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SOCIO-ECONOMIC FACTORS INFLUENCING FARMERS' PERCEPTIONS OF CLIMATE CHANGE IN TAMIL NADU: A PROBIT ANALYSIS

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Abstract: This study empirically investigated the determinants of farmers' climate change perceptions, applying a Maximum Likelihood Probit Model in Tamil Nadu. The data used in this study came from a primary survey conducted for the first author's doctoral thesis. The quantitative and qualitative information were collected from 660 farmers across 10 districts, representing five agro-climatic zones. The study showed that 79 per cent of farmers correctly perceived climate change. The estimated results of the Probit Model revealed that education, farming experience, and land ownership significantly increased the probability of perceiving climate change. However, older age and the presence of non-farm income sources decreased this probability. Agro-climatic zones also played a crucial role, with farmers in the southern zone demonstrating greater perception compared to those in the western zone. By differentiating between organic and conventional farmers, the study offered comparative insights into how various farming systems shaped climate perception. The findings highlighted the need for government interventions and policymakers to strengthen farmers' perception of climate variability through education, training, and zone-specific extension programmes. Enhancing perception was essential to promote effective adaptation strategies that protected farmers' livelihoods amid increasing climatic challenges.

Keywords: Agriculture, Climate change, Perception, Probit Model, Tamil Nadu

JEL Classification: P28, Q12, Q54

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I. Introduction

The growth performance of the agriculture and agro-based sectors of an economy was directly determined by climate factors. Climate variations, such as changes in temperature and rainfall patterns, affected the production and productivity of major food crops in both developed and developing nations (Zhu *et al*., 2011; Uddin *et al*., 2014; Chandio *et al*., 2020; Ahsan *et al*., 2020; Ozdemir, 2022; Ahmed & Fatema, 2023). Increasing climate variation caused significant losses in the yield rate of food crops, led to water scarcity, crop failure, and the spread of animal diseases, insect pests, weeds, and plant diseases, thereby increasing the need for chemical control. Extreme climate variation challenged food security, farmers' livelihoods, soil fertility, and cropping cycles in developing countries (Lobell *et al*., 2007; Barnwal & Kotani, 2013; Galle & Katzenberger, 2025).

The average temperature had been steadily rising all over India (Dash *et al*., 2007; Attri & Tyagi, 2010; Kumar *et al*., 2023). Agriculture formed the backbone of all Indian states' economies, providing livelihoods for over 60 per cent of the population (Economic Survey, 2022-23). India held a prominent global position in agriculture as the second-largest producer of fruits, vegetables, rice, and wheat. The country was also a significant global exporter of agricultural products. Within India, Tamil Nadu was the 11th largest geographical area and the 6th most populous state with 6 per cent of the national population, and was the 3rd largest contributor to India's GDP.

Tamil Nadu was historically one of the agrarian states of India. Agriculture played a central role in the livelihoods of people in Tamil Nadu, which had a long-standing agrarian tradition (Mariappan, 2024) and it was divided into seven agro-climatic zones across 38 districts. About 93 per cent of total land holdings were small and marginal farmers, and 41.17 per cent of the rural working population was engaged in the agriculture and allied sectors in Tamil Nadu (MOSPI, 2023). Approximately 62.37 per cent of the cultivated land in Tamil Nadu was managed by marginal and small farmers (Agricultural Census, 2015–2016). The agricultural sector contributed 13.2 per cent to the state's Gross State Value Added (Economic Survey of Tamil Nadu, 2025). Tamil Nadu continued to rank among the top states in the productivity of key crops, including oilseeds, groundnuts, paddy, maize, and sugarcane (Agricultural Statistics at a Glance, 2023). However, the contribution of the agricultural sector to the state's Gross Domestic Product (SGDP) had significantly declined over time, mainly due to climate variations (Directorate of Economics and Statistics, Government of Tamil Nadu, 2025).

Tamil Nadu farmers relied mainly on the Northeast Monsoon (NEM), which brought heavy rainfall to the coastal regions. However, the non-coastal regions received less widespread rainfall, leading them to face crop loss, financial stress, and other related issues. The state was frequently experiencing extreme climate events, such as prolonged droughts and recurrent floods, which posed serious challenges to agriculture and rural livelihoods (Mohanty & Wadhawan, 2021). Tamil Nadu's meteorological data also clearly showed an increasing trend in both temperature and rainfall, as illustrated in Figure 1. Abnormal climate variation severely challenged the growth of the agriculture sector, livelihood opportunities of farmers, food security, and so on. At the time, climate awareness and understanding remained comparatively low among Indian farmers (Leiserowitz & Thaker, 2012). Therefore, to address these problems, an empirical evaluation of the determinants of farmers' perceptions of climate variation in Tamil Nadu is essential. This is because farmers who accurately perceived climate change tended to adopt a variety of adaptive practices, including mixed cropping, crop diversification, adjusting planting dates, improved water management techniques, and other similar strategies. The following review section critically evaluated the existing body of knowledge to understand the factors influencing farmers' climate perceptions and to establish the need for the current study.

II. Review of Literature

This section provided a concise review of relevant global and national studies for the current study. For instance, Tesso *et al*. (2012) analysed perceptions and adoption of climate change in Ethiopia's North Shewa Zone using data from 452 households and applied Heckman's two-step selection model. Farmers demonstrated a strong awareness of climate change, which was influenced by education, extension services, early warning systems, and farm location. The study found that higher perception levels significantly increased the likelihood of adopting adaptation strategies, highlighting the role of education in fostering adaptation. Roco *et al*. (2014) examined farmers' perceptions of climate change in four municipalities of Mediterranean Chile using survey data from 274 farmers and climatic records (1987–2011). Probit analysis revealed that most farmers perceived declining rainfall, rising temperatures, and increased frequency of droughts. Education, age, and land tenure significantly influenced clarity of perception, with younger, better educated, and land-owning farmers showing greater awareness.

Adegboye & Otuagoma (2015) conducted a study among plantain farmers in Nigeria regarding their perceptions of climate change. The study collected data from 136 farmers in Delta State, Nigeria, using an interview schedule. Analyses were conducted using descriptive statistics, including frequency, mean, and standard deviation. Farmers were found to use 18 different methods to reduce the impacts of climate-related risks. Findings indicated that farming experience significantly enhanced farmers' understanding of climate change and its adverse effects on agriculture, suggesting that experiential knowledge plays a critical role in shaping perception and adaptive capacity. Marie *et al*. (2020) examined climate adaptation strategies in Ethiopia's Gondar Zuria district using survey data from 121 farmers, as well as both binary and multinomial logistic regression. The study identified age, gender, family size, farm size, and income as significant determinants of adoption, with access to information and markets further enhancing adaptation. Farmers reported crop failure, soil erosion, and water shortage as the main climate-related challenges. Irham *et al*. (2022) compared Indonesian organic and conventional vegetable farmers in Yogyakarta and Central Java to examine their perceptions of climate change and adaptation strategies. The study surveyed 112 organic and 112 neighboring conventional farmers using questionnaires to assess their socioeconomic characteristics, climate perceptions, and adaptation practices, which were analyzed through chi-square and logistic regression. Both groups perceived rising temperatures and negative impacts on production, but they differed in their perceptions of rainfall trends. Adaptation strategies also diverged, with organic farmers employing crop rotation, organic manure, mixed cropping, and shading. In contrast, conventional farmers adjusted planting dates, adopted less water-intensive crops, and relied on traditional calendars.

The following available studies in the Indian context are briefly reviewed. For instance, Varadan & Kumar (2014) studied the understanding and awareness of climate change among 200 farmers residing in the dryland areas of Villupuram and Virudhunagar districts, Tamil Nadu. Using descriptive statistics and Garrett's ranking, the study identified key adaptation measures practiced by farmers. The results revealed that farmers commonly responded to climatic variability by altering sowing dates, modifying fertilizer application, practicing crop rotation, and adopting drought-tolerant varieties. These strategies highlight the proactive role of dryland farmers in adjusting their practices to mitigate the impacts of climate uncertainty. Chapke *et al*. (2025) conducted a study on the perception of climate change among millet farmers from the tribal community in Kolli Hills in Tamil Nadu. The study collected data from 125 farmers on millet farms using a semi-structured interview schedule. The study found that community participation and the utilization of mass media also have a positive impact on perception. Experienced farmers who integrated scientific knowledge with local community knowledge helped reduce the effect of climate impact on their millet cultivation

III. Research Gap and Objectives

The available studies revealed that no Indian study has examined the determinants of climate change perception in Tamil Nadu, focusing on both organic and conventional farmers applying appropriate econometric model. This study therefore aims to fill this gap in the Indian literature and further explore this field. The objective of this study is, therefore, to analyse farmers' perceptions of climate change in Tamil Nadu and to identify the key determinants of these perceptions. By comparing organic, conventional, and combined farming systems, the research will highlight differences in awareness and recognition of climate change across these systems. The findings will provide valuable insights to inform policies and interventions that enhance perception, a crucial first step toward effective adaptation in the agricultural sector.

IV. Econometric Methodology

Source of Data

The study used both primary and secondary qualitative and quantitative information. Secondary data on rainfall and temperature from 1990-91 to 2023-24 were obtained from the Indian Meteorological Department, Government of India. The Season and Crop Report (2023-24) had classified the agro-climatic zones into seven. The present study collected the primary data from five zones, namely (i). Western (Coimbatore, Erode, and Tiruppur), (ii). North Western zone (Salem), (iii). Cauvery Delta zone (Tiruchirappalli), (iv). High Rainfall zone (Kanyakumari), (v). Southern zone (Dindigul, Sivagangai, Tirunelveli and Tenkasi) where both organic and conventional farmers were concentrated.

The primary data were collected from 660 farmers, comprising 275 organic and 385 conventional farmers, using a multistage stratified random sampling method. The primary data were collected between October 2024 and February 2025 by the first author as part of the Ph.D. thesis work. The interview schedule used in the study included questions related to perceptions of rainfall, temperature, cyclones, drought, and floods. Each sample farmer was asked whether they observed an increase, decrease, or no change in temperature and rainfall over recent years. Based on actual climatic data from Tamil Nadu, it was observed that both the mean annual temperature and rainfall had shown an increasing trend, as shown in Figure 1. Therefore, farmers who correctly reported an increase in both temperature and rainfall were classified as having perceived climate change. Those who reported otherwise were categorised as non-perceivers.

Specification of Econometric Model

In this study, the maximum likelihood probit model was used to analyse the factors influencing their perception. The probit model was specified as

$$Y_i^* = X_i\beta + \varepsilon_i \tag{1}$$

Where, Y_i^* denoted unobserved (latent) variable, X_i represented the vector of explanatory variables such as age, education, etc (Variable definitions and measurements were provided in Table 1), and β denoted the vector of parameters to be estimated, and ε_i referred an error term ($\varepsilon_i \sim N(0, 1)$). The observed binary outcome was defined as

$$Y_i = \begin{cases} 1 & if\ Y_i^* > 0 \\ 0 & otherwise \end{cases} \tag{2}$$

$Y_i^* > 0$, indicated that the farmer perceives climate change. From the above specification, the probability that farmer i perceives climate change could be written as

$$P(Y_i = 1 \mid X_i) = \Phi\,(X_i, \beta) \tag{3}$$

Where, Φ represented the cumulative distribution function of the standard normal distribution. To make the results more interpretable, marginal effects were calculated for the probit models. Since almost all the explanatory variables in the model were binary, marginal effects were interpreted as discrete probability changes rather than derivatives. For binary variables, the marginal effect was calculated as the difference in the predicted probability of perceiving climate change when the variable changes from 0 to 1, holding other factors constant.

$$\text{MEbinary} = \Phi\,(X_i\beta \mid X_{ik} = 1) - \Phi\,(X_i\beta \mid X_{ik} = 0 \qquad (4)$$

In the empirical analysis, average marginal effects were estimated to know the mean of probability differences across the sample. This approach ensures that the results were directly interpretable as changes in the likelihood of perceiving climate change associated with categorical and binary factors (Cameron & Trivedi, 2005; Wooldridge, 2010; Greene, 2018).

V. Result and Discussion

Figure 1 illustrated the trend of temperature and rainfall in Tamil Nadu from 1990-91 to 2023-24. The temperature displayed a clear upward trend, rising at

Figure 1: Trends of the temperature and rainfall in Tamil Nadu

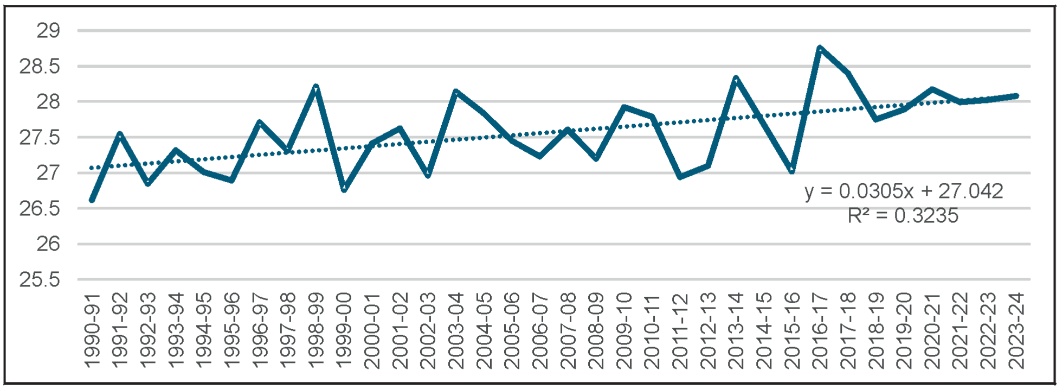

Figure 1A: Average Temperature (Degree celcius)

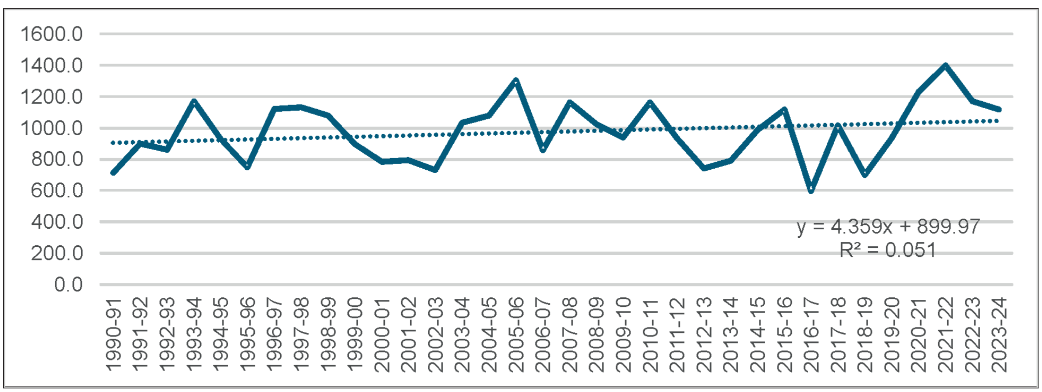

Figure 1B: Annual Rainfall (mm)

Source: Authors' computation based on the secondary data from IMD, Government of India.

an average rate of 0.03°C per year. Rainfall also showed a slight increasing trend of approximately 4 mm per year, although there were significant fluctuations from year to year, indicating high interannual variability.

The coefficients of determination (R^2) revealed that the temperature trend accounted for a moderate portion of the observed variation ($R^2 = 0.32$), while rainfall explained only a small part ($R^2 = 0.05$). The concurrent increase in temperature and rainfall reflected on-going regional climate changes, indicating that Tamil Nadu was experiencing a gradual warming alongside a marginal rise in precipitation. Based on secondary data showing rising trends in both temperature and rainfall, farmers in the primary survey were classified as perceivers or non-perceivers of climate change.

Figure 2 showed the percentage of farmers' perceptions of climate change by farming type in Tamil Nadu. Overall, 79.10 per cent of farmers reported perceiving climate change, while 20.90 per cent did not. Organic farmers had the highest level of awareness, with 82.90 per cent aware and 17.10 per cent unaware of climate change. Conventional farmers showed slightly lower awareness, with 76.40 per cent perceiving climate change and 23.60 per cent not perceiving it. This indicated that, while the majority of farmers were aware of climate change, organic farmers were more sensitive to environmental changes than conventional farmers. Table 1 presented the definitions, measurements, and expected effects of the variables used in this study. Based on previous literature, each variable was expected to influence climate change perception either positively or negatively. Table 2 summarised the distribution of farmers

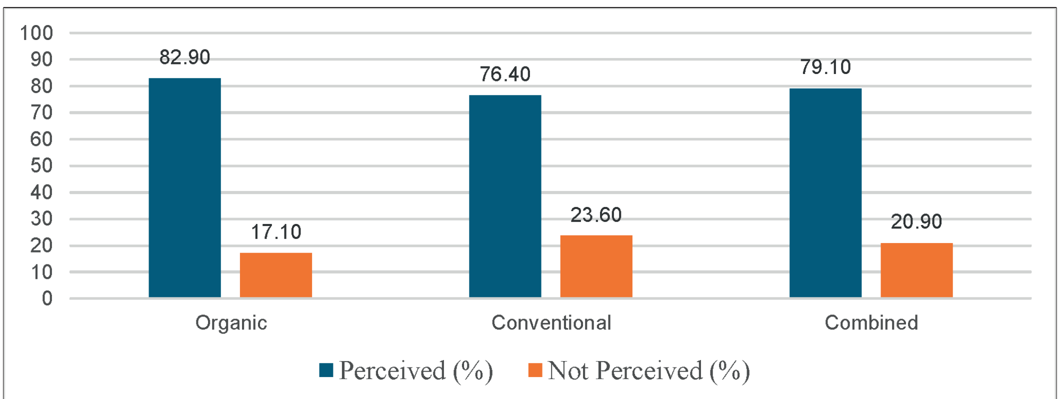

Figure 2: Farmers of climate change perception in Tamil Nadu

Source: Authors' computation based on primary data by farming type, climate change perception, and key social, economic, and demographic characteristics, providing an overview of the sample profile.

Table 3 presented the estimated probit coefficients and corresponding average marginal effects of the factors influencing climate change perception among samples of organic, conventional, and combined farms. From the probit and marginal effect results, it was evident that all models were statistically significant, with a likelihood ratio test yielding a probability value of 0.000. The Pseudo R^2 values of 0.2974 for organic farmers, 0.1608 for conventional farmers,

Table 1: Variable definition and measurement of the variable

Variable Name	*Variable Symbol*	*Definition and Measurement of variable*	*Type of variable*	*Expected Sign*
Climate Change Perception	CCP	1 if the farmer perceives climate change correctly, 0 otherwise.	Binary	
Age group of the Farmer	AGE	Age of the farmer.	Continuous	+ve/-ve
Educational Qualifications of the Farmer	EDU	1 if Secondary or above, 0 if Illiterate or Primary level.	Binary	+ve/-ve
Income from farming activity	INC	1 if Farm income is > ₹80,000 (High), 0 if Farm income is < ₹80,000 (Low).	Binary	+ve/-ve
Other than farm income	OIN	1 if the farmer has other sources of income (Yes), 0 otherwise (No).	Binary	+ve/-ve
Experience of the Farmer	EXP	1 if the farming experience is more than 20 years (Higher), 0 if the farming experience is up to 20 years.	Binary	+ve/-ve
Land ownership	LNO	1 if the farmer is cultivating on their own land only, 0 if leases or both own and lease.	Binary	+ve/-ve
Agro-climatic Zones	ZONE	1 if the agro-climatic zone is Southern, 2 if the agro-climatic zone is Cauvery Delta, 3 if the agro-climatic zone is High Rainfall, 4 if the agro-climatic zone is North Western. 0 if the agro-climatic zone is Western,	Categorical	+ve/-ve

Source: Authors' computation based on primary data and 0.1272 for the combined sample indicated that the models provided a reasonable level of explanatory power for understanding the determinants of farmers' perceptions of climate change. Since the probit coefficients themselves were not directly interpretable in terms of probability, the marginal effects were used to provide more meaningful insights. These effects indicated the change in the probability of perceiving climate change when the explanatory variable changed, while other variables remained constant.

Table 2: Descriptive statistics of the sample farmers

Variable	*Category*	*Percentage / Mean*	*Min*	*Max*
CCP	Perceived	79.09	0	1
	Not perceived	20.91		
AGE	Years	54.25	38	83
EDU	Lower	30.60	0	1
	Higher	69.40		
INC	≤ ₹80,000	12.10	0	1
	> ₹80,000	87.90		
OIN	No other income	33.00	0	1
	Has other income	67.00		
EXP	≤ 20 years	60.20	0	1
	> 20 years	39.80		
LNO	Own land only	61.80	0	1
	Lease or both own & lease	38.20		
ZONE	Western	43.60	0	4
	Southern	35.00		
	Cauvery Delta	8.00		
	High Rainfall	7.60		
	North Western	5.80		

Source: Authors' computation based on primary data

Previous studies had identified age as a key factor affecting climate change perception, although the evidence remained mixed. Some researchers suggested that older farmers, with their extensive farming experience, were better at recognising gradual climatic shifts (Maddison, 2006). Conversely, other studies indicated that when climate change was a more recent or sudden phenomenon, younger farmers tended to be more aware, while older farmers demonstrated lower accuracy (Roco *et al*., 2015; Byg & Salick, 2009). Consistent

Table 3: Estimated Probit and marginal effect results

Variables	*Organic Farmers*		*Conventional Farmers*		*Combined farmers*	
	Probit	*Marginal Effect*	*Probit*	*Marginal Effect*	*Probit*	*Marginal Effect*
AGE	-0.024 (0.017)	-0.004 (0.003)	-0.104*** (0.018)	-0.026*** (0.004)	-0.065*** (0.010)	-0.016*** (0.002)
EDU (Illiterate or Primary level)®	-	-	-	-	-	-
Secondary or above	1.783*** (0.280)	0.318*** (0.358)	0.069 (0.157)	0.017 (0.040)	0.543*** (0.125)	0.135*** (0.030)
INC (≤ ₹80,000)®	-	-	-	-	-	-
> ₹80,000	-0.379 (0.401)	-0.068 (0.071)	-0.005 (0.219)	-0.001 (0.056)	0.083 (0.175)	0.020 (0.043)
OIN (No other income)®	-	-	-	-	-	-
Has other income	-0.148 (0.237)	-0.026 (0.042)	-0.287* (0.166)	-0.073* (0.042)	-0.367*** (0.127)	-0.091*** (0.031)
EXP (≤ 20 years)®	-	-	-	-	-	-
> 20 years	1.225*** (0.362)	0.218*** (0.059)	0.182 (0.154)	0.046 (0.040)	0.299** (0.121)	0.074** (0.030)
LNO (Own land only)	-	-	-	-	-	-
(Lease or both own & lease)	-0.808 (0.522)	-0.144 (0.090)	0.295* (0.156)	0.076* (0.039)	0.164 (0.119)	0.040 (0.029)
ZONE (Western)®	-	-	-	-	-	-
Southern	0.499*** (0.220)	0.100*** (0.045)	0.606*** (0.183)	0.160*** (0.046)	0.530*** (0.137)	0.138*** (0.034)
Cauvery Delta	0.996*** (0.321)	0.165*** (0.047)	0.574** (0.291)	0.153** (0.068)	0.562** (0.221)	0.145** (0.049)
High Rainfall	0.932 (0.638)	0.158 (0.075)	0.865*** (0.328)	0.211*** (0.063)	0.765*** (0.260)	0.183*** (0.048)
North Western	0.899*** (0.431)	0.155*** (0.059)	0.524 (0.343)	0.142 (0.082)	0.570** (0.262)	0.146** (0.057)
Constant	0.761 (1.350)	-	6.025*** (1.168)	-	3.342*** (0.714)	-
Sample size	275		385		660	
LR chi2(10)	63.75		48.51		84.04	
Prob>chi2	0.000		0.000		0.000	
Pseudo R2	0.2974		0.1608		0.1272	
Log Likelihood	-88.368282		-176.68125		-295.36357	

Source: Authors' computation based on primary data

*Notes: ***, **, and * are statistically significant at the 1%, 5%, and 10% levels, respectively.*

The category indicated in parentheses is robust standard error.

® indicates the reference category of the independent variable.

with this latter view, the findings of this study revealed that age had a negative and statistically significant effect on climate change perception for both conventional and combined farmers at the 1 per cent level, while the coefficient was negative but insignificant for organic farmers.

This suggested that older farmers were less likely to accurately perceive climate change than younger farmers. The marginal effects (-0.026 and -0.016) showed that with each additional year of age, the probability of recognising climate change dropped by approximately 2.6 per cent for conventional farmers and 1.6 per cent for all farmers combined. This suggested that younger farmers were more aware of climate issues, possibly because they had better access to information and education.

Education was generally found to enhance farmers' perception of climate change (Roco *et al*., 2015; Deressa *et al*., 2011). However, this relationship was not uniform across contexts. Evidence from tribal farming communities suggested that, despite lower levels of formal schooling, farmers often demonstrated stronger perceptual skills through their traditional knowledge and close connection to the environment (Chapke *et al*., 2025; Tume *et al*., 2019). Education had a strong, positive, and highly significant effect on the perception of climate change among organic and combined farmers, significant at the 1 per cent level. For organic farmers, the marginal effect (0.318) indicated that being more educated (secondary level or above) increased the likelihood of perceiving climate change by 31.8 per cent. Similarly, among combined farmers, education increased the probability by 13.5 per cent compared to that of illiterate or primary-level educated farmers. However, for conventional farmers, the coefficient was positive but statistically insignificant. This implied that education played a crucial role in enhancing climate awareness, particularly among organic farmers, who might already have been more environmentally conscious.

Farm income had a positive but statistically insignificant effect across all groups. Although farmers with higher farm income were more likely to perceive climate change, the lack of statistical significance suggested that income level alone did not determine climate awareness. This suggested that perception was more influenced by experience and education than by income status. This finding was consistent with studies that also reported no significant relationship between income and climate change perception among farmers (Debela *et al*., 2015). The coefficient for non-farm income was negative and statistically significant for conventional and combined farmers at the 10 per cent and 1 per cent levels, respectively, and negative but insignificant for organic farmers. This result suggested that farmers with additional non-farm income sources were less likely to accurately perceive climate change compared to farmers who relied solely on farming. The marginal effects showed that having other sources of income decreased the probability of perception by 7.3 per cent and 9.1 per cent, respectively. This may have been because reduced dependence on farming led to less attention to climatic variations that impacted agriculture. However, this result stood in contrast to the work of Jha & Gupta (2021), who found that farmers with higher or diversified income sources were more likely to perceive climate change.

Experience had a positive and significant impact on perceptions among organic and combined farmers, suggesting that farmers with more than 20 years of experience were more likely to recognise changes in climate patterns than farmers with less than 20 years of experience in the reference category. The marginal effects implied that experienced organic farmers and combined farmers had a 21.8 per cent and 7.4 per cent higher probability of perceiving climate change compared to less experienced farmers. This finding indicated that accumulated farming experience enhanced awareness through long-term observation of weather variability and crop responses. This aligned with the work of Debela *et al*. (2015) and Mbwambo *et al*. (2021). The coefficient of land ownership was positive and significant only for conventional farmers at the 10 per cent level. This suggested that those cultivating their own land were more likely to perceive climate change than tenants or mixed cultivators. The marginal effect of 0.076 indicated that ownership increased the likelihood of perception by 7.6 per cent. However, the relationship was insignificant in both the organic and combined groups.

Agro-climatic zones exhibited strong, consistent marginal effects. Farmers in the Southern, Cauvery Delta, High Rainfall, and North Western zones showed a positive and statistically significant perception of climate change compared to the reference zone (Western). The coefficient for the Southern Zone was positive and statistically significant at the 1 per cent level for all three groups. The marginal effects of 0.100 for organic, 0.160 for conventional, and 0.138 for combined farmers indicated that farmers in the Southern Zone were 10, 16, and 14 per cent more likely to correctly perceive climate change than those in the Western Zone. This suggested that farmers in the Southern agro-climatic region were more climate-aware, possibly because of their greater exposure to recurrent droughts and irregular rainfall patterns. Such experiences may have made them more observant of shifts in climate and its impacts on agricultural productivity.

For the Cauvery Delta Zone, the coefficients were positive and highly significant at the 1 per cent level for organic farmers and at the 5 per cent level for conventional and combined farmers. The corresponding marginal effects of 0.165, 0.153, and 0.145 indicated that farmers in the Cauvery Delta were 14 to 17 per cent more likely to perceive climate change than their counterparts in the Western Zone. This heightened perception was expected, as the Cauvery Delta region was highly sensitive to climatic variability, particularly rainfall fluctuations and irrigation water availability. Farmers in this region often faced challenges related to monsoon dependency and river flow variability, which made them more aware of climatic changes affecting agriculture. The high Rainfall Zone exhibited a positive, statistically significant relationship for both conventional and combined farmers at the 1 per cent level, though it was not significant for organic farmers. The marginal effects of 0.211 for conventional and 0.183 for combined farmers indicated that these farmers in this zone were 21 per cent and 18 per cent more likely to correctly perceive climate change than those in the Western Zone. This finding suggested that even in regions receiving abundant rainfall, increasing rainfall irregularity and extreme events, such as floods, may have increased farmers' perception of changing climate patterns.

The coefficient for the North Western Zone was positive and statistically significant for organic farmers at the 1 per cent level and combined at the 5 per cent level, while it was positive but insignificant for conventional farmers. The marginal effects of 0.155 for organic and 0.146 for combined indicated that farmers in the North Western Zone were about 15 per cent more likely to perceive climate change than those in the Western Zone. This region was relatively drier and more prone to temperature fluctuations, which may have made farmers more sensitive to gradual climate variations, especially those following organic practices that depended heavily on natural weather conditions rather than synthetic inputs. The geographical location of agro-climatic zones or districts had been identified as a significant factor in several studies. For instance, Roco *et al*. (2015) found that a municipality's location significantly influenced farmers' perceptions of climate change. Similarly, Tesso *et al*. (2012) emphasised that the agro-ecological zone played an important role in shaping farmers' perceptions and adaptation strategies to climate change.

VI. Summary & Conclusion

This study examined farmers' perceptions of climate change and their determinants across organic and conventional farming in Tamil Nadu using probit model. The study' findings were summarised as: The analysis revealed significant differences in the factors influencing climate change perception among organic, conventional, and combined farmers. For organic farmers, education, experience, and zones including Southern, Cauvery Delta, and North Western were positively influencing the climate perception. In the case of conventional farming, land ownership of cultivated land and agro-climatic zones in the Southern, Cauvery Delta, and North Western regions positively influenced perceptions.

The results showed that education and longer farming experience significantly enhanced farmers' likelihood of recognising climate change, emphasising the importance of knowledge and long-term exposure to agricultural variability. Land ownership had only a limited effect, while agro-climatic zones proved to be key influences. Farmers in the Southern agro-climatic zone demonstrated a higher perception of climate change than those in the Western Zone. These findings carried important implications for agricultural policy and climate adaptation efforts. Strengthening education and awareness programs, particularly among older and less educated farmers, was vital to enhance recognition of climate change and foster the timely adoption of adaptive practices. Location-specific interventions were also necessary, as perception was strongly linked to the agro-climatic context. Moreover, given that non-farm income reduced attentiveness to climate signals, policy initiatives had to ensure that farmers, especially those partially disengaged from agriculture, remained adequately informed about climate risks.

This study contributed to the literature by offering a comparative perspective on farming systems, which had been largely overlooked in the Indian context. While the analysis underscored important drivers of perception, it was limited to perceptions alone. Future research would expand the framework to investigate how these perceptions translated into concrete adaptation strategies. The findings emphasised that improving education and location-specific awareness initiatives could enhance farmers' ability to recognise climate risks, a crucial step towards building resilient agricultural systems.

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