



Agroforestry improves food security and reduces income variability in semi-arid tropics of central India

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Abstract This study, using cross sectional data from 170 farmers, empirically established that agroforestry positively affects food security and significantly reduces income variability among farmers in Bundelkhand region lying in semi-arid tropics of central India. A 1% increase in the tree density and tree diversity on farm significantly increases food security status by 0.231% and 0.141% points, respectively. Further variability in income reduces by around 0.38% and 0.16% with unit percentage increase in tree density and diversity, respectively. Therefore, amid the epoch of global climate change, agroforestry practice can be a crucial climate smart agriculture option. Farmers' challenges were also identified and ranked by using Problem Confrontation Index (PCI). The study unveils that, efforts towards controlling stray animals, creating marketing environment, strengthening and streamlining the extension services for more technological and input support requires a strategic institutional framework as a key to upgrade agroforestry in the region.

Keywords Agroforestry · Food security · Income variability · Semi-arid tropics · Central India

Introduction

The adverse impact of climate change on Indian agriculture and food systems has been long evident (Kumar 2011; Choudhary and Sirohi 2020). Predictions suggest that the changing climate in absence of adaptation measures may reduce productivity of Indian agriculture by 25% by end of this century (Birthal et al. 2014). Further, by 2030 India's food production is expected to drop by 16% and the number of those at risk for hunger could increase 23% due to climate change (IFPRI 2022). Given that agriculture represents the primary livelihood strategy for the vast majority of rural poor of the country, building resilience through climate smart agriculture (CSA) practises has become a priority agenda of development planning (Sapkota et al. 2019; Choudhary and Sirohi 2022). Agroforestry- integration of trees in an agricultural landscape is a well cited CSA solution for the dual climate and food security challenges (Chavan 2014; Reppin et al. 2020). The intangible benefits in terms of biodiversity and natural resource conservation, microclimate moderation and pollution control offered by the agroforestry systems have been widely recognized in different countries including India (Dhyani and Handa 2013; Chavan et al. 2015; Dinesh et al. 2017; Ranjan 2021). However, the global benefit of ecosystem services cannot be a motivating argument for farmers to invest in tree based

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farming practices. Climate friendly efforts at smallholder farm level need to produce tangible and direct livelihood benefits for farmers, such as being a source of additional income, food, fuel or fodder with mitigation being a co-benefit (Ogle et al. 2014).

In India, research and development programmes on promoting agroforestry over the past five decades has been spread over time and regions but, the speedy transition of tree-based farming in the country is still a challenge. The challenge is more unnerving for arid and semi-arid regions where climate and food related risks are high (Choudhary and Sirohi 2020; Singh et al. 2022). Nonetheless, few past experimental studies have indicated the benefits of agroforestry in financial terms (GoI 2001), farmer's field based studies indicating its socio-economic benefits is very limited in Indian context. Further, majority of farmers in the country have been hesitant to adopt agroforestry systems due to one and other reasons (Chavan et al. 2015). Lack of uniform policies and regulations relating to felling and transporting farm-grown timber and other products in different Indian states are major reported challenges that impede growth of agroforestry at national level (Dhyani and Handa 2013; Dev et al. 2019). Moreover, Institutional finance and insurance coverage in agroforestry has not been at par with its potential due to lack of awareness of technical and economic data on different agroforestry models (National Agroforestry Policy 2014). The marketing infrastructures for agroforestry produce, which can play a significant role in the minds of the farmer looking to adopt agroforestry, are unavailable in the country except in the few states (Chavan et al. 2014). As the contribution of tree farming practises to the livelihood of farmers depends on local biophysical and socio-economic factors, understanding regional benefits as well as constraints from farmer's perspective is crucial for agroforestry based policy planning and its effective implementation.

The present study therefore examine the impact of on-farm integration of trees on two important socio-economic parameters namely income variability and food security of the households in Bundelkhand region lying in semi-arid tropics of central India. Agroforestry adoption intensity was measured in terms of tree density (trees/acre) and tree diversity on the farmer's field. We specifically focus on food security aspect as the recent study conducted by Singh et al. (2021) in the Indian state of Uttar Pradesh revealed that Bundelkhand region stands low in terms of sustainable food security status compared

to the other regions of the state. Additionally, the study attempts to highlights local factors that refrains the farmers to adopt agroforestry. It is believed that the findings of the study would be of great help for research and policy stakeholders for scaling up climate change mitigating measures while improving rural livelihood in the vulnerable landscape.

Materials and methods

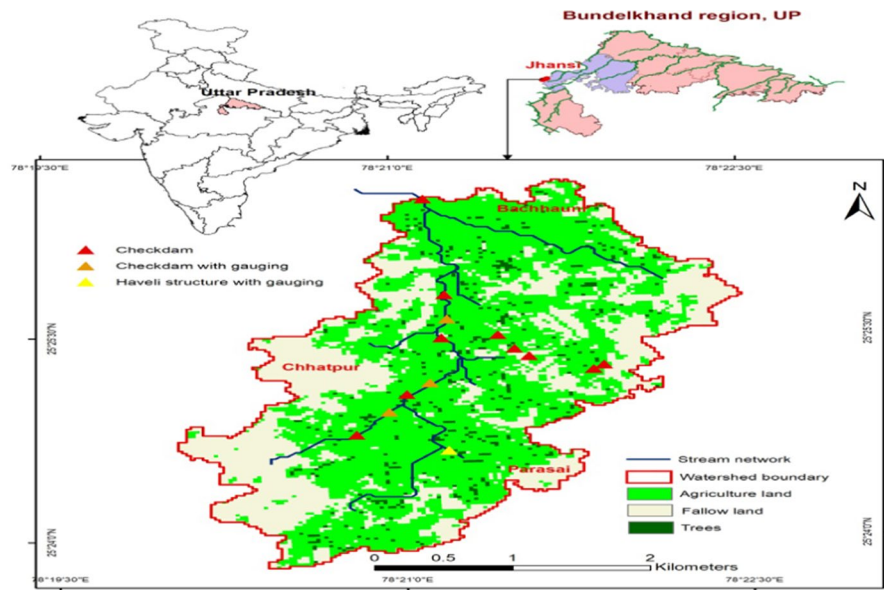
Study area, sampling and data

Our analyses are based on primary survey data collected from Jhansi district of Bundelkhand region (Fig. 1). The district falls in semi-arid tropics receiving average annual rainfall of around 900 mm of which *kharif* season (June–September) has around 90% of the annual precipitation and the remaining 10% is distributed throughout the remaining eight months. The prevalent undulating topography, hard rock geology, low soil fertility, scarce groundwater resources along with poor and erratic rainfall lead to frequent droughts and crop failure in the region (Kumar et al. 2022). Most of the population in the district Jhansi are dependent on crop/livestock-based activities and around one-third of the area is covered by degraded forest, permanent pastures, fallows and wastelands.

The study used both purposive and random sampling approach for drawing sample respondents. The first stage of the sampling approach involved purposively selecting 3 villages namely *Parasai*, *Chattpur*, *Bachhauni* located in Jhansi block of the district (Fig. 1) as the farmers of the villages (141 from Parasai, 133 from Chattpur and 120 from Bachhauni) has been beneficiaries of technological interventions of ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi during the period 2011–14. Around 14,290 tree saplings were distributed to the farmers from 2011–12 to 2013–14 (ICAFRI 2013) and are planted within the physical boundary of these villages.

The second stage involved randomly selecting farm households using probability proportion to size method from each village. A total of 170 respondents (61 from Parasai, 57 from Chattpur and 52 from Bachhauni) were surveyed and relevant information on their socio-economic parameters, farm characteristics and institutional parameters were collected for the agricultural year 2021–22.

Fig. 1 The locale of the study area delineating selected villages



Three focus group discussions (FGDs) with farmers were also conducted one in each selected village to explore farmers’ perceptions of related constraints in adoption of agroforestry. The FGD technique is a widely used as qualitative data collection approach in social science research that provide a large extent of content validity of the general scientific information (Cornwall and Jewkes 1995; Kidd and Parshall 2000; Kraaijvange et al. 2015).

Analytical framework

We used the coefficient of variation (CV) to compute income variability. The estimation of CV in cross sectional data has been used in previous literature as a proxy for household income variability (Falco and Chavas 2009). This estimation involves measuring deviations of each household’s income from the village mean in a given agricultural season. This is based on the assumption that each household’s mean income can be approximated by the average income of the households in its village.

Following Reppin et al. (2020), the Shannon Index (H) was used to describe tree diversity across the study area. The index is calculated as

$$H' = - \sum_{i=1}^s p_i \ln p_i \tag{1}$$

where, p is the proportion (n/N) of individuals of a particular species (n) divided by the total number of individuals (N) and s is the number of species.

To estimate household food security, the study employed Food Consumption Score (FCS) approach following WFP (2009). The FCS is inspired by the World Food Program (WFP), using the frequency of consumption of the eight food groups consumed during the last seven (07) days preceding the survey by households. Mathematically, FCS can be expressed as follows:

$$\begin{aligned} FCS = & w * f(cereals\ and\ or\ tubers) + w * \\ & f(pulse) + w * f(milk) + w * f(fruit) \\ & + w * f(meat\ and\ or\ fish) \\ & + w * f(sugar) + w * f(vegetables) \\ & + w * f(oil) + w * f(condiments) \end{aligned} \tag{2}$$

where, FCS = Food Consumption Score, f = frequency of food consumption (number of days for which each food group was consumed during the past 7 days), and w = weighted value representing nutritional value of selected food groups.

The FCS has thresholds consumption categories of poor food consumption (0–21), borderline food consumption (21 < FCS ≤ 35) and acceptable food consumption (FCS > 35) (Mango et al. 2018). The FCS approach precisely measure of the quality of the household diet. Nonetheless, the FCS bears some weaknesses, like it does not consider foods consumed outside the

household and it does not provide any information of intra-household food distribution. Despite its weaknesses, FCS is still considered one of the very useful measures of household food security (Douyon et al. 2022).

To analyze the effect of tree farming on income, food security and income variability, we constructed two regression models as follows:

$$\ln(FCS_i) = \beta_0 + \beta_1 \ln T_Density_i + \beta_2 \ln T_Diversity_i + \sum_{i=3}^n \beta_i \ln X_i + \varepsilon_i \quad (3)$$

where, FCS is food consumption score of i^{th} household, T_Density and T_Diversity indicate tree density and tree diversity at the farm of i^{th} household. X_i is vector of household or farm level characteristics. β_s are the elasticity coefficient and ε_i is random error term.

The second model was the same as Model 1, but measures of income variability (CV) replaced the FCS in model 2.

To understand constraints in practising agroforestry in the study area, Problem Confrontation Index (PCI)—a mathematical problem ranking index that is defined as a set of objects whose state must satisfy a number of problems or limitations, was developed. The farmers were asked to give their ranking to the 10 selected problems, which were identified through focus group discussions (FGDs). A five-point rating scale was used for computing the problem score of a respondent. Each farmer was asked to indicate the extent of difficulty by each of the problems by checking any of the four responses such as 'Very High', 'High', 'Medium', 'Low' and 'Not at all' and weights were assigned to these responses as 4, 3, 2, 1 and 0, respectively. Thus, the problem confrontation score was obtained by adding weights of responses to the problems. After computing the PCI scores, the problems were ranked according to their PCI score. For making rank order, PCI was computed as used by

Saha et al. (2021). The PCI was computed by using the following formula:

$$PCI = (P_{vh}X4) + (P_hX3) + (P_mX2) + (P_lX1) + (P_nX0) \quad (4)$$

where, P_{vh} = Total number of farmers expressed problem as very high; P_h = Total number of farmers expressed problem as high; P_m = Total number of farmers expressed problem as medium; P_l = Total number of farmers expressed problem as low and P_n = Total number of farmers expressed problem as not at all.

Results and discussion

On farm stand structure of tress and its uses in the study area

A total of 36 tree and shrub species were inventoried at the surveyed farms with average size was 4.77 ± 1.11 acre. The land use types with the highest density were grazing land (around 10 trees per acre) followed by boundary (around 7 trees per acre) and cropland (around 3 trees per acre) (Table 1). A converse trend was observed for species diversity, being highest for trees planted in boundaries ($H' = 2.76$) compared to other land use types. Shannon diversity index for the cropland was minimum with an average H' of 0.84 per farm. Native tree species dominated the area as its composition captured between 55 and 73% of the tree species in the study area (Table 1).

A total of 10 uses and benefits of on-farm trees were documented for major available tree species by farmers in the study area. Figure 2 is graphical presentation of proportion of total statements on use of trees for that purpose (black column) and number of tree species associated with that use (white square). Further, the square above averaged trend-line indicates that many species are used for that purpose, while square below trend line indicate specific trees for that use (more

Table 1 Density, composition and diversity of tree species for different land use type within household surveyed

Land use area	Households	Tree density (No./Acre)	Composition (%)		Shannon index
			Exotic	Native	
Boundary	127	7.39	41.34	58.66	2.76
Cropland	56	3.11	44.56	55.44	0.84
Grazing land	29	10.23	26.12	73.88	1.23

Source: Survey data

narrow selection of species). The most frequently mentioned use of trees was fruit, followed by construction material, fire wood, timber and shade. The bulk of these benefits were provided by *Mangifera indica*, *Bambusa spp.*, *Dalbergia sissoo*, *Eucalyptus spp.*, and *Carissa carandas* (Appendix 1). Other uses like live fencing, medicine, fodder and vegetable were reported by less than 10% of household.

Covariates and descriptive statistics

Statistics presented in Table 2 show that the FCS on average was at 28.33 indicating that household in the study area are in borderline food consumption category and the average variability of their income was 51.84.

On an average farmers plant around 7 trees per acre in the study area with average Shannon index value of 1.60. The average age of the sample household head (49 years) indicates that farm households are still in their active farming years. For our sample, statistics reveals a typical large family setting with low dependency ratio signifying possibilities of family labour use. The household heads were primary educated with considerable experiences in farming (17 years). Majority of the farmers were small holders (4.77 acres) with average animal unit holding of 5.19. Access to extension and training services within the sample was approximately 56% while larger proportion of farmers (77%) reported access to farm credit.

Graphically examination of the relationship between the tree densities at the farmer’s field with their income variability (Fig. 3) suggests a positive relationship between the two, implying that farmers

who intensively diversified their farms with trees tend to have a lower variability of income (i.e., their incomes tend to be more stable).

The second plot suggests that tree density and FCS are positively related as indicated by the fitted line. This means agroforestry based diversification lead to more food security. Scatter plot of tree diversity with income variability and FCS depicts the same trend as the latter two variables have with tree density. Since these findings are graphical and descriptive and only suggestive of the potential relationship between these variables, we provide more plausible empirical results estimated through econometric framework.

Impact of agroforestry on income variability and food security

Among the surveyed households, around 30% of households were in Acceptable food consumption category (FCS > 35), around 48% were in Borderline food consumption category (21 < FCS < 35) and the rest around 22% were in poor food consumption category. The estimated results of the ordinary least square (OLS) model are presented in Table 3. The data set tested negative for the problem of heteroscedasticity and multicollinearity. Our estimates support the relationship depicted in Fig. 3 of a positive relationship between agroforestry practises and food security. A 1% increase in the tree density and tree diversity on farm significantly increases FCS by 0.231% and 0.141% points, respectively, ceteris paribus. The plausible explanation is that tree based farm diversification not only provides fruits for human diet diversity but also generate additional income which improves the purchasing power for the household for allied goods.

Fig. 2 Stated uses and benefits of trees available in the study area

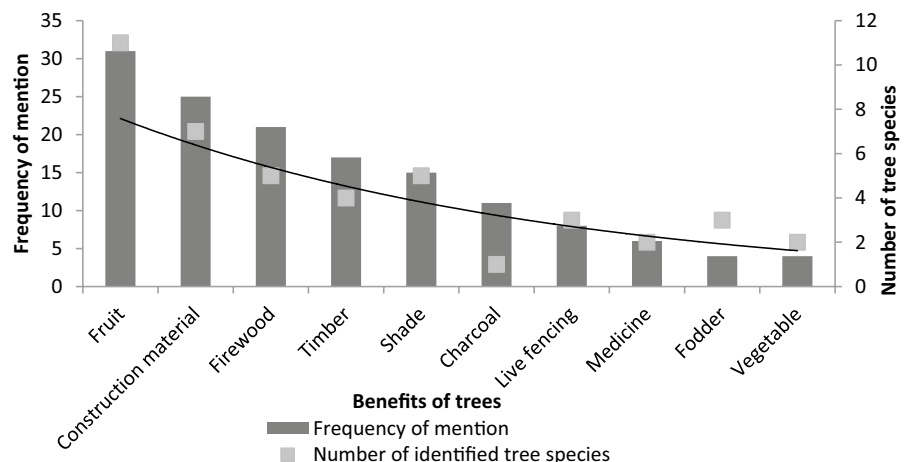


Table 2 Definitions and summary statistics of key variables

Variables	Description	Mean (S.D.)			
		Parasai	Chatapur	Bacchauni	Overall
<i>Dependent variables</i>					
CV_I	Coefficient of variation of income	52.88 (28.54)	50.43 (27.35)	52.21 (28.17)	51.84 (28.02)
FCS	Average daily food consumption score	29.04 (8.12)	27.71 (7.86)	28.23 (8.62)	28.33 (8.22)
<i>Independent variables</i>					
T_Density	Tree density (Number/acre)	6.41 (4.83)	7.45 (5.87)	6.87 (5.02)	6.91 (5.24)
T_Diversity	Tree diversity	1.31 (0.23)	1.84 (0.76)	1.65 (0.45)	1.60 (0.48)
AHH	Age of household head (Years)	50.17 (8.89)	49.68 (9.79)	48.15 (8.96)	49.33 (9.21)
HHS	Household size (Number)	6.32 (0.97)	5.99 (1.14)	6.68 (0.92)	6.33 (1.01)
HHE	Education status of household head (Years of schooling)	6.25 (2.45)	5.98 (2.22)	6.27 (1.89)	6.16 (2.18)
HHEXP	Experience of household head in farming (Years)	18.12 (6.98)	16.15 (7.11)	17.54 (7.27)	17.27 (7.12)
ALU	Adult livestock unit	4.88 (1.15)	5.32 (1.10)	5.37 (1.38)	5.19 (1.21)
DPNDR	Dependency ratio: Expressed as ratio of economically inactive members to the total household	33.21 (2.45)	33.13 (1.98)	33.08 (2.14)	33.15 (2.19)
Farm_Size	Farm areas in acres	4.89 (0.98)	4.98 (1.26)	4.45 (1.09)	4.77 (1.11)
D_Market	Distance to nearest market (Km)	4.20 (0.21)	4.13 (0.22)	4.18 (0.26)	4.17 (0.23)
EXCONTACT	% of households exposed to extension services, training and demonstration in previous year of the survey	56.38 (2.43)	56.26 (2.14)	55.89 (2.25)	56.17 (2.27)
Credit	Farmer has access to farm credit (1 = Yes, 0 otherwise)	0.72 (0.018)	0.85 (0.029)	0.74 (0.022)	0.77 (0.023)

Figures in parentheses are standard deviation

Source: Authors' estimates based on survey data

Our finding is in congruence with the result reported by Quandt (2021) from Kenya and Miller et al. (2020) from Uganda. The results further indicate that integrating trees on farm has a significant negative effect on income variability. Unit percentage increase in the tree density decreases income variability by about 0.38%. Further, income variability reduced by about 0.16% with unit percentage increase in tree diversity, holding all things constant. This supports the relationship depicted in Fig. 3 and implies that besides improving food security, agroforestry play crucial role in increasing income stability of the farmers.

After detailed discussion with farmers, it was discovered that trees on their farm provide a supplemental source of income and food in case of crop raiding by the stray animals. It is important to note here, the traditional practice of “anna-pratha” in the entire Bundelkhand region, where cattle are let loose, particularly during rainy season, for free grazing in others' fields destroys around 30 to 35% of the agriculture produce (Rathod and Dixit 2020). Therefore, the trees seem to have resilience vis-a-vis crop insurance effect in the study area. Various other socio-economic variables also have a significant

influence on our outcome variables; FCS (farming experience, adult livestock unit, dependency ratio and farm size), and income variability (age, household size adult livestock unit and dependency ratio). For brevity, we do not focus much on interpreting the coefficient estimates of other factors on our outcome variables.

Constraints in practising agroforestry

The estimate overall PCI score of all problems and their corresponding ranks are presented in Table 4. Disturbances from stray animals was ranked high (with PCI value 295) among the limitations preventing the farmers from fully adopting agroforestry practices, followed by unfavourable weather condition and low market demand. Farmers mentioned that the newly planted tree seedlings/saplings are completely destroyed by the animals. An important policy lesson emerged from this analysis is requirement of a management framework for the stray animals at village/community level. Strengthening of “gaushalas” in Bundelkhand region would also be imperative in minimising crop loss and promotion of tree-based farming practises. Further, ensuring parallel

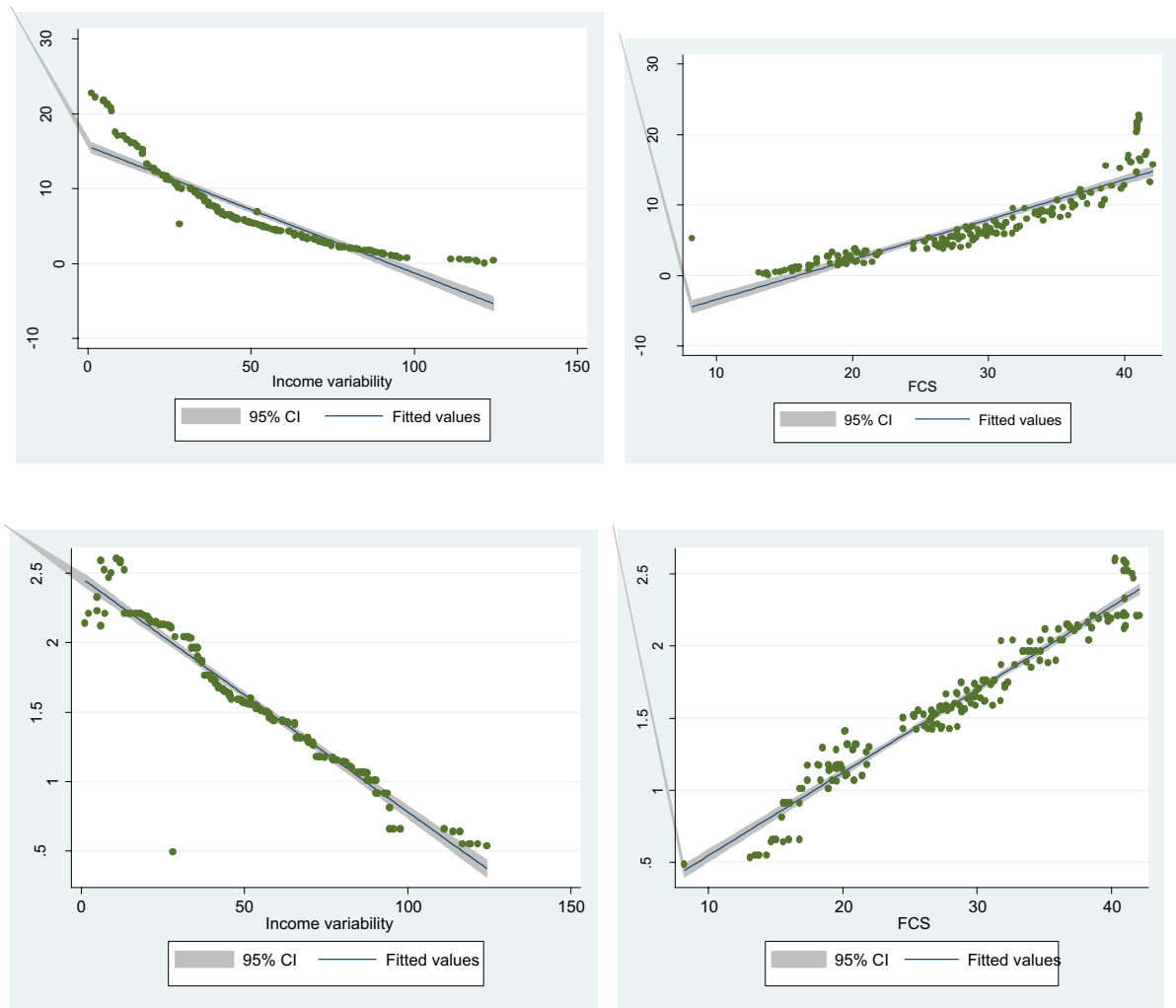


Fig. 3 Scatter graph of tree density, tree diversity, income variability and FCS

development of supporting market environment for tree-based product encompassing backward and forward market linkages shall sustain the livelihood imperatives.

Pest and disease attack on trees, unavailability of quality saplings in the market and lack of technical knowledge are other challenges in the study area with PCI value above 200. It was highlighted by the farmers that they have fields that are not suitable for cereal production hence is left idle. Therefore, besides increasing supply of quality saplings, focus should also be given on regular training on pest and disease management of tree species suitable for the region. Imparting technical knowledge on alternate land management systems like silvipasture and hortipasture shall prove to be crucial in utilizing the idle land for promoting agroforestry. The other reported

problems include irregular support from government, lack of capital, irrigation difficulty and unsatisfactory returns.

Conclusion

The present study has empirically analyzed the socio-economic impact of agroforestry in climate vulnerable landscape of Bundelkhand region of Central India, and established a strong and positive association of tree density and tree diversity with food consumption of household and inverse relation with their income variability. Therefore, strategic implementation of tree-based farm diversification can go a long way in providing the

Table 3 The effect of agroforestry in the study area: OLS estimation results

Variables	FCS		Income variability	
	Coefficient	Standard Error	Coefficient	Standard Error
T_Density	0.231*	0.037	−0.388*	0.014
T_Diversity	0.141**	0.071	−0.163*	0.003
AHH	0.021	0.141	0.119*	0.017
HHS	−0.031	0.103	−0.216*	0.010
HHE	0.131	0.102	0.211	0.122
HHEXP	0.062**	0.031	0.017	0.111
HHEXP Squared	−0.003	0.003	–	–
ALU	0.113*	0.030	−0.317*	0.007
DPNDR	−0.034*	0.011	0.113**	0.057
Farm_Size	0.319*	0.001	0.017	0.018
Farm_Size Squared	−0.010*	0.005	–	–
D_Market	0.001	0.003	0.000	0.001
EXCONTACT	0.010	0.007	0.121	0.114
Constant	1.529*	0.039	1.317*	0.192
R ²	0.790		0.831	

* and ** indicate statistical significance at 99% and 95% confidence level, respectively

Table 4 Problems associated with agroforestry practices in the study area

Particulars	Percentage of respondents					PCI	Rank
	Very high	High	Medium	Low	Not at all		
Stray animals	46	26	12	9	7	295	1
Unfavourable weather condition	40	30	14	11	5	289	2
Low market demand	33	28	21	11	7	269	3
Pest and disease attack on trees	30	33	19	10	8	267	4
Unavailability of quality saplings in market	26	28	21	16	9	246	5
Lack of technical knowledge & skills	17	26	27	21	9	221	6
Irregular support from government	11	28	23	27	11	201	7
Capital constraints	15	21	25	25	14	198	8
Irrigation difficulty	7	10	26	31	26	141	9
Unsatisfactory return	4	6	13	33	44	93	10

necessary ammunition for adapting to intensifying climate change effects, particularly in the semi-arid tropics regions. This requires an institutional arrangement for quality management and public–private partnerships for enabling accelerated quality input and output delivery needs to enhance overall tree-based farming in the region. Initiatives for the genetic improvement of cattle breeds, rapid livestock pregnancy diagnosis and construction of fodder banks at block level will go a long way towards preventing stray cattle from being seen as pests on farmer's fields. Additionally, strengthening the extension services and training facilities on agroforestry practises and increasing their outreach should also be in priority policy list for promoting the agroforestry across

the semi-arid tropics which faces similar challenges such as Bundelkhand.

Declarations

Conflict of interest The authors of the submitted manuscript declare that they have neither financial nor non-financial conflicts of interest relevant for the content of the article.

Appendix 1

See Table 5.

Table 5 Tree species and its benefits mentioned by the farmers in the survey

Fruit	Fruits from trees are either consumed at home or sold for additional income	<i>Mangifera indica</i> , <i>Psidium guajava</i> , <i>Citrus sinensis</i> , <i>Phyllanthus emblica</i> , <i>Punica granatum</i> , <i>Syzygium cumini</i> , <i>Ziziphus mauritiana</i> , <i>Annona reticulata</i> , <i>Cordia species</i> , <i>Carissa carandas</i> , <i>Buchanania lanzan</i> , <i>Madhuca indica</i> , <i>Aegle marmelos</i> , <i>Tamarindus indica</i> , <i>Pithecellobium dulce</i>
Construction material	Parts such as poles obtained from the entire stem of young trees or from cut-offs from the stems of bigger trees. Small branches and twigs are also used for house construction (walling)	<i>Eucalyptus globules</i> , <i>Dalbergia sissoo</i> , <i>Tectona grandis</i> , <i>Bambusa spp.</i> , <i>Artocarpus heterophyllus</i> , <i>Madhuca indica</i> , <i>Albizia lebbek</i> , <i>Acacia nilotica</i> , <i>Azadirachta indica</i>
Firewood	Obtained either by pruning and drying harvested branches or by collecting dry fallen-off branches	<i>Eucalyptus globules</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Carissa carandas</i> , <i>Psidium guajava</i> , <i>Prosopis juliflora</i> , <i>Acacia nilotica</i> , <i>Pongamia pinnata</i> , <i>Butea monosperma</i> , <i>Anogeissus spp.</i>
Timber	Timber is usually the processed wood often sold to a customer at the farm or at a market. Usually the owner of the tree is responsible for harvesting, cutting and transportation	<i>Eucalyptus globules</i> , <i>Dalbergia sissoo</i> , <i>Tectona grandis</i> , <i>Mangifera indica</i> , <i>Madhuca indica</i> , <i>Albizia spp.</i>
Shade	Trees that are planted for shade in the compound and other farm components	<i>Azadirachta indica</i> , <i>Ficus religiosa</i> , <i>Ficus benghalensis</i> , <i>Ficus infectoria</i> , <i>Cassia fistula</i>
Charcoal	Woodfuel is used for charcoal burning	<i>Bambusa spp.</i> , <i>Prosopis juliflora</i>
Live fencing	Trees act as a live fence around crop, animal shelters and homesteads for protection	<i>Acacia catechu</i> , <i>Acacia Senegal</i> , <i>Acacia nilotica</i> , <i>Pithecellobium dulce</i> , <i>Leucaena leucocephala</i> , <i>Bambusa spp.</i> , <i>Prosopis juliflora</i> , <i>Anogeissus spp.</i>
Medicine	Trees with medicinal values	<i>Moringa oleifera</i> , <i>Azadirachta indica</i> , <i>Butea monosperma</i> , <i>Cassia fistula</i> , <i>Capparis deciduas</i> , <i>Tamrind indica</i> , <i>Madhuca indica</i> , <i>Aegle marmelos</i> , <i>Phyllanthus emblica</i>
Fodder	Leaves and branches, can be used as fodder	<i>Moringa oleifera</i> , <i>Leucaena leucocephala</i> , <i>Ziziphus mauritiana</i> , <i>Alianthus excels</i> , <i>Acacia Nilotica</i> , <i>Azadirachta indica</i> , <i>Albizia spp.</i> , <i>Dalbergia sissoo</i>
Vegetable	Trees planted for vegetable	<i>Moringa oleifera</i>

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