (1984) in social forestry programme, local extension staff must be an integral part of information gathering and the design process. Their participation should be structured in such a way as to provide them on the job training in the gathering and analysis of social information.

Mohan Sundaram (1985) stated that there was no awareness on the part of the rural poor about their rights and how to utilise various programmes specially meant for them.

In this context Sen et al. (1985) in a study people participation in Farm Forestry in West Bengal concluded that about 60 per cent of the sample participants reported that they came to know about social/farm forestry programme from the local forest officials. Of course, the role of local leaders in social forestry activities was commendable (36.97%). They also reported that the awareness of respondents was mainly focused
on the fulfilment of fuel wood requirements. Monetary benefit after the sale of produce was also another aspect about which majority of the respondents were aware. Poor awareness was observed in the areas of effect of forest on ecology and better utilisation of lands unfit for agricultural crops, soil conservation etc. However, greater awareness about different benefits were observed among the beneficiaries.

Singh (1985) in a study on social forestry reported that majority of the respondents had favourable attitude towards social forestry programme having average knowledge about different aspects of social forestry programme. They were quite aware of the programme.

Rao (1986) in a study on social forestry in Andhra Pradesh concluded that majority of the respondents were having medium awareness, average knowledge about social forestry programme and also had favourable opinion towards it.

Similarly, Peddalah (1987) in his study on social forestry in Andhra Pradesh found that majority of the sample respondents were having medium level of awareness about different aspects of social forestry programme, had medium level of knowledge followed by high level and also had favourable opinion followed by highly favourable opinion towards social forestry programme.

Tschinkel (1987) after an analysis of eleven cases of reforestation concluded that the initial phases of further projects
should include at least an extension service that is personal and intensive with frequent follow-up visits and co-ordination of agriculture and forest extension work to ensure integration of tree planting with farm practices.

Joshi (1988) recommended that voluntary agencies should be involved more and more in the task of afforestation to make social forestry a successful programme.

Patel (1988) suggested that a scheme to link incentive with the production of fuel, fodder and timber under agroforestry should be involved. Besides, massive demonstration plots on the government farms, waste land and progressive farmer's farm should be conducted to create awareness amongst farmers, bankers and Govt. officials.

Patnaik (1988) reported that about 58% of the respondents of his study came to know about social forestry after its inception and 38% of the respondents had known about the project before the start of plantation. Further, he also concluded that individual benefit oriented scheme in a village over a common land, may not earn favourable sanction of the villagers and may sometimes give rise to conflict and dissensions.

Rao (1990) in his study on "Critical study of social forestry in Andhra Pradesh" concluded that there was no significant difference between small and marginal farmers in respect of awareness scores. Majority of small and marginal farmers
were well aware of different aspects of social forestry. Comparatively low awareness was noticed regarding their awareness about components of social forestry and different schemes providing financial assistance. Further, he also reported that there was a significant difference between the small and marginal farmers in respect of knowledge. In other words, small farmers had better knowledge and differed significantly when compared with marginal farmers. Majority of the small and marginal farmers had medium to low level of knowledge about selected practices of Eucalyptus, Casuarina and Babul. The knowledge of respondents had significant association with education, social participation, extension contact, annual income, mass media exposure, information seeking behaviour, cosmopoliteness and has significant association with age. Besides, he also concluded that majority of the small and marginal farmers had neutral to favourable opinion towards social forestry programme.

2.3 Farming system in relation to social forestry

From Nigeria, Kio (1972) has advocated the use of fast growing *Gmelina arborea* for cultivation with food crops and felled after 10 years for pulping. Alternatively, on a more extensive basis, the rotational planting and replanting of *Cocoa* under the long-lived *Triplochiton scleroxylon*, on a 40 year cycle, could maintain families cultivating approximately one hectare.
Amon and Adetunji (1973) reported that the yield of food crops (especially Yam and Cassava) from agro-forestry farms was greater than that from long cultivated shifting cultivation farms. The rapid flush of nutrients which occurs immediately, the forest soil is utilised by food and tree crops which have been planted at the same time as clearing occurred.

Studies on primary biological productivity have led Dickinson (1972) and Leith (1976) to conclude that conversion of natural vegetation in the humid tropics into crop land may reduce productivity substantially, if present agricultural practices are continued. Native crop plants with minimum fertilizer demands for given starch, oil and sugar yields should be developed in those areas rather than introducing exotic that require large inputs of nutrients.

Broughton (1977) stated that it is an established practice in commercial plantation crop system, particularly rubber and oil palms, to cultivate fast growing leguminous cover crops, the recognised advantages being nitrogen fixation and soil conservation.

Lagemann (1977) in his study of Ibo farming practices in South Eastern Nigeria where population density range as high as 1000/Km² found a strong positive correlation between population density and the intensity of tree use. Land area devoted to multistorey compound gardens increases with population
density, reaching 29 per cent of the cultivated area and producing 59 per cent of the crop output in the most densely settled areas.

Patil and Pathak (1977) stated that under unculturable waste lands, the silvi-pasture with top feed/fuel trees of multiple use in combination with herbaceous pasture plants largely of perennial nature and legumes under tree plantations for pasturage are more desirable. This system of utilisation of unculturable land is widely accepted and assumes greater economic returns. In their study "Energy plantation and silvi pastoral systems for rural areas" they used Subabul and Sevari in inter cropping with the dry land crops like groundnut, sesamum which are important oil seed crop and pigeon pea as a pulse crop to get a sizable amount of green leguminous fodder in summer time when it is extremely scarce.

Buol and Sanchez (1978) opined that for thousands of years, indigenous people have obtained a living within the rain forests of humid tropics by means of shifting cultivation and casual food collection and hunting within the forest. Currently about 36M/Km² of land that is about 30% of the World's exploitable soils are under shifting cultivation, producing food for more than 250 million people, representing about 8 per cent of the World's population.

Mc Connell and Dharmapala (1978) stated that a proven alternative of improved mixed tree crop system is the multi-tree
crop associations typical of the kandy gardens in Sri Lanka, which present useful opportunities in several countries. In Sri Lanka the model farm area is less than 0.5 ha., but this does not provide for a typical farmers subsistence. The ideal structure is thought to be a combination of approximately 0.67 ha. of forest garden, with 0.5 ha. of cleared vegetable land and less for fodder crops to support goats and one or two milk cattle.

Felker (1978) stated that integration of trees in crop production fields is an essential part of traditional farming system in the dry region. The typical example is the extensive use of Acacia altibida in the groundnut and millet production area of Sub-saharan Africa.

Nair (1979) pointed out that the intimate association of plants in the small holder integrated system, minimises erosion hazards and precludes the possibility and even the necessity to cover crops. However, application of manures and fertilisers and other soil management packages are important if reasonable yields of the interplanted crops and the main (plantation) crop are to be ensured.

Rao and Willey (1980) stated that research has shown that multiple cropping is indeed beneficial through increased overall production per unit area, improved production stability over time and gives a better income distribution over the years through harvests of different crops at different seasons.
Spears (1980) quoted one extensive project as Caqueta in Columbia, where settlers were given 85 ha. of land for pasture and cattle. Experience showed that a typical family needed between 250-500 trees to provide basic domestic needs for fuel wood and other forest produce. However, the holdings were too small for viable beef production and farmers were dependent on subsistence crops for their living.

Further, he added that an alternative solution leading to intensified production of timber and a better income for taungya farms has been implemented in Kenya, where plantations of exotic soft woods, mainly pines and maxican cypress have a productivity 15 times greater than that of indigenous forests, they have replaced. These forests together with cropping of maize, beans and potatoes, provide a satisfactory income for the farmers and at the same time reduce pressure on the native forest reserves.

Salem and Nao (1981) reported that wind breaks are mostly found in areas where strong dry winds are dominant. Tree rows are also used in irrigation areas. In different parts of South-East Asia, farmers plant Sesbania grandiflora around their rice fields for wood fuel production.

In a special study of 15 developing countries by FAO, 1981 it was found that the present rate of fuel wood plantation establishment of 63,500 hectares per annum would have been
increased by more than ten times to 6,70,000 hectares per year if a shortage shall be avoided in the year 2000.

Kang et al. (1981) observed that the productive role of woody perennials in agroforestry system includes production of food, fodder, fire wood and various other products. One of the most promising technologies of this kind that is applicable in a wide range of situations is the hedge-row intercropping (alley cropping) in crop production fields. Promising results have been obtained from this type of studies conducted at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, where the practice is called alley cropping. The most promising system based on those trials is *Leucaena leucocephala* / maize grain yield at a reasonable level even without nitrogen input on a low fertility sand inceptisol, the nitrogen contribution by *Leucaena* mulch on maize grain yield being equivalent to about 100 kg ha\(^{-1}\) for every 10 t ha\(^{-1}\) of fresh prunings. The hedge-row intercropping system offers the advantage of incorporating a woody species with arable farming system without impairing soil productivity and crop yields.

Relwani and Rangenkar (1981) reported that Subabul is preferred over many other fast growing trees as it fixes 500-550 kg of atmospheric nitrogen per hectare per year. The shoots if buried improve the fertility of the land.
Simon (1981) reported that most wood fuel is collected and used for home consumption. In Costa Rica and Nicaragua, only 24 per cent of the small farmers buy their wood on the market, while in rural areas of Java 70 to 80 per cent of the households collect their own wood fuel and in Phillipines it was 67 to 80 per cent.

World Bank (1981) in a study concluded that for Sub-Saharan Africa the estimated fuel wood need in 2000 will be 280 m/m³. In order to meet this need, 19 million hectares of fuel wood plantations will have to be established. Annual planting will have to increase more than 20 fold i.e. from 70,000 ha per year to 1.5 million ha. Drastic measures expressed in conventional terms of area of closed fuel wood plantation, means that 50 million ha. of such plantations will have to be established between now and the end of the century to ensure a reasonable degree of self sufficiency.

Keswani and Ndunguru (1982) reported that multiple cropping systems on the same unit of land either inter cropped or in sequence have been the main phenomenon in tropical farming system since time immemorial. In most instances, a cereal and a legume have been the intercrops although other crop combinations like coffee/banana, simsim/maize/cassava, cotton/maize etc. are common.

Wiersum (1982) reported that in Java where rural population densities are among the highest in the world, three forms of
tree gardening have been distinguished, ranging from home garden to mix-gardens and village forests. The area devoted to home gardens increased with population density, occupying anywhere from 15-75% of the cultivated area, producing more than 20% of household income and 40% of household caloric requirements and providing one of the highest returns to labour of all available employment opportunities.

Bhatt and Yusufzai (1983) found that Subabul can yield 70 to 100 tonnes fodder per hectare under irrigated condition in eight or nine cutting per year for more than 15-20 years.

Chowan (1983) reported that with respect to agroforestry in cultivated land in Maharashtra, a total of 435 farmers in 150 villages have planted 21,09,000 subabul seedlings over an area at 1315 hectares and raised both the food and fodder crops with subabul in an integrated system.

Jodha (1983) concluded that one additional risk that may rapidly become a certainty is lack of access to common property or common access resources. Many resource poor farmers especially tribal people are dependent on common access forest and pasture lands for fuel wood, fodder or grazing and a variety of non wood forest products.

Fort Mann (1984) reported that now forestry is fashionable, extension programmes and packages will increasingly include a tree component. Unfortunately, since most planners still think
of the farmers as male only, a few of those who formulate those projects consider their impact on women or the role of women in implementing them. It is the intelligence, energy, initiative and labour of women that will determine whether agroforestry and other 'tree' projects work or not. Further, he concluded that agroforestry and other tree projects in developing countries often simply fail to take women into account yet, women provide at least half the rural labour and had significant number of rural households, as well as, being the major users of fuel wood and wood products. It is essential that women participate in agroforestry projects and benefit for them. Project design must take into account women's access to land, labour and capital and the effect of projects on their labour burden.

Mathur et al. (1984) reported that in the states of Uttar Pradesh, Punjab, Haryana, the Eucalyptus has been planted by farmers on field bunds, along field boundaries in rows, along water channels and in compact stocks in agriculture fields with variable spacing. They also reported that cultivation of Eucalyptus at wider spacing in combination with agricultural crops at years rotation ensures high economic returns.

Raintree (1984) reported that in general, lower the agriculture land pressure, the heavier the reliance on cash income and community development incentives to make "integral taungya" system attractive to farmers. Social equity considerations aside, self interest alone may justify this approach to foresters
as one of the few realistic ways of enlisting farmers as allies, rather than enemies in the forestry production effort.

Tiwari et al. (1984) reported that a study was conducted in Ramganga catchment in U.P. hills to determine the financial feasibility of afforestation of community lands. The study revealed that all the tree plantations were found to be feasible at 5% discount rates in terms of net present value, gross benefit cost ratio and the study further recommended for mixed plantation.

Bentley et al. (1985) have concluded 'complexity' as an advantage that favours the resource-poor farmers. The reason is that larger farmers world over have shifted towards simpler production system, especially mono cropping pattern of grain and woody plants, where the essence of management is "goals and controls" or "management by objective" small farmers, but especially those who are largely subsistence rather than market oriented, instead have a strategy of diversification and complexity to avoid the risks of failure in any one activity as well as to meet yearly needs.

Gariappa (1985) in his study "Relevance of Social Forestry to the rural poor" observed that except in heavily concentrated plantation areas, marginal and small farmers rarely adopt farm forestry.

Jones (1985) concluded that promotion of forestry activities can be greatly facilitated through the application of the Farming
System Research Methodology better to understand farmers motivations for planting or maintaining trees on farms and thereby avoid the recommendations of production techniques and species which do not address immediate forest needs of farming populations of which conflict with other farm priorities.

Ruangpanit (1985) reported that field projects on forestry for local community development are under way in Thailand. Their accomplishment is very dependent on their ability of the foresters in charge, participation of the beneficiaries or the people in the local community is extremely important and if they do not participate in the planning and implementation the community forest project will not satisfy individual and local needs, if they do not participate in receiving the benefits, the project will have no meaning for them.

Mane (1986) reported that sufficient infrastructural arrangements, formulation of practical strategies and intensive extension efforts have good potential to take up social forestry as an instrument of development.

Rao (1986) opined that Eucalyptus has an assured future in Andhra Pradesh, considering the large demand for the Eucalyptus for industrial sector. He also reported that most preferred species for Andhra Pradesh are Eucalyptus of Mysore hybrid and the Jadhpure variety.

Dogra and Kapur (1987) observed that in Punjab, about 85% of the total Eucalyptus planting is done by farmers who
harvest the trees after 7-8 years. Further, he concluded that *E. camaldulensis* has the maximum average crop height and diameter and is best for wood production.

Patel and Patel (1987) opined that intensive research and development effort backed by appropriate public policy may have to be made in the area of social and farm forestry so as to restore ecological security, meet fuel, fodder and other domestic products.

Dalvi and Shukla (1988) reported that about 70 per cent of the expenditure incurred in the plantation activity of the social forestry programme is composed of wages of unskilled labourers. Although the message of planting trees has been received by all categories of farmers, performance of small farmers is poor.

Mukul Sanwal (1988) reported that most problems in social forestry programme are not related to technical production questions, but to issues of distribution and equity. To date, most studies have emphasized strategies for halting deforestation and planting more trees, often to the exclusion of strategies for maintaining the plantations and meeting the needs of the poor.

Patnaik (1988) found that nearly 250-300 mandays were generated over an half ha plot for the beneficiaries of social forestry in Orissa during 1986-87.

Maithan and Sharma (1989) stated that for production of firewood the range of spacing varying from $1 \times 1 \text{ m}$ to $1.5 \text{ m} \times 31$
1.5 m may be adopted. With these spacings higher bark percentage and lower under bark diameter are expected in case of Eucalyptus plantations. They also concluded that for wind breaks and shelter belts the row to row distance of 2 to 3 mt and plant to plant distance varying from 1 to 2 mt may be suitable in case of Eucalyptus plantation. On field bunds spacing of 1.5 mt and on railway and road side 1 x 1 to 3 x 2 mt spacing may be adopted.

Rao (1990) reported that there was no significant difference between adoption level of small and marginal farmers. In other words, extent of adoption of social forestry by the small and marginal farmers were same. As a whole there was a medium to low adoption by both the small and marginal farmers. Majority of them not adopted different practices like chemical seedling treatment, depth of planting and number of seedlings per area of Eucalyptus, Casuarina and Babul. The extent of adoption of respondents had significant association with education, social participation, extension contact, annual income, mass media exposure, information seeking behaviour and cosmopoliteness. The adoption had non-significant association with age.

Further, he concluded that most of the farmers have perceived many of the advantages and disadvantages of Eucalyptus. Both small and marginal farmers rightly perceived that Eucalyptus does not require water management, useful for poles and protection is not necessary. The important disadvantages perceived were it reduces the water table in the soil and harmful to other crop.
A great majority of small and marginal farmers were perceived that the casuarina plants are having fast growing habit, plant protection is not necessary and requires less water. The important disadvantages perceived were not suitable for all types of soils and requires intensive care and management. Majority of small and marginal farmers perceived pod of the Babul are good source of fodder, useful for implements, suitable for all types of soils and less water is needed. The important disadvantages perceived were slow growth habit and protection is difficult.

2.4 Social forestry in relation to environment

King and Chandler (1978) concluded that life style is becoming less common however, as population increase impose greater pressure on forest resources. They have observed that forest clearing now takes place at an annual rate of 0.4 to 0.5% of the total area of tropics. Valuable timber resources are depleted, protective cover is removed for vast watershed areas with consequent increase in erosion and the potential for food production is decreased in both areas of shifting cultivation and also in those down stream areas under permanent cultivation that support additional population.

Andriesse (1979) however, while accepting the general objectives of agroforestry has cautioned against over-optimism. The traditional cultivator is not wilfully destructive, rather
It is population pressure particularly of migrant communities, that present the greatest threat. Even with agroforestry environmental requirements are likely to take second place to the drive for increased production.

Wilson and Kang (1981) reported that in alley cropping the leaves can be incorporated into the soil as green manure or retained on the surface as mulch. The two methods of leaf utilisation are important considerations for effective implementation of alley cropping.

Zeuner (1981), Neumann (1983) observed that looping and prunnings from hedge-row species could also provide mulch to aid in preventing sheet erosion between trees.

Read (1982) reported that in field trials he could find no consistent trend between green manure and mulch in the first crop and attributed the results to high soil nitrogen levels. However, in the second season the crop grown without application of more nutrient showed that Leucaena had a better residual effect than Calcium Ammonium Nitrate.

Budowski (1983) reported that use of trees and other woody perennials to protect agriculture fields from trespassing or against the adverse effects of wind is a widespread practice in many agricultural systems. A large number of multi purpose woody perennials are being used as effective live fences at
Similarly very encouraging results have been obtained at the Pakistan Forestry Research Institute, Peshawar (Sheikh and Chima, 1976, Sheikh and Khallique, 1982).

Bently (1984) reported that at least 150 million hectares of India have common access or common property rights for part to all of the year for grazing, for gathering of fuelwood or for other resource values. These rights which are especially important to the resource-poor and landless, are a major cause of land productivity degradation.

Nair (1984) stated that erosion hazards rather than soil fertility posed greater problems of soil management in most taungya system.

Stocking (1984) reported that there is clear evidence of a link between soil erosion and fertility decline. Material loss by sheet erosion contains a disproportionately high content of nutrients, compared with the top soil as a whole. There is also loss of soil organic matter, the highest content being at the surface as well as the washing away of litter prior to its decomposition.

Jambulingam and Fernandes (1986) reported that extensive areas in the western part of Madurai district have been planted up with wind breaks to protect crop land from the ferocity of
the pre south-west monsoon winds that occur regularly in May and June. These wind breaks usually consist of a central rows of Azadirachta indica flanked by rows of Prosopis juliflora and Euphorbia tirucalli. All these species are drought tolerant.