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### Creating Livelihood Opportunities for Women through Agroforestry Systems

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#### INTRODUCTION

In India, women spend more time on unpaid care work than men, and on an average, spend about thirty min to five hours in collecting fodder, fuel wood and water for the household. They are an essential part of farm households, it is equally important to recognize and value their role in agriculture, especially to ensure agricultural growth for reducing poverty, increasing the food and nutritional security and enhancing the livelihoods of women and family. Arranging fuel wood, fodder and water is the responsibilities of women in rural households, for which they depend on common property resources. Increasing demand for these resources outstrips the re-growth of these resources, which further enhances the work load and drudgery of women as now they have to travel longer distances (Laxmi *et al.* 2003, Veld *et al.* 2006 and Sahoo & Singh, 2015) for meeting the daily requirement, often settling for poorer-quality material.

In the household, it the mother who decides what the young children should be fed as well as the dietary intake of the entire household. While taking care of the family, women often neglect their own health and become under nourished and weak. Usually the women in the household throughout India rise from the bed earliest and go to bed the last. Therefore, it is not surprising that the women, like in Odisha suffer chronically from anaemia (MSSRF, 2015). Thus, to improve their nutrition and that of the household, it is important to understand and recognize their work load within and outside the home, and make appropriate provisions to allow women to take care of themselves, children and other family members.

The drudgery is women increase many folds because of the crop failure, which has become an annual phenomena due to the increased frequency of natural calamities like droughts, floods, cyclones. This ultimately leads to increased poverty, loss of income, loss of fertile land and resources, besides

loss of livestock. So, to protect the women from undergoing this hardship is to improve and strengthen their means of livelihoods and increase the agricultural productivity. Tree based SMART agricultural practices can assist the rural women to improve their livelihood and reduce their daily drudgery by bringing the resources near to their households. This study provides an overview of the drudgery faced by rural women in India and the innovative ways to create livelihood options for them through agroforestry systems.

### **ROLE AND DRUDGERY OF WOMEN IN AGRICULTURE AND HOUSEHOLD WORK**

Women are an essential part of farm households, it is important to recognize and value their role in agriculture, especially to ensure agricultural growth for reducing poverty, increasing the food and nutritional security and enhancing the livelihoods of women and family. Today, three-fourths of women workers are in agriculture, finding sustenance in this sector. They provide for as female agricultural labour, as farmers, co-farmers, female family labour and as managers of farms in their widowhood or when male migrate to cities, and as farm entrepreneurs. In the rural India, women work extensively for the production of the major grains and cereals, in land preparation, seed selection and seedling production, sowing, applying manure, fertilizers and pesticides, weeding, transplanting, watering, threshing, winnowing and harvesting.

The house hold and community members, throughout the country, play an equal role in livestock rearing. The women constitute about 70% of the total workforce in this sub-sector (Singh, 2012). In certain regions, communities and small herds and flocks, they contribute to more than 90% of the labour requirement for livestock rearing, ranging from animal care, grazing, fodder collection and cleaning of animal sheds to processing of milk and livestock products.

Mulch animals, small ruminants and backyard poultry are an important source of income for poverty stricken farm households. However, the reduced resources of fodder, increases women drudgery as now they have to spend more time and energy for sourcing the required quantity of fodder.

Arranging fuel wood is another main responsibilities of women in rural households, for which like fodder collection, they depend on common property resources. Increasing demand for fuel wood outstrips the re-growth of these resources, further enhancing the work load and drudgery of women as now they have to travel longer distances (Laxmi *et al.* 2003, Veld *et al.* 2006) for meeting the daily requirement, often settling for poorer-quality, especially for fuel wood, like twigs, branches, dry leaves, etc. Women in arid and semi-arid ecologies walk approximately 2.5 km daily to collect the fuel wood and fodder, often carrying loads of 14-18kg on their head. They spend about 40 to 50 hours per month (Laxmi *et al.* 2003, Parikh 2011) in gathering and transporting the required quantity of material for their family. Women spend much more time collecting fuel wood in areas with degraded forests (Nirmal *et al.* 2009).

Rural and low income households use fuel wood and animal dung in the traditional 'chulhas' or stoves for cooking that are generally three stones arranged in a rectangular shape to function as a stove. These are often placed in a corner of the kitchen with little ventilation. These stoves burn the fuel inefficiently, consuming higher quantity of wood, producing a lot of smoke, causing air pollution and adding carbon to the atmosphere. Villagers in the state of Madhya Pradesh of India (Singh *et al.* 2014) burn 621 tonnes of different types of biomass annually for cooking. The smoke from these unburned and partially burned biomass in traditional stoves creates serious health hazard to the women and children. In some places when faced with a shortage of fuel wood in the common property

resources, the rural households are found to switch to firewood from private trees and in the long run even alter the mix of private trees on their land in favour of trees more appropriate for firewood (Heltberg *et al.* 2000, Veld *et al.* 2006).

In India, women spend more time on unpaid care work than men, and on an average, spend about thirty min to five hours in collecting fodder, fuel wood and water for the household. However, their most of the labour goes unpaid and even unnoticed at time. Apart of the taking care regime, gender plays an important role ensuring the nutritional security of household. FAO (2013a) reports, that the women's knowledge, education, social status, health and nutrition, and their control over resources are key factors that affect nutritional outcomes of the family. While taking care of the family, women often neglect their own health and become under nourished and weak. Besides, it is a well-established fact that the over burden of work and chronic sleep deprivation can produce as much as 50% reduction in serum iron level (Watts, 1988), or anaemia. Usually the women in the household throughout India rise from the bed earliest and go to bed the last. Further, landless women contribute significantly as the agricultural labourers, as they are involved in most of the agricultural operations. Along with this, a majority of labour force contributing to the collection of non-timber forest produce is rural women, especially in tribal regions. As more and more men are moving towards urban areas for non-farm job, the role of women in managing the farms increasing many fold. As the report submitted to the Planning Commission in 2007, only 53% of all male workers are in agriculture, while 75% of all female workers and 85% of all rural female workers are in agriculture.

### **EFFECT OF AGRICULTURAL PRODUCTIVITY**

The lives of women and men agricultural labourers and farmers are dependent on and severely affected

by the state of the agriculture. With increased frequency of natural calamities like droughts, floods, cyclones, the crop failure have become annual phenomena, leading to increased poverty, loss of income, loss of fertile land and resources. Such conditions push the farmers to take extreme steps when faced with debts with high interest rates, use of spurious seeds and pesticides, lack of technical know-how and support, poor crop management, failure to secure water availability, and sudden crop loss. The majority of farmers are marginal and small farmers, of whom women dominate, having less than one hectare land. Under such conditions the hardships faced by the women increases many folds. To protect the women from undergoing this hardship is to improve and strengthen their means of livelihoods and increase the agricultural productivity. This requires scientific knowledge based farming system that brings the daily households needs near to the home and increase the farm productivity. The shift in the approach for promoting agricultural practices that create diversified livelihood opportunities in the areas where women are already present will have multi fold benefits. It is essential to acknowledge that both women and men have different priorities, issues and needs. One of the approaches is to involve both, men and women in participatory discussions while planning suitable tree based farm interventions, as it help in better selection and production of crops and livestock, and significantly contributes to reduction in the farm drudgery of women.

### **TREE BASED SMART AGRICULTURE FOR IMPROVING LIVELIHOOD**

Tree based SMART agricultural practices can assist the rural women to improve their livelihood and reduce their daily drudgery by bringing the resources near to their households. These practices follow the SMART protocol (Specific, Measurable, Achievable, Realistic, and Tangible), and are innovative and farmer as well as environment friendly, and have the

potential to provide the above mentioned benefits. The SMART - agriculture is a combination of emission reducing and carbon sequestration, cost and energy expense reducing and productivity enhancement practices (Figure 1). In general, the SMART agriculture practices advocates a gradual transition and transformation of “purely field crop agriculture” based livelihood practices to agroforestry based livelihood systems, which ensure the availability of food, fresh fruits and vegetables through-out the year (Sahoo,2014). The practice significantly contributes to higher productivity, crop diversity, cropping intensity, resilience to natural disasters, and thus, ensures the increased food availability and better nutrition (Sahoo and Das, 2013). The income level through such practice is regular and increases with time. This when implemented cuts energy expense in farming, reduces emissions, sequesters more carbon, arrests land degradation, and improves the degraded lands, which are among the major issues regarding agriculture.

### Provide for fuel wood

The House-listing and Housing Census Data, 2011, of the Government of India (Census Data 2011)

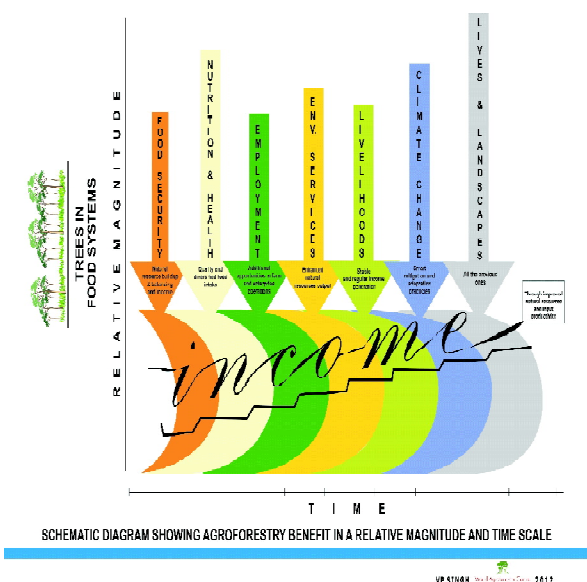


Figure 1: Benefits of tree based SMART-agriculture practices (Agroforestry Systems)

reported that 65.79% of Indian households (HH) use firewood, crop residues and cowdung cake as fuel for cooking and the rest use liquid petroleum gas / piped natural gas (LPG/PNG), kerosene, coal or some other type of fuel for cooking. The percentage of fuel types used for cooking varies in rural and urban area populations; 86% of HHs in the rural area use firewood, crop residues and cowdung cakes, while it is only 14% of HHs in the urban area. Similarly, 35% of HHs in rural area use cleaner fuels like LPG/ PNG for cooking and 65% of HHs in the urban area use.

India uses 216.42 million tonnes (ISFR 2011) of fuel wood for cooking annually and 27%, i.e. 68.74 million tonnes, comes from forests. Only 19.25 million tonnes of fuel wood comes from the current growing stock of trees outside forest (TOF) annually. People in Andhra Pradesh State consume 24.3 million tonnes, followed by Jharkhand State that consumes 21 million tonnes and Rajasthan State consumes 18.8 million tonnes. Increasingly, the trees are logged for fuel wood for cooking and heating, in some cases. Unaffordability precludes the rural households (HHs) from shifting to better combustible fuels (Parikh 2011, Laxmi *et al.* 2003), like liquefied petroleum gas (LPG), piped natural gas (PNG) or even kerosene oil, resulting in continued/ increased logging of trees for fuel wood. The open traditional stoves burn the fuel inefficiently, consuming higher quantity of wood, producing a lot of smoke, causing air pollution and adding carbon to the atmosphere. The villagers in the state of Madhya Pradesh of India (Singh *et al.* 2014) burn 621 tonnes of different types of biomass annually for cooking. The consumption level of fuel wood depends on the socio-economic status, availability of resources in the vicinity and occupation of the households. Others have found that households involved in agricultural labor consume more fuel wood (Bandyopadhyay and Shyamsundar, 2004, Pradhan *et al.*, 2012 and Pandey, 2002). The sources of fuel wood include trees, shrubs and crop residues.

The rural communities generally use available hardwoods (Khan and Tewari 2009, Nirmal *et al.* 2009, Swaminathan and Varadharaj 2001) as they yield more heat and emit less smoke; the choice of species varies from place to place. Rural women in arid and semi-arid ecologies walk approximately 2.5 km daily to collect the fuel wood, often carrying loads of 14-18kg on their head. They spend about 40 to 50 hours per month (Laxmi *et al.* 2003, Parikh 2011) in gathering and transporting the required quantity of fuel wood for their family. Women spend much more time collecting fuel wood in areas with degraded forests (Nirmal *et al.* 2009).

**First approach:** One of the simplest ways to address this drudgery of women is to encourage them to shift to energy “efficient” cooking stoves (Singh, *et al.*, 2014). Energy “efficient” stoves have been found to have better fuel combustion and higher energy efficiency. They are portable, can use multiple fuels and produce less smoke. They are also affordable. They can reduce carbon dioxide emissions by about 25-50% (World Bank 2010) through their improved efficiency and from reduced biomass consumption thereby positively contributing to reduction in degradation and depletion of common resources. There are few studies conducted on the adoption potential of efficient stoves in rural areas. There is a variation in adoption level, which seems to be related to the relative abundance of fuel wood in the common properties and access to it, including the travel distance, land size owned / devoted to produce fuel resources, education and financial status (Inayat J. 2011) of the HHs for buying the stove. Lewis and Pattanayak (2012) have however, found that the basic theory of technology adoption holds true for efficient stoves, and the socio-economic status of the households and institutional arrangements play a role in related household decision making.

**Second approach:** Trees on the farm in the agricultural landscape, provide for the easy availability of the fuel wood for women. With the participatory approach, men and women prioritize and plan the

tree plantation on their farms according to their needs. The trees whether they are for food, timber, fruits, medicinal or fodder require regular pollarding, which provides for the household needs of the fuel wood. This reduces the labour time and energy of women as they get the fuel wood near to their household and that too at all seasons. Through the adoption of efficient cooking stoves in India at four ecologies, arid, semiarid, humid and temperate, Nayak, *et al.* (2014) in their study found that there is an average of 40%, saving in the use of fuel wood for cooking and heating in some cases, along with the same extent reduction in the fuel wood volume, travel time and labor use in the collection of the fuel wood from community lands / forests. The savings in the use of fuel wood for cooking ranges from 1.1 tons in semi-arid areas to 2.3 tons in humid areas. Women save an hour on average from collecting fuel wood and cooking operations, and HHs were marked by less sooty environments. The participating women during experience sharing interviews express eagerness to utilize their saved time in other economic activities, such as homemade traditional food producing/ providing businesses, running a grocery shop, tailoring, etc., to contribute to HH income. Others preferred assisting their male counter parts in farm activities, especially the rearing of livestock as this can provide nutrition, income, manure and fuel.

### **Provide for fodder**

Arranging fodder for livestock is another laborious responsibility of women in rural households. In villages it is a cultural practice to keep livestock in homes and is a symbol of status and wealth. The livestock animals kept are cows / buffaloes, small ruminants (sheep and goats), and poultry. The women in the household, to collect fodder, rely heavily on the natural resources available in the nearby forest areas or common property resources, farm fields or they take their small ruminants for grazing. At times they have to travel 10-15 km to collect the fodder. With degradation of natural

resources, and reduced regeneration of pasture lands, the distance travelled in search of fodder is increasing. If the fodder is available near the homesteads there will be decrease in the drudgery of women and they will save some time from travelling. Degradation of these natural resources have increased the labour of women as now they have to travel more distances to collect fuel wood, water and fodder. The decrease in agricultural productivity also burdens the women with food security of the household. Although, women and men both are responsible for sustainable management of natural resources, the way women use their knowledge of resources and conserve it plays a great role in maintaining the local biodiversity. The fodder and fuel wood resources can be brought near to households, thereby also improving the common property resources. This can be achieved by populating the landscapes, degraded pasture lands, farms and backyards with fodder and multipurpose trees. For this endeavour participation of the community is essential for planting them (Singh, *et al*, 2014). This will require numerous number of tree seedlings. For achieving such as a result, capacity building training to rural women on establishing tree nursery, raising high quality tree seedlings and its maintenance, will provide employment and income generation avenues. These women can usefully utilize the time saved through adoption of smart household practices in by producing much need planting material for this purpose. The nursery can be established in the backyards, under trees, etc. and is not laborious. With adequate knowledge and know-how of establishing a tree nursery, the rural women will be more independent, their time and work will be valued thereby increasing their social status in the community. This will also enhance their livelihood and is good revenue generating option.

### **Provide for nutritional and food security**

The trees based SMART agricultural practices significantly contribute to increased food supply, enhanced nutritional and health security, and

increased farm income along with other benefits, such as the resilience to climate change, improved natural resource base and systems productivity, etc. These practices can be easily implemented in different ecological and socio-economic settings, and at all levels of land holding size. Figure 1 above, gives a general graphical representation of the benefits that accrue from adopting the tree based SMART agriculture, or incorporating the tree farming in the food systems, i.e. agroforestry system / practices in relative magnitude and timescale.

Trees are often referred to as “safety nets” due to their greater resilience to adverse climates than the annual crops, and thereby making significant contributions to food basket during crop failures, or seasonal crop production gaps (Blackie *et al.*, 2014; Keller *et al.*, 2006; Shackleton and Shackleton, 2004). Agroforestry systems provide diversified farm produce, including fruit, vegetable, flowers, pods, leaves, nuts, etc. which contribute to improved food and nutritional security.

The tree based-SMART agricultural practices, i.e. agroforestry systems have been proven to make the livelihoods sustainable and improve nutrition by increasing diverse food production and raising incomes. IFAD (2015) has reported that only increase in food production alone does not necessarily translate into improvements in diets, or nutrition. The most effective approach therefore, is to aim specifically to promote the availability, accessibility and consumption of diverse, nutritious foods through actions all along the supply chain i.e. from production to consumption.

Agronomic interventions, such as improvements in soil health, etc. can also raise the nutritional value of the produce. Adoption of diversified crop and their nutrient dense improved varieties and different agroforestry systems can significantly increase the diversity and nutritional value of food produced (FAO, 2013). Higher incomes and more diversified food production when

combined with nutritional information, such as labelling, or media campaign, education, and behaviour change communications can lead to better food choices and diets. Many studies in Africa have shown that women are extensively involved in the marketing of agroforestry products and its value chains (Kiptot and Franzel, 2011), especially those areas which are dominated by women and children such as indigenous fruits, spices, and vegetables. Awono *et al.* (2002), in a study of production and marketing of safou in Cameroon, noted dominance of women in fruit collection, transporting the collected fruits to markets and selling it at retail shops. Similarly, the Shea kernels and Shea butter trade in Benin is dominated by the women (Schreckenber, 2004). However, Kiptot and Franzel (2012) have noted that given the women's literacy levels are lower than men, they are relatively disadvantaged and as their marketing of agroforestry products is restricted to the local retail shops, women often fail to benefit equitably from the growing national and international markets. It has been established beyond doubt, that promoting participatory adaptation of innovations in tree based SMART agricultures (Leakey *et al.*, 2004), which integrate the local and scientific knowledge, facilitate integration of high value species in the farming system. Women and men prioritize the tree species according to their problems, needs and knowledge. Women generally give importance to trees that provide them, food, fruits, fodder, fuel wood, medicines and prefer local species. Agroforestry practices provide economic, social and ecological benefits to the community, thereby improving the livelihood of the women.

### **Provide resilience to climate change**

The small and marginal land holders in the country are most vulnerable to natural calamities of flood, drought, cyclones, etc. The farming community is dominated by small and marginal, scattered and fragmented land holdings with diverse livelihood

activities. This precludes them, especially women from getting advantages of the market prices for their commodity, and better seeds and fertilizers at lower cost. They are not able to benefit from certain advanced methods of monetary benefits, such as carbon finance markets, payments for ecological services, etc. Climate smart agricultural practices can insulate from ill climatic effects, reduce emissions, sequester carbon and improve income and livelihoods via reduced costs, enhanced productivity and probably via access to carbon finance (Sahoo *et al.*, 2016a). One way of helping the farmers, both women and men, to restore their livelihoods is through cash benefits from the government. This may assist them at the time of calamity; however for a long term solution, the farming system should be made more robust and sustainable. It is timely that the resilience of the farmers is increased for the natural calamities through adoption of sustainable agricultural practices, such as agroforestry, conservation agriculture, etc. This will provide the farmers a coping mechanism at the time of loss of crop in floods or cyclonic storms. Adoption of different tree based interventions assist the farmers, especially women to increase livelihood opportunities, thereby reducing the vulnerability of smallholders to climate variability, especially the sudden natural disasters like flood, and cyclones. In Odisha, where the same cyclones visit every 4-5 years, farmers prefer short rotation tree species (Nayak *et al.* 2014). The rotation period of these trees is 4-5 years, which means they can be harvested before the area is visited by the cyclone.

Diversification of the production systems by including the tree component has provided buffer against income risks associated with climate variability (Singh and Sahoo, 2011). Plantations at the time of maturity would provide the smallholders economic security, which further enhance their resilience to climate change. Even at a cost of Rs. 1000 per tree at the time of maturity say in 10 years, which is very conservative and unlikely for the high

value wood species like teak and high value mango fruit, the farmers can expect to earn significant amount of monetary benefits by selling timber (Singh, *et al* 2014, Sahoo, *et al* 2016) depending upon the density of trees planted at their farms. So, the trees planted on the fields significantly reduce the drudgery of the women. Earlier they use to travel long distances to collect fuelwood for cooking. With trees on the fields, the fuelwood has come near to their homes reducing their burden. In addition, agroforestry management systems offer opportunities for creating synergies between mitigation and adaptation strategies. Smallholders have the opportunity to sell the timber and farm produce from the agro-forestry models which would add to their earnings.

### CONCLUSION

Tree based SMART agricultural practices gives an opportunity to the rural women to improve their livelihood and reduce their daily drudgery by bringing the resources near to their households. These practices follow the SMART protocol (Specific, Measurable, Achievable, Realistic, and Tangible), which is a combination of emission reduction and carbon sequestration, cost and energy expense reducing and productivity enhancement practices. In general, the SMART agriculture practices advocates a gradual transition and transformation of “purely field crop agriculture” based livelihood practices to agroforestry based livelihood systems, which ensure the availability of food, fresh fruits and vegetables through-out the year. The practice significantly contributes to higher productivity, crop diversity, cropping intensity, resilience to natural disasters, and thus, ensures the increased food, fodder, fuel wood availability. The income level through such practice is regular and increases with time. These when implemented cuts energy expense in farming, reduces emissions, sequesters more carbon, arrests land degradation, and improves the degraded lands, which are among the major issues regarding agriculture.

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