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Socio-economic study of farming communities, their knowledge on climate change and agroforestry systems in the cluster of villages of Chhattisgarh plain region, Madhya Pradesh

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Abstract
The study was carried out to examine the socio-economic status of farming communities, their knowledge on climate change and adoption of agroforestry systems in cluster of three villages of Balaghat District of Madhya Pradesh during 2017-19. Farming communities are mainly depending on the agriculture and dairy for their socio-economic upliftment. Average 5.7 persons were present in each farming communities. All the farmers rear 8-10 livestock for milk, meat and for farming. The 40-50% livestock population was accounted by milch animals i.e. cow and buffalo. Whereas, the farmers feed paddy and wheat straw as a dry fodder. More than 50% farmers were falls under marginal and small farmers' category. The family income was highest from agriculture land use system (51-68%) as compared to other systems. The 56% farmers falls in medium, 22% under high, 15% under low and 7% under very low knowledge category of the awareness about climate change. Decrease in ground water level (95.83% farmers), erratic and sporadic rainfall (90.83% farmers) and increase in disaster events (76.67%) were the indicators of climate change on which most of the farmers aware about them, and ranked first, second and third, respectively. Increased use of vehicle (86.67%), over population (74.17%), industrialization and urbanization (72.50%) and increased use of insecticides/ pesticides/ fertilizers etc (65.00%) were the main causes of climate change. Afforestation and reforestation was the technology widely known amount the farmers (74.17% farmers). Around 56.67% farmers of the study area have medium whereas, 21.67% farmers has low, 12.5% farmers have least and 9.17% farmers has high knowledge about agroforestry. Most of the farmers practice agroforestry systems traditionally and this reason ranks 1st followed by systems can be practiced on degraded lands (2nd rank) and minimizing risk (diversified yield) ranks 3rd for the adoption of agroforestry systems. The 95.83% farmers thought about the legal issues regarding planting and felling of tree species, reduce yield of agriculture crops (89.17% farmers), allelopathic effect (84.17%), unavailability of quality planting material (79.17%), long time required for getting returns from tree species (75.83%) were the issues responsible for less adoption of agroforestry systems on commercial basis.

Keywords: Land use pattern, socio-economic factors, climate change, knowledge of agroforestry

Introduction
After green revolution, India has enjoyed rapid economic growth. Whereas, the country also facing the magnitudes of rapid human population growth (Gupta *et al.*, 2017) [16]. It affects on land holdings, land use pattern, cropping pattern and on family socioeconomic conditions (Sarvade *et al.*, 2014a) [29]. According to the Agriculture Census of India 2015-16, an average land holding dropped to 1.08ha as compared to 1.15ha in 2010-11. Whereas, the small and marginal land holdings covered by the 86.08% of the total farming communities of the country and shares 46.94% in the total operated area (Anonymous 2019) [3]. Perpetual decreasing land holding is a serious issue and challenge for agriculture sector of the country. Small and marginal land holdings are the main constraint in the mechanization in agriculture. Where the growing cash crops for increasing economic return per unit area, farm mechanization is the key requirement.

Socioeconomic condition of the farmer shows their economic and social position in the society. Gender might effects on the cropping pattern in agriculture and kind of farming system. Females of the farming community are the working hands in agriculture (Bala 2010) [6]. Farid *et al.* (2009) [14] reported the roles of women in farming & non- farming activities *viz.* post-harvest operations, rearing of livestock and poultry, agroforestry etc. The women labour in agricultural and non-agricultural sector firstly they look to meet the family needs and to enhance the family income.

Whereas, the literacy rate also affects on the farming systems and socioeconomic condition as well. Literate farmers are aware about new farming technologies, which helps to improve their socioeconomic conditions. Literate farmers also adopt agro-advisories given by the institutes, universities, KVKs and other sources. Such activities helps to improve the farm output in case of quantity and quality as well (Yadav *et al.*, 2016) [37]. Changing climatic conditions in last few decades made vulnerable changes in land use and cropping pattern of the country (Ninan and Bedamatta, 2012) [22]. Now days all the farmers are aware about the climate change due to its different kinds of consequences. Some farmers know due to the losses occurred in agriculture production, whereas some are aware due to the adverse climatic events such as high intensity rainfall, flooding, drought incidences etc. (Raghuvanshi *et al.*, 2017) [24]. Ansari *et al.* (2018) [4] reported that the farming community understand the various dimensions of climate change such as increase in temperature, erratic and sporadic rainfall, increase in duration of heat stress due to high temperature, decrease in ground water table and several others.

In such situations, farming communities has to think about its consequences and go for the integrated farming systems. Integrated farming has potential to enhance agriculture production and productivity (Yadav *et al.*, 2019) [36]. Along with integrated farming, farmer should go for cash crops in some extent which will help to improve the livelihood and secure them for nutritional food requirement (Arora, 2013) [5]. Practicing agroforestry systems can be a best option for sustainable agriculture. In agroforestry, we can grow agriculture field crops, fodder crops, horticultural crops, fruit trees and forest MPTs (Multipurpose Tree Species). Diversified products may yield from the agroforestry systems, which helps to reduce the production risk and uncertainty in economic benefits (Sarvade and Singh, 2014; Sarvade *et al.*, 2014a; Singh *et al.*, 2015; Sarvade *et al.*, 2019b; Sarvade and upadhyay, 2019) [25, 29, 33, 30, 26]. Agroforestry systems also helps to improve soil health, where it cut downs the production cost at some extent (Sarvade *et al.*, 2014b; Sarvade *et al.*, 2017; Sarvade *et al.*, 2019a) [31, 27, 28]. In case of the adoption of agroforestry system, people gave prefer for fuel wood, fodder, vegetable, fruit, and timber while moderate or low preferences for medicine, cottage industry/ handicrafts, fibre/ floss, oilseeds and animals/ birds/ insects etc. (Gupta *et al.*, 2017; Islam *et al.*, 2015) [16, 17]. Banyal *et al.* (2015) [7] reported that the high financial return was the only response holding the key as motivational factor for adoption of agroforestry practices. Rather than these benefits of agroforestry, adoption rate is very low due to the inadequate availability of quality planting material, thinking more about negative impacts of tree species on crop and legislative measures for planting and felling of MPTs (multipurpose tree species) (Sharma *et al.*, 2017) [32]. Moreover, the policy matters are also responsible for the farmers' avoidance in adoption of agroforestry systems (Chavan *et al.*, 2015) [11].

So, that the finding the impact of climate change on agriculture and adoption of agroforestry systems for mitigating climate change impacts and improve the socioeconomic conditions of farming communities, the study was carried out in selected three villages during 2017-19.

Materials and Methods

The present research study was conducted in cluster of three villages i.e. Lendejhari, Chillode, Koppe of Lalbarra block, Balaghat district of Madhya Pradesh during 2017-19. The district was bounded by 21° 19' to 22° 24' N Latitude and 73° 31' to 81° 30' E Longitude with an altitude of 330m above sea level (masl) (Table 1 & Figure 1). The district encompassed in Survey of India toposheet Nos. 64B, 64C, 55N and 55O. It is bounded by the Mandla district of Madhya Pradesh in North, Rajnandgaon & Durg districts of Chhattisgarh in the East and South, and Seoni district of Madhya Pradesh in the west (Anonymous 2013; Masih *et al.*, 2015) [1, 20]. Black cotton soils, sandy loam & lateritic are the three types of soils of the district. The main source of irrigation in the district are canals and dug wells, the tube wells and ponds. Climate of the district is sub- tropical characterized by a hot summer and general dryness except during the southwest monsoon season. The normal annual rainfall of Balaghat district is 1294.5 mm. Maximum temperature (43° C) recorded during the month of May and minimum (8° C) during the month of December (Anonymous 2013; Masih *et al.*, 2015) [1, 20].

Stratified random sampling method was used to decide sampling sites and number of farm families (Kindt and Coe, 2005) [18]. Data for this study was obtained from both primary and secondary sources. Secondary data was collected from the government records and farm families from three villages were classified in four categories i.e. Marginal holdings (≤1 ha), Smallholdings (>1 ha and ≤2 ha), Semi-medium holdings (>2 ha and ≤4 ha), Medium holdings (>4 ha and ≤10 ha) for primary data collection for socioeconomic study by following guidelines of All India Report on Agriculture Census (Anonymous, 2015) [2]. The primary data was collected from the 120 farm families by using structured questionnaires. The knowledge of farmers on climate change and adoption of agroforestry systems was collected from the survey conducted at three villages i.e. Koppe, Chillod and Lendejhari (Raghuvanshi *et al.*, 2017; Chouhan *et al.*, 2017; Yadav *et al.*, 2016; Banyal *et al.*, 2015) [24, 13, 37, 7]. The collected data was analysed by using MS Office Excel and SPSS software.

Table 1: Situation of three villages of Lalbarra block of Balaghat district of Madhya Pradesh

Particulars	Sites		
	Site 1 (Village- Koppe)	**Site 2 (Village- Chillod)**	**Site 3 (Village- Lendejhari)**
Latitude & Longitude Elevations	21°48'19''N 80°04'27''E 301.50 masl	21°49'52''N 80°04'43''E 295.30 masl	21°49'27''N 80°6′25''E 298.70 masl
Geographical Area (ha)	580.668	769.005	974.262
Net sown (ha)	375.941	469.601	197.814
Irrigation facilities	Canal, open wells, borewell and farm ponds	Canal, open wells, borewell and farm ponds	Canal, open wells, borewell and farm ponds
Crops grown			
Kharif	Rice Irrigated, Rice unirrigated, Maize, Pigeon pea, French bean, Sesame and Zinger	Rice irrigated, Rice unirrigated, Maize Pigeon pea, Lobia Zinger and Colocasia	Rice irrigated, Rice unirrigated, Maize Pigeon pea, Zinger and Colocacia

Rabi	Wheat, Gram, Mustard and Linseed	Wheat, Gram, Mustard and Linseed	Wheat, Gram, Mustard and Linseed
Summer	Rice, Cow pea, Moong and Urad	Cow pea, Moong and Urad	Cow pea, Moong and Urad
Green fodder			
Fodder crops	Berseem, Sorghum, Maize, French bean, Moong and Urad	Berseem, Sorghum, Maize, Lobia, Moong and Urad	Berseem, Sorghum, Maize, Moong and Urad
Grasses	Napier, Guinea, Anjan Grass and naturally grown seasonal grasses	Napier, Guinea, Anjan Grass, naturally grown seasonal grasses	Napier, Guinea, Anjan Grass, naturally grown seasonal grasses
Fodder trees	*Albizia*, *Bauhinia*, *Morus*, *Leucaena*, *Azadirechta*, *Ziziphus*, *Sesbania*, Bamboo, Arjun, Jamun	*Albizia*, *Bauhinia*, *Morus*, *Leucaena*, *Azadirechta*, *Ziziphus*, *Sesbania*, Bamboo, Arjun, Jamun	*Albizia*, *Bauhinia*, *Morus*, *Leucaena*, *Azadirechta*, Bamboo, Arjun, Jamun
Dry fodder	Paddy and wheat straw	Paddy and wheat straw	Paddy and wheat straw

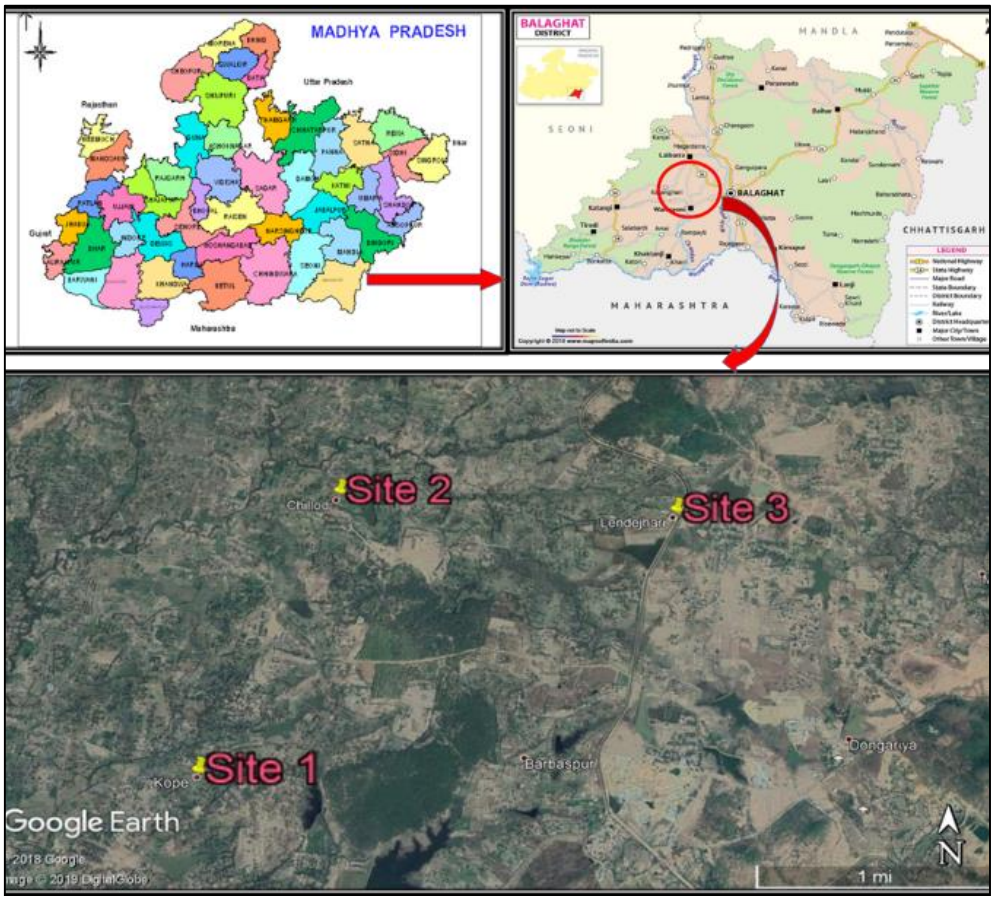

Fig 1: Study area

Results and Discussion

An average family size was 5.70, whereas the greater family size reported from medium land holding families (Table 2). Highest sex ratio was reported from small land holding farmers and lowest from medium land holding farmers. Females from the small and marginal farming communities are temporarily work as farm labours on the farms of other categories of farm families. Male farmers are also works in rice mills of the nearby areas. Literacy rate of the farmers was higher than 90 per cent in case of all farmers' categories. High literacy rate among the farming community indicates their awareness about the farming technologies and about other income generating sources. Such demographic parameters were positively correlated with the family annual income, farmers' knowledge about agroforestry and climate change by many researchers (Yadav *et al.*, 2016; Maleknia *et al.*, 2013; McGinty *et al.*, 2008) [37, 19, 21]. Bargali (2015) [8] and Bala (2010) [6] were also reported that the women's attitude was far better than the men in practicing agriculture, which impacts on the the adoption of agroforestry systems and increasing family annual income.

The data given in Table 3 describes the population of the livestock of the farming communities. All the farming communities of the villages were reared the livestock for farming work and generating additional income along with agriculture production (Sarvade *et al.*, 2019b) [30]. Each farmer reared 8-10 livestock units for the different purposes. Average livestock population was 8.9 (~ 9 animal units) from different categories of farmers, in which contribution of cow was higher in comparison to other. In case of all categories of farming communities, population of cow and buffalo was highest as compared to the other. As the goat population was highest at marginal and small farmers, they treat it as the additional income source from the small land areas. In case of semi-medium and medium farmers, they reared cow and buffalo for the generating income from milk production. Sarvade *et al.* (2019b) [30] and Sarvade and Upadhyay (2019) [26] were stated that the rearing livestock helps farmers to improve their socioeconomic conditions. Chandran *et al.* (2014) [10] also reported that the most of the farmers of district Sitamarhi of north Bihar reared livestock for their livelihood improvement.

An average land holding for marginal farmers was 0.64 ha, 1.36 ha for small, 2.50 ha for semi-medium and 5.54 ha for medium farmers (Table 4). In case of land utilization pattern, maximum land area was covered under agriculture crop, especially cereal crops (rice, wheat, gram, mustard and linseed). Least area was covered under horticulture and other systems such as agroforestry and pasture. In case of horticulture crops, farmers grow vegetables in small areas on commercial basis. Whereas, they grow vegetables, fruit trees, agriculture crops and forest trees in home gardens (locally they called it as badi). Chavan *et al.* (2015) [11] explained wadi as agri-horti-silvi model practicing in Maharashtra, Gujarat, Karnataka, Uttar Pradesh, Uttarakhand, Rajasthan, Madhya Pradesh, Chhattisgarh, Bihar, Andhra Pradesh and Jharkhand. Only 2 semi-medium and 1 medium category farmers were cultivated mango orchards on commercial basis. High land holding farming communities were kept some area as pasture for their livestock. All the farming communities practicing traditional agroforestry system for fruit, fodder, fuelwood and timber production along with food grain and vegetable production. Tiwari *et al.* (2010) [34] reported that the land use pattern depends on the livelihoods of the communities, anthropogenic forces and natural causes.

In case categories of farm families, total family income was highest from agriculture land use system (51-68%) and least from the other sources (0.63%), traditional agroforestry (2.00%), business (3.97%), horticulture (4.94%) and government jobs (7.11%) (Table 5). In case of income from livestock, marginal farmers earn highest (33.82% of total income) as compared to all the categories of farm families. Semi-medium category farmers earn highest income (67.83% of total income) from the agriculture as compared to all other categories of farmers. Chakravorty *et al.* (2019) [9] reported significant change in the growth of income from rearing livestock and increased the cost on both labour wages and non-farm business activities in 2003-13. They also reported that the distribution or diversification of income sources in India's agricultural economy such as cultivation (63.5%), livestock (3.7%), other agricultural activity (1%), non-agricultural enterprises (4.7%), wage / salaried employment (22%), pension (1.1%), remittances (3.3%), and others (0.7%). Singh *et al.* (2015) [33] reported the highest income was generated by practicing agri-silvi-culture system in Giri catchment, Himachal Pradesh.

The farmers were also judged for knowing about the changing climatic conditions, their impact on agriculture and strategies used for the adaptation and mitigation of climate change. Generally, all the farming communities were aware about the climate change and their consequences. Around 56% farmers comes under the medium knowledge category of farmers, 22% under high knowledge category, 15% under low and 7% under very low (Figure 2). All these farmers were interviewed to judge their knowledge about different indicators of climate change. Erratic and sporadic rainfall, increase in duration of heat stress, prolonged drought, high winds and heat waves, decrease in ground water level, increase in disaster events, insect-pest infestation, decline in soil fertility, and decrease in agriculture yield were the some indicators identified and asked about these indicators to the farmers for their consequences (Figure 3). More than 50% farmers had knowledge of all the indicators of the climate change listed for the study. Decreasing ground water level and erratic, sporadic rainfall and increase in disaster events were the indicators ranked first, second and third, respectively with 95.83%, 90.83% and 76.67% response of farmers. Such findings were reported by Raghuvanshi *et al.* (2017) [24]. Occupation of the people and social participation significantly affects on the knowledge level about climate change (Chouhan *et al.*, 2018; Tripathi and Mishra, 2017) [12, 35].

The possible causes of the climate change were also discussed with farmers and know their awareness. About nine causes of the climate change were discussed with farmers for the study (Figure 4). Most of the farmers agree with the increased use of vehicle (86.67%), over population (74.17%), industrialization and urbanization (72.50%) and increased use of insecticides/ pesticides, fertilizers etc (65.00%) as these are the main causes of climate change. Whereas, only 16.67% farmers didn't know about the causes of climate change. Along with these reasons, 62.50% farmers know about burning of agricultural waste, 56.67% farmers know about deforestation, 54.17% farmers about forest fire, 51.67% farmers about other developmental activities and 42.50% farmers about paddy cultivation. Such causes of the climate change were also recognised in the study conducted by Raghuvanshi *et al.* (2017) [24].

As compared to the knowledge of farmers about indicators and causes of climate change, farmers had petite knowledge about adaptation and mitigation strategies. However, farmers of the study area has knowledge about all the strategies used for adaptation and mitigation of climate change (Figure 5). Afforestation and reforestation was the technology widely known amount the farmers (74.17% farmers) which was closely followed by improved land management, e.g. erosion control and soil protection through tree planting (70.83% farmers), Change the crop variety (67.50%), improved rice cultivation (65.00%), adjustment of sowing dates (62.50%), built rain water harvesting structures (61.67%), water use and irrigation efficiency (57.50%), water storage and conservation techniques (55.83%) and reduced deforestation (53.33%). Most of the other techniques comprised in minimum known category of climate change adaptation and mitigation techniques. Raghuvanshi *et al.* (2017) [24] and Tripathi and Mishra (2017) [36] reported some adaptation and mitigation strategies adopted by farmers such as changing sowing and harvesting timing, cultivation of crops of short duration varieties, inter-cropping, changing cropping pattern, investment in irrigation, and agroforestry.

Around 56.67% farmers of the study area have medium whereas, 21.67% farmers has low, 12.5% farmers have least and 9.17% farmers has high knowledge about agroforestry (Figure 6). Further studied the reasons of adoption of agroforestry systems (Table 6). Yadav *et al.* (2016) [37] and Philip *et al.* (2013) [23] reported that the knowledge of agroforestry has significant related with literacy rate, land holding size and farmers' level of education. Minimizing risk (diversified yield), additional income (improves socioeconomic conditions), improving soil health, environmental amelioration, can practice on degraded lands, provide raw material to forest based industries and tradition were some identified reasons of the adoption of agroforestry systems by the farming communities. Most of the farmers practice agroforestry systems traditionally and this reason ranks 1st followed by systems can be practiced on degraded lands (2nd rank) and minimizing risk (diversified yield) ranks 3rd for the adoption of agroforestry systems. Such reasons were stated by Banyal *et al.* (2015) [7]. Sarvade and Singh (2014) [25] reported that the food security was the main reasons for adoption of agroforestry systems in India. Whereas, 95.83% farmers thought about the legal issues regarding planting and felling of tree species is the main issue

responsible for less adoption of agroforestry systems on commercial basis (Figure 7). Reduce yield of agriculture crops (89.17% farmers), allelopathic effect (84.17%), unavailability of quality planting material (79.17%), long time required for getting returns from tree species (75.83%), competition of tree species with crops for moisture (73.33%), competition of tree species with crops for light (70.83%), competition of tree species with crops for nutrients (66.67%), inadequate market facilities (60.83%), tree species hosting insect-pest and pathogens (57.50%) and inadequate availability of package & practices for tree species (39.17%) were the other some obstacles in the adoption of agroforestry systems on commercial basis. McGinty *et al.* (2008) [21] reported the behavioural control, attitudes about conservation and availability of labour mostly affect the farmers' intentions to adopt agroforestry systems. Gitonga and Mukoya (2016) [15] reported that the land size, secured land tenure, education level, monthly income and distance to the shopping centre showed positively influence farmers' access to sources of agroforestry information.

Table 2: Demographic characteristics (± SD) of the respondents from three villages of Lalbarra block of Balaghat district of Madhya Pradesh

Farmers category	Family size	Sex ratio	Literacy rate
Marginal holdings (≤1)	5.75 ± 0.64	1000 ± 12.33	92.32 ± 4.51
Small holdings (>1 and ≤2)	5.08 ± 0.42	1180.87 ± 19.76	93.33 ± 2.87
Semi-medium holdings (>2 and ≤4)	6.00 ± 0.61	1140.88 ± 20.40	94.41 ± 3.05
Medium holdings (>4 and ≤10)	6.89 ± 0.61	830.92 ± 23.15	92.59 ± 4.14
Mean	5.70 ± 0.28	1090.06 ± 10.33	93.27 ± 1.73

Table 3: Livestock population, consumption of fodder and fuelwood per household of the respondent farm families.

Farmers category	Livestock population				Total
	Goat	Cow	Buffalo	Bullock	
Marginal holdings (≤1)	2.25 (26.72)	2.92 (34.68)	1.42 (16.86)	1.83 (21.73)	8.42 ± 0.54
Small holdings (>1 and ≤2)	2.32 (28.43)	2.32 (28.43)	1.48 (18.14)	2.04 (25.00)	8.16 ± 0.75
Semi-medium holdings (>2 and ≤4)	2.00 (19.70)	4.57 (45.02)	1.79 (17.64)	1.79 (17.64)	10.15 ± 1.12
Medium holdings (>4 and ≤10)	1.11 (11.48)	4.67 (48.29)	2.11 (21.82)	1.78 (18.41)	9.67 ± 2.43
Mean	2.05 (23.03)	3.32 (37.30)	1.63 (18.31)	1.90 (21.35)	8.90 ± 0.55

Values in parenthesis are the percentages

Table 4: Average land holding and land utilization pattern.

Farmers category	Land holding	Cultivated land	Agriculture		Horticulture		Other	
			Cereals	Pulses	Vegetables	Orchard	Traditional Agroforestry	Pasture
Marginal holdings (≤1)	0.64	0.64 (100)	0.34 (53.13)	0.10 (15.63)	0.10 (15.63)	-	0.20 (31.25)	-
Small holdings (>1 and ≤2)	1.36	1.30 (95.59)	0.79 (58.09)	0.20 (14.71)	0.15 (11.03)	-	0.30 (22.06)	0.06 (4.41)
Semi-medium holdings (>2 and ≤4)	2.50	2.40 (96.00)	1.40 (56.00)	0.25 (10.00)	0.20 (8.00)	0.40 (16.00)	0.30 (12.00)	0.10 (4.00)
Medium holdings (>4 and ≤10)	5.54	5.50 (99.28)	4.30 (77.62)	0.30 (5.42)	0.24 (4.33)	0.60 (10.83)	0.40 (7.22)	0.04 (0.72)
Mean	2.51	2.46	1.71	0.21	0.17	0.25	0.30	0.05

Table 5: Average family income and the main contributing practices.

Farmers category	Contribution in family income							Family income
	Agriculture	Horticulture	Traditional Agroforestry	Livestock	Gov. Job	Business	Other	
Marginal holdings (≤1)	41808.00 (51.46)	7525.00 (9.26)	1250.00 (1.54)	27479.00 (33.82)	-	-	3187.50 (3.92)	81, 250.00
Small holdings (>1 and ≤2)	50256.00 (63.55)	6430.00 (8.13)	3040.00 (3.84)	14194.00 (17.95)	3600.00 (4.55)	1040.00 (1.32)	520.00 (0.66	79, 080.00
Semi-medium holdings (>2 and ≤4)	146040.00 (67.83)	2642.86 (1.23)	678.57 (0.32)	28250.00 (13.12)	35000.00 (16.26)	2678.60 (1.24)	-	1, 63, 214.29
Medium holdings (>4 and ≤10)	152440.00 (62.65)	12778.00 (5.25)	7000.00 (2.88)	42222.00 (17.35)	-	28889.00 (11.87)	-	2, 43, 333.33
Mean	86243.00 (63.45)	6717.50 (4.94)	2725.00 (2.00)	24335.00 (17.90)	9666.70 (7.11)	5391.70 (3.97)	854.17 (0.63)	1, 23, 783.33

Values in parenthesis are the percentages

Table 6: Knowledge and reasons of agroforestry adoption by farmers of village cluster in Chhattisgarh Plain region of Madhya Pradesh.

Categories	Reasons of agroforestry adoption						
	Minimizing risk (diversified yield)	Additional income (Improves socioeconomic conditions)	Improving soil health	Environmental amelioration	Can practice on degraded lands	Provide raw material to forest based industries	Tradition
1-Disagree	2 (1.67)	-	4 (3.33)	-	-	2 (1.67)	-
2-Neutral	10 (8.33)	15 (12.50)	33 (27.50)	8 (6.67)	21 (17.50)	17 (14.17)	-
3-Agree	62 (51.67)	73 (60.83)	71 (59.17)	85 (70.83)	50 (41.67)	88 (73.33)	66 (55.00)
4-Strongly agree	46 (38.33)	32 (26.67)	12 (10.00)	27 (22.50)	49 (40.83)	13 (10.83)	54 (45.00)

Rank	3	4	7	5	2	6	1

Values in parenthesis are the percentages

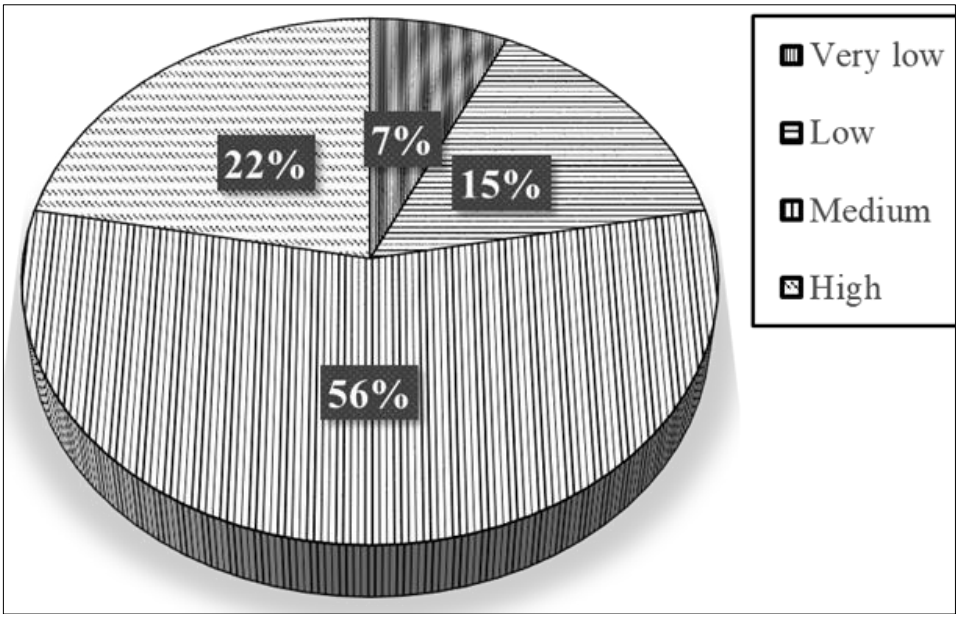

Fig 2: Levels of awareness about climate change

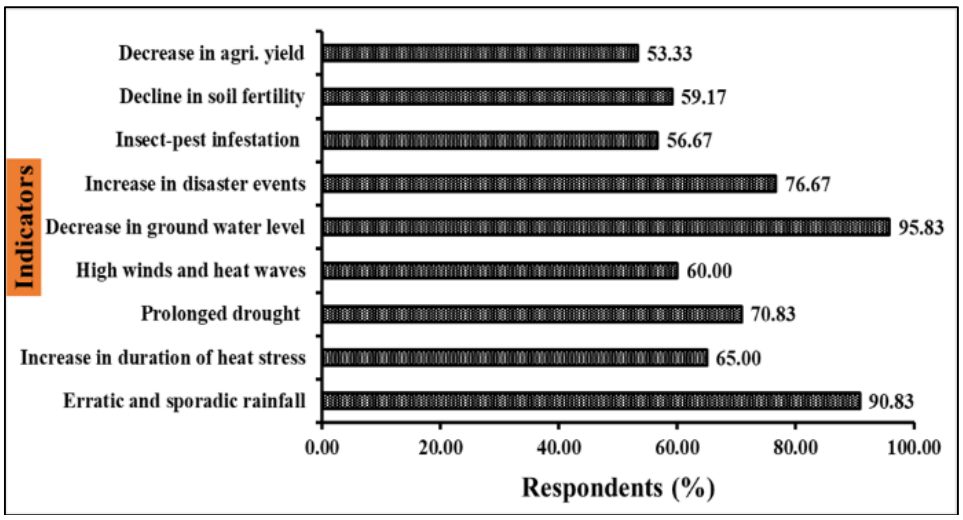

Fig 3: Indicators of climate change

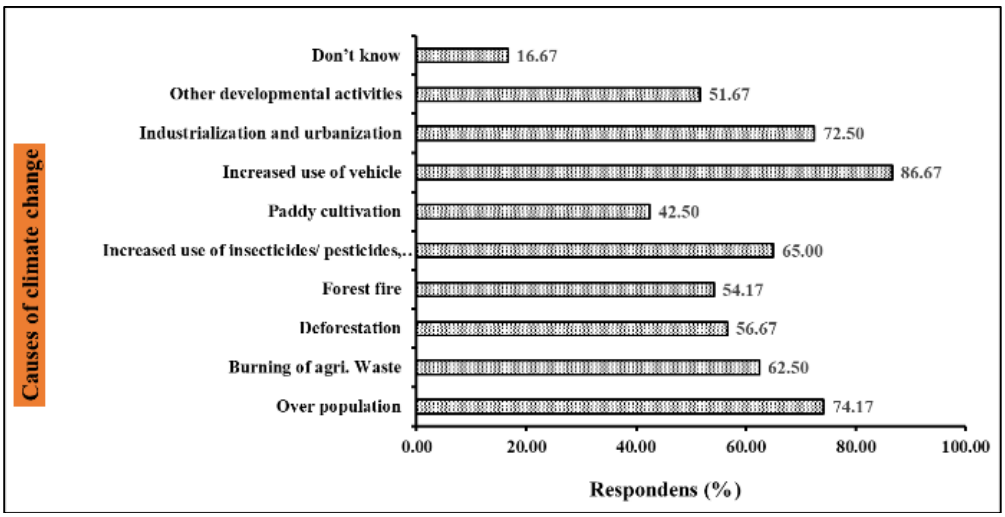

Fig 4: Causes of climate change

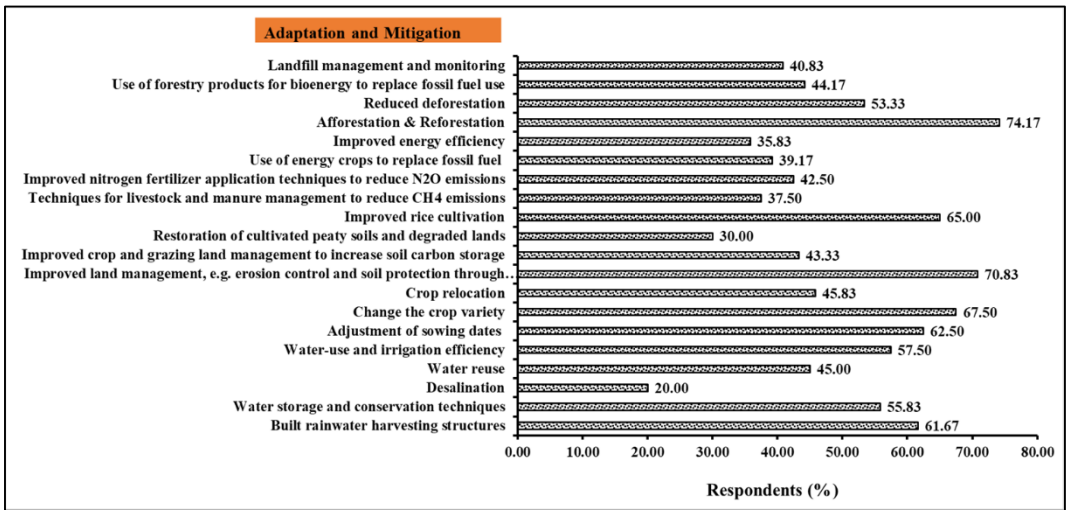

Fig 5: Adaptation and mitigation strategies for climate change

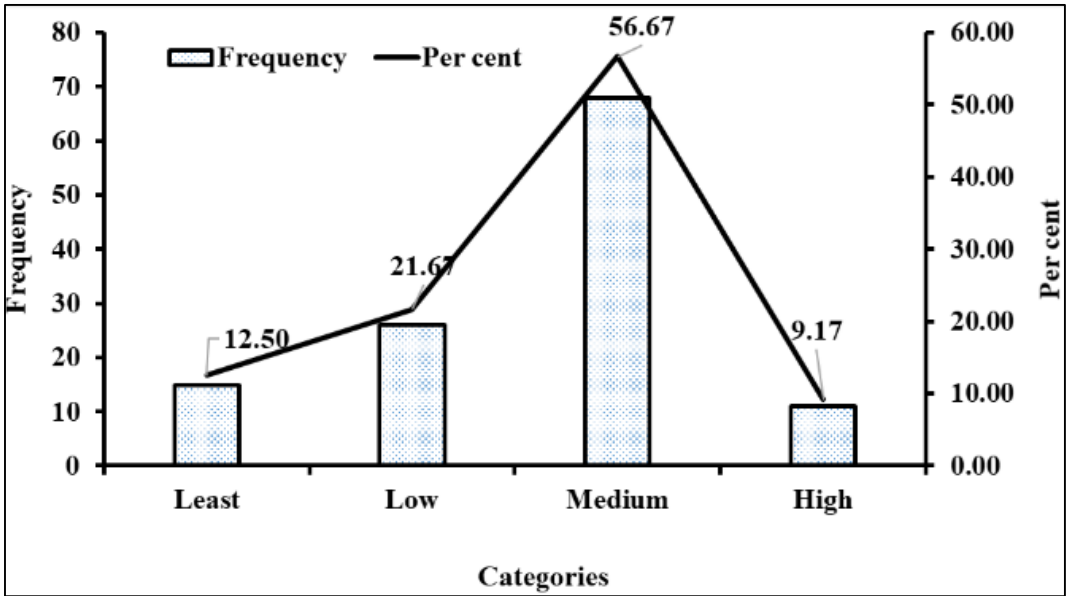

Fig 6: Knowledge of farming communities on agroforestry systems

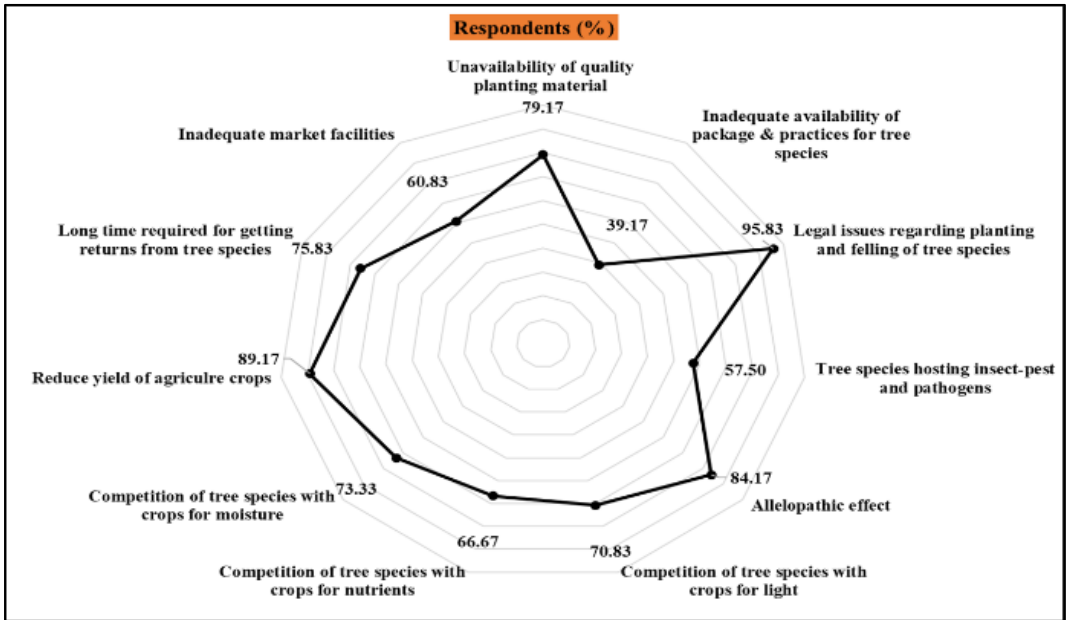

Fig 7: Reasons of low adoption rate of agroforestry systems on commercial basis

Conclusion

The study revealed that the most of the farmers falls in marginal and small land holding categories of farmers, their family income came from agriculture. Where they grow rice in *kharif* seasons widely. Sown area under *rabi* and summer crops was very low. The systems such as horticulture (vegetable and fruit crop cultivation) and other systems (traditional agroforestry and pasture) were the potential systems identified for socioeconomic up-liftment of the farmers. Most of the farmers has the knowledge of climate change and agroforestry systems. They also discussed the causes of climate change and strategies used for adaptation and mitigation of climate change. The peoples from farming communities know the agroforestry systems but do not know it's potential. Most of the farmers practices agroforestry systems traditionally but legal issues regarding planting and felling of tree species and negative tree-crop interactions were the factors, which restricts farmers for practicing commercial agroforestry systems.

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