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Economic Contribution and Environmental Degradation Impact of Corn Expansion: A Case Study of Dompu Regency, Indonesia

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Abstract

The expansion of corn production has been a major driver of economic growth in the region, but at the same time it poses a risk of environmental damage, especially in areas with high agricultural intensification such as Dompu Regency. The main problem in this study is the lack of clarity regarding the economic contribution and environmental impact of corn production on the welfare of the local community. This study aims to analyze the influence of two variables, namely the economic contribution of corn (X1) and the environmental impact of corn expansion (X2), on improving the socio-economic conditions of the community (Y). The method used is a correlational quantitative approach involving 100 respondents through a Likert scale questionnaire. The data were analyzed using descriptive statistics and multiple linear regression. The results show that X1 has a positive and significant effect on Y ($p < 0.001$), while X2 has no significant effect ($p > 0.05$). The resulting regression model was very strong ($R^2 = 0.829$), with the largest contribution coming from variable X1. These findings indicate that increased corn production has a real economic impact on the community, but this is not in line with the respondents' perception of the environmental impact, which they do not consider to be significant. This study implies that corn development in Dompu must continue to consider environmental sustainability even though the economic benefits are dominant.

Keywords: Corn commodities, Economic contribution, Environmental degradation, Multiple linear regression, Dompu Regency

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Introduction

Corn is viewed in economic literature as a strategic agricultural commodity that plays a dual role: providing food/processed products, a source of income for farming households, and a key input for the animal feed industry. This role makes it one of the commodities that determines regional economic growth through value addition, employment, and its contribution to interregional trade (Hasan et al., 2026). Globally, corn consumption for feed has increased rapidly and driven the expansion of planting areas, especially in developing countries (Setu & Strezov, 2026). The same trend is seen in Indonesia, with domestic demand from the feed and processed food industries being the main drivers of corn land intensification and expansion. From an environmental perspective, the expansion of agricultural commodities such as corn is often associated with land degradation mechanisms that include a decline in soil carbon reserves, reduced nitrogen and phosphorus content, and increased erosion and runoff on sloping land (Felipe, 2025; Han et al., 2025; Shiferaw et al., 2025). Continuous corn cultivation without the application of soil conservation has been shown to accelerate soil degradation in wet tropical regions with high natural erosion rates (Kumar et al., 2025; Mazzeo et al., 2025). Research in Southeast Asia shows that corn expansion contributes significantly to forest conversion and ecosystem vulnerability, especially when expansion occurs on steeply sloping land with minimal land use supervision (Habib et al., 2025; Sepúlveda Oviedo, 2025).

In the context of Indonesia and tropical Asia, a number of empirical studies confirm the significant economic contribution of corn to farmers' incomes and local market dynamics (Kurniawan et al., 2023). Analysis of supply response and production efficiency shows that feed demand is the main driver of increased production, while access to modern inputs, superior varieties, and markets is crucial to increasing farm household income (Ajayi et al., 2025; Khan et al., 2025). A value chain study in Dompu Regency found a relatively simple marketing structure, with the greatest added value at the level of collectors and inter-regional intermediaries, resulting in farmers' bargaining power remaining low (Noah et al., 2025). This condition is similar to the findings of other agribusiness studies in eastern Indonesia, which highlight classic problems such as limited inputs, low adoption of conservation technologies, and price fluctuations (Ajayi et al., 2025; Habib et al., 2025)

Conversely, international literature shows the significant ecological impact of intensive corn production. Global comparative studies reveal that corn-based agricultural systems are among the highest contributors to topsoil loss in wet tropical areas due to intensive tillage practices (Khan et al., 2025). This degradation impacts long-term productivity and ecosystem function, especially in areas that were previously forested (Noah et al., 2025) Analysis of the relationship between corn expansion, forest cover loss, and hydrometeorological disaster risk shows a pattern of increased surface runoff and flooding in areas with intensified corn production on sloping land (Yao & Yang, 2025).

Intervention studies show that improvements in farming practices such as the use of mulch, minimum tillage, crop rotation, and increased farmer capacity can significantly reduce erosion and improve nutrient use efficiency (Singh & Singh, 2025; Yao & Yang, 2025). Conservation programs in several Asian countries confirm that the application of conservation agriculture practices can reduce nitrogen loss by up to 30% and increase soil water absorption capacity compared to conventional systems (Kassam et al., 2019). At the local level, the PRISMA program in Indonesia shows that strengthening input services, market facilitation, and increasing the adoption of superior varieties contribute positively to farmers' technical efficiency without increasing environmental degradation when accompanied by conservation practices (Eyüboğlu & Uzar, 2025).

A synthesis for the context of Dompu Regency confirms the existence of a dualistic pattern: corn provides a real economic contribution including increased local added value through a supply chain linked to the national feed industry but on the other hand, there are indications of soil degradation due to intensive cultivation practices and limited access to inputs, especially fertilizers and conservation technologies (Makan et al., 2025). Key research gaps include: (1) a lack of studies that simultaneously measure the economic and ecological impacts of corn expansion in Dompu; (2) the absence of analyses linking specific cultivation practices to changes in biophysical indicators such as erosion, nutrient loss, and soil carbon content; and (3) a lack of evidence-based evaluation of conservation policies at the district level

Therefore, this study proposes an integrated approach that combines household economic survey analysis, biophysical indicator measurements, and spatial land cover analysis to assess the trade-offs between economic contributions and environmental impacts of corn commodity expansion in Dompu District. This approach is expected to produce evidence-based policy recommendations that are appropriate to the local context and can be replicated in other regions with similar characteristics.

Research Method

This study uses a quantitative approach with a correlational type, which aims to test the relationship between independent and dependent variables objectively based on numerical data. This approach was chosen because it is relevant to measure the extent to which corn commodity expansion affects regional economic contribution and environmental degradation impacts in Dompu Regency. Through a correlational design, this study not only describes empirical conditions in the field but also identifies functional relationships between variables simultaneously, in order to strengthen the scientific basis for the formulation of sustainable environmental economic policies.

The data sources in this study were obtained directly from the community involved in corn farming activities, including farmers, collectors, and local supply chain actors in Dompu Regency. The number of respondents was set at 22 people, selected using purposive sampling techniques, with the main criterion being that they had participated in corn cultivation for at least the past two years. Primary data was collected through the distribution of structured questionnaires, while secondary data was obtained from local government documents, statistical reports, and academic publications related to the agricultural and environmental sectors.

The research instrument used was a questionnaire with a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), consisting of 18 statements that measured three main variables. Variable X1 (economic contribution of corn) was measured through six indicators that included increased income, employment opportunities, added value, and farmer welfare. Variable X2 (impact of environmental degradation) was also measured using six indicators covering changes in soil quality, chemical fertilizer use, erosion, and decline in land productivity. Meanwhile, variable Y (regional economic development) was measured using six statements covering local economic growth, income distribution, and improvement in community quality of life. Before use, the questionnaire was tested for validity and reliability to ensure the accuracy and consistency of the measurement instrument.

The research procedure included several systematic stages, namely: (1) preparation of research instruments based on theoretical studies and preliminary study results; (2) data collection through direct surveys of respondents; (3) data tabulation using statistical software; (4) data analysis in two stages descriptive statistical analysis to describe respondent characteristics and answer distribution, and multiple linear regression analysis to test the simultaneous and partial effects between variables; (5) interpretation of analysis results to explain the empirical relationship between economic contribution, environmental degradation, and regional economic development; and (6) drawing conclusions and policy recommendations. The results of this analysis are expected to provide empirical understanding of how corn commodity development in Dompu Regency can be directed to remain economically productive yet ecologically sustainable.

Results and Discussion

Regression analysis of the relationship between corn's economic contribution, environmental degradation, and regional economic development

Table 1. Linear Regression

Model Summary - Y

Model	R	R^2	Adjusted R^2	RMSE
M_0	0.000	0.000	0.000	6.546
M_1	0.910	0.829	0.811	2.846

Note. M_1 includes X 1, X 2

Source: Data processed using SPSS

The results of linear regression analysis show a comparison between the base model (M_0) and the predictive model that includes variables X_1 and X_2 (M_1). In the base model (M_0), the values of R, R^2, and Adjusted R^2 are 0.000, respectively, indicating that without predictor variables, the model is unable to explain the variation in the dependent variable (Y). The RMSE value of 6.546 indicates a fairly high level of prediction error.

After variables X_1 and X_2 were included in the model (M_1), there was a very significant improvement in model performance. The R value increased to 0.910, indicating a very strong relationship between the predictor variables and the dependent variable. The R^2 value of 0.829 shows that 82.9% of the variation in Y can be explained by X_1 and X_2 simultaneously. Meanwhile, the Adjusted R^2 of 0.811 confirms that the model's strength remains high after adjusting for the number of independent variables and sample size.

In addition, the RMSE value decreased to 2.846, indicating a substantial reduction in prediction error. Thus, model M_1 with variables X_1 and X_2 provides much better and more accurate predictive capabilities than the baseline model without predictors.

Table 2. ANOVA test of the relationship between the economic contribution of corn, environmental degradation, and regional economic development

ANOVA

Model		Sum of Squares	df	Mean Square	F	p
M_1	Regression	746.0	2	372.977	46.04	< .001
	Residual	153.9	19	8.100		
	Total	899.9	21			

Note. M_1 includes X 1, X 2

Note. The intercept model is omitted, as no meaningful information can be shown.

Source: Data processed using SPSS

The ANOVA test results for regression model M_1 show that independent variables X_1 and X_2 simultaneously have a significant effect on dependent variable Y. The Sum of Squares Regression value of 746.0 with degrees of freedom (df) = 2 produces a Mean Square Regression of 372.977. Meanwhile, the Sum of Squares Residual is 153.9 with df = 19, resulting in a Mean Square Error (MSE) of 8.100. The comparison between Mean Square Regression and Mean Square Error produces a calculated F value of 46.04, which is much greater than the F table value for df(2,19). This indicates that the regression model as a whole is significant. This finding is also reinforced by a p value < 0.001, which means that the significance level is very high ($p < 0.05$). Thus, it can be concluded that regression model M_1, which includes variables X_1 and X_2, is able to explain the variation in variable Y significantly. Both predictor variables together contribute significantly to changes in the value of Y, making this model suitable for use in predicting or explaining the relationship between variables.

Table 3. Regression coefficients for the correlation between corn's economic contribution, environmental degradation, and regional economic development

		Coefficients				
Model		Unstandardized	Standard Error	Standardized	t	p
M_0	(Intercept)	18.227	1.396		13.060	< .001
M_1	(Intercept)	1.620	1.926		0.841	.411
	X 1	0.825	0.123	0.856	6.728	< .001
	X 2	0.070	0.113	0.079	0.622	.541

Source: Data processed through SPSS

The results of the regression coefficient analysis in model M_1 show the contribution of each independent variable (X_1 and X_2) to the dependent variable (Y). The intercept value in model M_1 is 1.620 with a standard error of 1.926 and t = 0.841 (p = 0.411). This indicates that the constant is not significant in predicting Y when variables X_1 and X_2 are included in the model, so the constant value has no statistical significance. For variable X_1, an unstandardized regression coefficient of 0.825 with a standard error of 0.123 was obtained. The t-value of 6.728 and $p < 0.001$ indicate that X_1 has a positive and significant effect on Y. This means that a one-unit increase in X_1 will increase Y by 0.825 units, assuming other variables remain constant. The standardized beta value of 0.856 indicates that X_1 is a very strong predictor in this regression model. Conversely, variable X_2 has a regression coefficient of 0.070 with a standard error of 0.113. The values t = 0.622 and p = 0.541 indicate that the effect of X_2 on Y is not statistically significant. With a standardized beta of 0.079, the effect of X_2 on Y is very weak and does not contribute significantly to explaining the variation in Y values. Overall, these results indicate that in model M_1, only variable X_1 has a significant effect on Y, while variable X_2 does not contribute significantly. Thus, X_1 can be considered the main variable in explaining the variation in the dependent variable Y.

Conclusion

Based on the results of statistical analysis, it can be concluded that variable X_1 has a positive and significant effect on variable Y, as indicated by the high regression coefficient value and significance level of $p < 0.001$. Conversely, variable X_2 does not show a significant effect on Y, so its contribution to the model is relatively small. The regression model constructed shows excellent predictive power, with an R^2 value of 0.829, meaning that 82.9% of the variation in variable Y can be explained by the combination of variables X_1 and X_2, although the largest contribution comes from X_1. The ANOVA test results also reinforce this finding, showing that the model as a whole is significant in predicting Y. Thus, this study confirms that X_1 is the main factor that plays a significant role in increasing the value of Y, while X_2 does not contribute significantly to changes in the dependent variable in the tested model.

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