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Article

Effects of Village Education and Access to Information on Mangrove Forest Areas: Studies in Indonesia

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Abstract

This study seeks to gather empirical evidence regarding education and access to information in affecting mangrove forests in Indonesia. The motivation for this study comes from the fact that Indonesia has experienced enormous mangrove deforestation in the last three decades. This study uses village level data in Indonesia. With a combination of geospatial data and PODES, the author uses the unbalanced panel data and Fixed Effects Model (FEM) to analyze the correlation of 9-year basic education facilities and higher education as well as national private TV broadcasts and overseas TV broadcasts on the area of mangrove forests. The author found that villages that have higher education facilities and get overseas TV broadcasts have a positive correlation with the area of mangrove forests in the village area. Higher education and broad access to information globally can certainly increase villagers' knowledge and concern about the importance of mangrove forests. Therefore, government policies are needed to improve higher education facilities and access to global information in villages to reduce the exploitation of villagers against mangrove forests, especially for village communities located around mangrove forests.

Keywords: education; access to information; mangrove; Indonesia; panel data.

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1. Introduction

More than 1,6 billion people worldwide, mostly poor, are estimated to depend on forests for their livelihoods (The World Bank, 2004; World Resources Institute, 2005), with income from forest resources helping to reduce poverty among many rural households (Cavendish, 2000; Fisher, 2004; Hogarth et al., 2013; Sunderlin et al., 2005, 2008; Vedeld et al., 2007; Yemiru et al., 2010). In Indonesia, forests are vital socially and economically because more than 90% of the Indonesian population living around forest areas depends on natural resources for their daily needs (Badan Pusat Statistik, 2018).[1] The natural resources in question include mangrove forests in it.

Indonesia is home to more than 20% of the world's mangrove area and has more mangrove species than that of other countries (Giri et al., 2011). The latest extensive data collected by the Ministry of Environment and Forestry (KLHK) found that Indonesia has 3.364.080 Ha of mangrove habitat (Direktorat Konservasi Tanah dan Air, 2021).

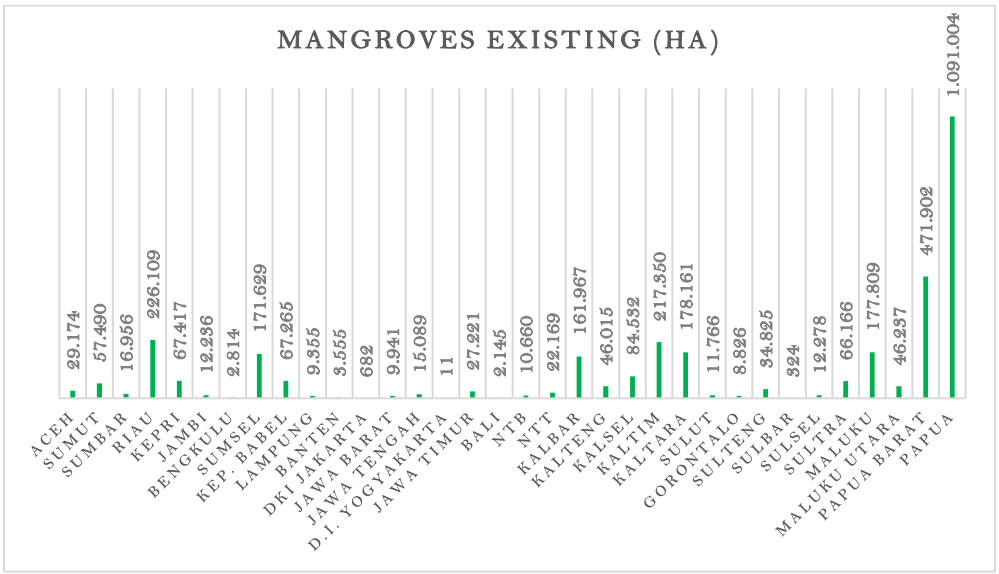

Figure 1. Distribution of Existing Mangroves Per Province in Indonesia in 2021

Source: Direktorat Konservasi Tanah dan Air, KLHK (processed by the author)

Results of national mangrove mapping carried out by Direktorat Konservasi Tanah dan Air KLHK (2021) show that the area of existing mangroves is 3.364.080 Ha, and the potential area of mangrove habitat is 756.183 Ha.[2] This means that the area of the mangrove ecosystem in Indonesia is 4.120.263 Ha, which is the sum of the existing mangrove area and the potential for mangrove habitat. The current condition of existing mangroves is dominated by dense mangroves (93%), followed by medium mangroves (5%) and rare

[1] Data of population dependence on forest/forest areas and villages/kelurahan located around forest areas based on data collection on village/kelurahan potential in 2018 issued by Badan Pusat Statistik (BPS).

[2] Potential area of mangrove forest in Indonesia consists of: abrasion area (4,129 Ha); open land (55,889 Ha); abrasive mangroves (8,200 Ha); ponds (631,802 Ha); embossed land (56,162 Ha).

mangroves (2%) (Direktorat Konservasi Tanah dan Air, 2021). Province that has the most extensive mangroves is Papua Province covering an area of 1.091.004 Ha, followed by West Papua Province covering an area of 471.902 Ha, and Riau Province covering an area of 226.109 Ha, as shown in Figure 1.

Although they cover only a tiny part of the global forest cover, mangroves represent a rich and valuable ecosystem that can contribute a wide range of provisional, regulatory, cultural, and supportive services to communities adjacent to mangroves (Palacios & Cantera, 2017; Spalding et al., 1997). The importance of mangroves in the ecology is also underscored by their superior ability to store carbon compared to other forests. (Alongi, 2012; Murdiyarso et al., 2015).

Indonesia has more mangroves in terms of species and area than that of other countries and can be said to be an essential mangrove habitat in the world (Ilman et al., 2016). However, according to FAO (2007) the last three decades, Indonesia has lost 40% of its mangroves. This means that Indonesia has the world's largest speed of mangrove damage (Campbell & Brown, 2015). One of the leading causes is the lack of education and environmental knowledge of the users of such resources (Jurin et al., 2010a; Vicente-Molina et al., 2013).

This research explores how education and access to information in the village affect the mangrove forests in coastal areas of Indonesia. The assessment of psychological training factors reveals that increasing knowledge and awareness of exploiters as well as channels and sources of information are two factors having a significant and positive influence on sustainable forest management, as discovered by Jurin et al. (2010) and Vicente-Molina et al., (2013). This suggests that the path to sustainable development entails improving public education about protecting natural resources because sustainable and inclusive development requires human power (Yazdanpanah & Feyzabad, 2017). Most environmental problems stem from a lack of holistic knowledge of human and natural relationships. Therefore, proper education and informing villagers about the information of sustainable forest management to optimize the utilization of natural resources becomes important (Jurin et al., 2010b), while limited knowledge can hinder environmentally friendly attitudes (Vicente-Molina et al., 2013).

This research differs from the previous one, where previous research mainly focused on households. This research looks more at education and access to information at the village level in Indonesia. Moreover, the research that discusses education and access to information in the village on the area of mangrove forests in Indonesia is still minimal. Most previous studies discussed only mangrove forests from the environmental side, while this research explores the socio-economic side using quantitative econometric methods. Thus, this research is essential to see the extent of the influence of education and access to information in the village on the mangrove forests in coastal areas of Indonesia.

2. Socio-economic Relations in Influencing Mangrove Forest Resources

All the resources that humans use are embedded in the complex Socio-Ecology System (SES) (Ostrom, 2009). SES is simply a form of human and natural systems that are interrelated and mutually influential (Berkes et al., 2003). Some scholars also describe this connectedness in other concepts, such as the socio-ecological system (Young et al., 2006),

eco-social system (Krieger, 1994), and coupled human-environment system (Turner II et al., 2003). SES is a system formed from biological, geological, and physical components (biogeophysical) as well as diverse actors and social institutions associated with those components. Mangroves, coastal ecosystems distributed along the (sub) tropical world, can be characterized as an excellent example of SES since their resources have been widely used traditionally in people's lives for food, wood, fuel, medicine, and socio-economic livelihoods (Alongi, 2002; Rönnbäck, 1999; Walters et al., 2008). Previous studies have shown the importance of socio-economic variables in the quality of natural resources. Among them is the level of education, as research conducted by Kamri (2013) shows that the level of education of respondents significantly influences natural resources. In addition to the research conducted by Feka et al. (2011).

Nevertheless, other studies have shown that education has a significant but negative correlation with conservation, which means people who depend on mangroves with some education are more aware of the pros and cons of conservation. A negative correlation between education and the preservation of the environment is mainly due to the lack of alternative livelihood opportunities (Roy, 2014). Moreover, inadequate knowledge about the environment is also found to be a factor in the local population's poor living conditions that rely heavily on ecosystem services (Saavedra-Díaz et al., 2015).

The results of other empirical studies show that the level of education impacts the household's awareness of climate change and their knowledge of the importance of mangrove forests in climate change mitigation (Nguyen et al., 2023). Furthermore, the educational background of residents plays a vital role in determining the importance of local ecosystem services, and the provision of information can help offset the influence of such higher education. People with higher education are already aware of the importance of identifying, quantifying, and assessing mangrove ecosystem services, while less educated people need to be encouraged to be aware of it. This will strengthen the role of education to increase support for better conservation (Jadin & Rousseau, 2022).

Mallick et al. (2021) also found that with higher educational qualifications, respondents were less likely to rely directly on mangrove forests. Higher educational qualifications make respondents less likely to rely directly on those resources. The effect of education on individuals is undoubtedly more lasting because it will increase knowledge and ultimately impact a person's cognitive abilities. This will usually shape his perception and attitude more maturely in describing a better understanding of the warning signs of mangrove vulnerability, danger, and misperception of risk (Collins, 2014; Quader et al., 2017).

Although the benefits of mangrove ecosystems are apparent, the damage continues to be alarming (Rakotomavo & Fromard, 2010). This has a negative impact on the resilience of mangrove ecosystems and the security of nearby communities that rely on forests. The loss of mangroves results from a lack of awareness, knowledge, and information from the local community about the conservation value of mangrove ecosystems (Badola et al., 2012). A fundamental weld identified is the lack of understanding of the direct relationship between mangrove ecosystems and the benefits of livelihoods provided to humans (Roy, 2016).

3. Methodology

3.1. Data and Identification

Some of the challenges in analyzing the education and access to information in the village on the area of mangrove forests are the difficulty of obtaining data on the area of mangrove forests so that this study uses geospatial data on land cover from the Ministry of Environment and Forestry by using ArcGIS to obtain the area of mangrove forests in Indonesia.[3] Based on the Technical Guidelines for Interpretation of Medium Resolution Satellite Imagery for Updating National Land Cover Data published by *Direktorat Jenderal Planologi Kehutanan dan Tata Lingkungan Kementerian Lingkungan Hidup dan Kehutanan* (2020) that the classification and monogram of mangrove forest land cover data consist of 2 (two) types, namely primary mangrove forests and secondary mangrove forests. Primary mangrove forest is the entire appearance of forests (mangroves, palm, and nibung) that are in a brackish aquatic environment that does not show any human disturbance (former logging, fire marks, road networks), excluding natural disturbances (floods, landslides, earthquakes). In contrast, secondary mangrove forests are primary mangrove forests that experience human disturbance (former logging, fire marks, road networks), including those that grow/are planted on sedimentation soils.

In addition, this study uses fixed *effect model* (FEM) panel data by combining data on the existence of educational facilities according to the level of education in the village/kelurahan and tv/radio program/broadcast data received in the village/kelurahan from PODES in 2011, 2014 and 2018 published by Badan Pusat Statistik as a variable of interest from this study which is then overlayed with mangrove geospatial data 2011, 2014 and 2018. This research uses the existence of educational facilities because it is considered an indicator of formal education. It then uses other informal sources of knowledge from television because it influences pro-environmental behavior (Vicente-Molina et al., 2013).

Another drawback in using PODES data is the absence of data on the number of poor people and population income data.[4] For this reason, poverty in this study was measured using a proxy for the number of beneficiaries of health insurance programs or health insurance provided by the Indonesian government to the poor.[5] This variable is used because

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[3] Land Closure is one of the Ministry of Environment and Forestry data produced since 1990 using medium resolution satellite imagery.

[4] In the PODES data, there is no number of poor people, there is only data on the number of poor letters issued by the village, this poor letter cannot describe the actual number of poor people, because there is no guarantee that all poor people will attend to get the poor certificate. The unavailability of community income data in the PODES data also makes us unable to group people with poor or non-poor categories based on the minimum amount of income that must be obtained.

[5] People who receive assistance from the health insurance program are people who fall into the category of poor and poor people determined by the government and regulated through government regulations. The health Insurance program for the poor (PJKMM) which is known as the Askesin program. Then the Askesin program in 2008 was replaced by the Public Health Insurance program or JAMKESMAS, but the purpose of this program remained the same, namely as social assistance for health services for the poor. Then since 2014, when the Social Security Organizing Agency (BPJS) Health began to operate, social assistance for health services was distributed through the BPJS Kesehatan Contribution Assistance Program (PBI). Data on beneficiaries of the health insurance program available at PODES also includes those from the Local Government budget or commonly referred to as Regional Health Insurance (JAMKESDA).

it can describe the number of poor and vulnerable people in the village.[6] In addition, before being designated as a beneficiary of the health insurance program, the local Social Service Office validates and verifies the beneficiary's eligibility. Changes can be made (additions and subtractions) related to eligibility as a beneficiary at any time.

Another problem is the limited data on the number of villagers in PODES. In 2011 there was data on the number of male and female residents, but in 2014 and 2018, there was no information about the number of residents. However, there was information about the number of families using electricity and families without electricity which will be used as the basis for multiplication to produce the number of villagers in 2014 and 2018.[7]

3.2. Estimation Strategy

Refer to empirical studies conducted by Aye et al. (2019b) by doing some modifications using educational variables consisting of data on the existence of 9-year basic education facilities (elementary to junior high school levels) and higher education facilities (high school to college level) and using information access variables consisting of national private TV broadcasts and foreign TV broadcasts such used analysis data panel. So this research will be estimated using the following model:

$$\text{Ln } mangrove_{it} = \beta_0 + \beta_1 basic\_educ_{it} + \beta_2 higher\_educ_{it} + \beta_3 dTV\_nation_{it} + \beta_4 dTV\_foreign_{it} + \beta_5 control_{it} + \theta_i + \delta_t + \in_{it} \quad (1)$$

Where $mangrove_{it}$ is the area of mangrove forest in units of hectares (Ha) contained in village i in year t, $basic\_educ_{it}$ is a continuous variable of 9-year basic education facilities (elementary to junior high school level) in village i in year t, $higher\_educ_{it}$ is a continuous variable of higher education facilities (high school to college level) in village i in year t, while dTV_nation_{it} is a dummy variable for national private TV broadcasts received in village i in year t where the value 1 indicates if the village received a national private TV broadcast and a value of 0 otherwise, and $dTV\_foreign_{it}$ is a dummy variable for overseas TV broadcasts received in village i in year t where the value of 1 indicates if the village received an overseas TV broadcast and a value of 0 otherwise. β_1, β_2, β_3 and β_4 to capture changes in the area of mangrove forests at the village level and the effect of education and access to information in the village. If the higher the education and access to information in the village, the greater the knowledge of the villagers to be able to preserve mangrove forests, so the authors expect the estimated results to be positive and statistically different from 0. Since the area of mangrove forests is expressed in the natural logarithm model[8], the effect of education and access to information in the village on the area of mangrove forests is

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[6] In 2008 the government through BPS conducted the Social Protection Program Data Collection (PPLS), this program aims to update the data of beneficiaries, the data collection is intended so that the recipients of program assistance are not only very poor and poor households, but also include vulnerable poor people.

[7] The average number of people in a family in a village is obtained by dividing the number of residents in a village by the number of families in the village, so that the average number of family members is obtained.

[8] Gujarati (2015) explains in his book that economists are often interested in the percentage change of a variable, such as the percentage change in GDP, wages, the money supply, and the like. For this reason, natural logarithms can be very useful in calculating percentage changes. The uses of using the natural logarithm model are to: avoid the presence of heteroskedasticity; knowing the coefficients that show elasticity; and bring the scale of the data closer together.

represented by percentage changes through the formula 100 ($e^{\beta} - 1$) (Wooldridge et al., 2016). $Control_{it}$ presenting control variables in the village i in year t.

In addition to the variables of interest mentioned above, several control variables are also used from several socio-economic factors that also affect the existence of mangrove forest ecosystems, such as users having open access to resources whose availability and use are not limited by general social structures or formal regulations that can threaten the existence of forest resources (Beck, 2009). Next came the forest near the farmland that was annexed to the farmland and underwent rapid land use changes due to a lack of apparent supervision and delimitation (Savari et al., 2022). In addition, poverty greatly influences the overexploitation and unsustainable use of natural resources, especially in forests and grasslands (Azadi et al., 2013b; Savari et al., 2020b; Vilà-Cabrera et al., 2018b). Unsustainable aquaculture is becoming a threat to natural resources (Ashton, 2008), and also, increasing conversion to agricultural land, human settlements, and other development functions has accelerated forest degradation (Duke et al., 2007). Poor management of conservation, restoration, and exploitation of natural resources has led to a significant annual decline in forest resources (Nikkami et al., 2016). These mangrove ecosystems certainly have economic and ecological benefits for coastal communities and protect them from waves, storms, cyclones, and tsunamis (Gashemi et al., 2011). However, droughts and scorching weather in recent years have made forests and natural resources vulnerable to fires (Guo et al., 2020).

4. Result and Discussion

4.1. The Effect of Education and Access to Information in the Village on the Area of Mangrove Forests

The author conducted the empirical test to see the influence of education and information access in the village on the mangrove forest area by estimating panel regression using data from 2011, 2014, and 2018.[9] As shown in Table 1, the authors took several steps to obtain the specification of the best options in estimating the effect of education and access to information. The author uses a Fixed Effects Model (FEM) estimate from education and access to village information on the area of mangrove forests using equation (1). In each column, the outcome variable uses the logarithm (ln) of the mangrove forest area to calculate the percentage change.

Model estimation (1) to see the correlation between educational variables of interest consisting of 9-year basic education facilities (elementary to junior high school levels) and higher education (high school to college level) to the outcome variable, namely the area of mangrove forests which shows statistically insignificant estimation results for basic education facilities of 9 years (elementary to junior high school levels). Meanwhile, the coefficient of the variable of higher education facilities (high school to college level) is 0,164 and statistically significant at the level of 5%.

[9] Before conducting empirical tests using panel data, it is necessary to do Hausman test for the selection of a method of estimating fixed effects or random effects. The results of the Hausman test show that the use of fixed effects is more appropriate in estimating panel data in this model.

The authors also did the same on model estimates (2) to see the correlation between the variables of interest in access to information consisting of national private TV broadcasts and overseas TV broadcasts to the outcome variables of mangrove forest area, which showed statistically insignificant estimation results for national private TV broadcasts. Meanwhile, the coefficient of the foreign TV broadcast variable is statistically significant at the level of 5%, which is 0,206.

Considering that other factors influence education and access to information from villagers, the author then estimates model (3) by adding control variables from social, economic, and other factors such as the number of residents (men and women), lighting on the main road of the village/kelurahan, infrastructure, land, and water transportation between villages, members of linmas/hansip in villages/kelurahan, residents participating in BPJS Kesehatan PBI and JAMKESDA as proxies for poverty in villages, the existence of marine users as aquaculture, the primary source of income from the agricultural sector, the existence of conservation forests, wave, forest fire, and tsunami disasters. The coefficient of the variables of education and access to the information after adding control variables from social, economic, and other factors shows the coefficient of outcome variables for higher education facilities (high school to college level) of 0,167 and statistically significant at the level of 5%, as well as the variables of foreign TV broadcasts statistically significant at the level of 5%, namely 0,247.

The authors do all the following model estimates by adding year-fixed effects to the regression model. These estimates are performed to capture any variations in results that occur over time and are not associated with other variables of interest. From the results of these estimates, the best estimation model here is model (3), where the variable outcome coefficient shows that there is a positive and statistically significant relationship at the level of 5% for higher education facilities (high school to college level) and foreign TV broadcasts, namely 18,17 % and 28,02%. The overall results seem consistent with empirical evidence that there is a positive relationship between higher education and access to information in the village on mangrove forest areas (Jurin et al., 2010a; Vicente-Molina et al., 2013).

Table 1. The Effect of Education and Access to Information in the Village on Mangrove Forest Area, baseline estimates

Variables	*Outcome Variable*: ln (Mangrove Forest Area)		
	(1)	(2)	(3)
Variable of Interest:			
Basic Education Facilities for 9 Years (Elementary to Junior High School Level)	-0,0007		-0,005
	(0,027)		(0,028)
Higher Education Facilities (High School to College Level)	0,164**		0,167**
	(0,075)		(0,075)
National Private TV Broadcasting		0,020	0,078
(1 if receiving a national private tv broadcast, 0 otherwise)		(0,093)	(0,093)
Overseas TV Broadcasting		0,206**	0,247**
(1 if receiving overseas tv		(0,101)	(0,103)

Variables	*Outcome Variable*: ln (Mangrove Forest Area)		
	(1)	(2)	(3)
broadcasts, 0 otherwise)			
Control Variables:			
Total Population (Male and Female)			0,003
			(0,002)
Lighting on the Main Road of the Village/Kelurahan			0,139*
(1 if there is lighting on the road, 0 otherwise)			(0,082)
Infrastructure and Facilities for Land & Water Transportation			0,053
between Villages			
(1 if there is land & water infrastructure, 0 otherwise)			(0,105)
Linmas/Hansip Members in Villages/Kelurahan			0,008
			(0,007)
Residents participating in BPJS Kesehatan PBI and			0,002
JAMKESDA			(0,004)
The Existence of Marine Utilization as Aquaculture			0,111
(1 if there is aquaculture, 0 otherwise)			(0,099)
The Main Sources of Income from Agriculture			0,029
(1 if the villagers earn from the agricultural sector, 0 otherwise)			(0,188)
The Existence of Conservation Forests			0,124
(1 if the forest functions as conservation, 0 otherwise)			(0,092)
Tidal Wave Events/Disasters			0,378***
(1 in case of tidal waves, 0 otherwise)			(0,117)
Forest and Land Fire Events/Disasters			0,103
(1 if there is a forest fire, 0 otherwise)			(0,167)
Tsunami Events/Disasters			-0,223
(1 in case of a tsunami, 0 otherwise)			(0,173)
Observation	6.016	6.500	6.016
Adj R-Squared	0,017	0,016	0,024
Village	2.490	2.548	2.490

Note: ***, **, * indicate statistically significant levels at 1%, 5%, and 10%, respectively. Robust standard errors are in parentheses.

This finding shows a consistent positive correlation for villages with higher education facilities (high school to college) affecting the preservation of mangrove forests, where these higher education facilities can describe the level of education of the village. It can be concluded that higher education in the village, on average, has a positive effect on the area of mangrove forests. This is because villagers who have studied higher education value the existence of natural resources higher than villagers who only take basic education (Jadin & Rousseau, 2022). The same thing is shown by overseas TV broadcasts, where the correlation is also positive and consistent, where the foreign TV broadcasts can describe access to foreign information from the village. So we can conclude that the wider the information obtained by the villagers, the average positive effect on the area of mangrove forests (Jadin & Rousseau, 2022).

4.2. Robustness Check

To test the consistency of the unbalanced panel estimation results from this study sample, the authors conducted the first robustness check test by estimating the balanced panel, as shown in column (2) in table 2 below. In addition, in the PODES data, several villages do not have health insurance assistance program recipients, so the outcome variable is worth 0 (zero). To anticipate data administration problems, considering that several villages do not have recipients of the health insurance assistance program, to be able to test the consistency of the estimation results from equation (1). As another robustness check, authors tried to make estimates by not making the village i in the year t as a sample in the calculation when the value of the recipients of the health insurance program assistance in The village in i the year t is valued at 0 (zero) as shown in column (3). This is done so that the model can better capture the downward trend in the number of beneficiaries of health insurance programs.

From table 2, we can compare the estimation results from robustness checks that use unbalanced panel data, such as column (1), and those that use balanced panel data, such as column (2), then use a sample of villages whose beneficiaries are 0 (zero) such as column (3). The estimation results show that the coefficient value of the higher education facilities variable (high school to college level) is 0,155 for column (2) and 0,172 for column (3) and is significant at the level of 1%. Similarly, the overseas TV broadcast variable coefficient value of 0,264 is statistically significant at the level of 5% in column (2), and 0,221 is statistically significant at the level of 1%.

This shows consistent results that, on average, there is a positive relationship between higher education and access to foreign information from villagers in the area of mangrove forests in Indonesia.

Table 2. Robustness Check the Effect of Education and Access to Information in the Village on Mangrove Forest Area: Dropping Observations

Variables	Outcome Variable: ln (Mangrove Area)		
	Basic Model (unbalance)	Basic Model (Balance)	A sample of the villages that beneficiaries numbered 0
	(1)	(2)	(3)
Basic Education Facilities for 9 Years (Elementary to Junior High School Level)	-0,005	-0,003	0,009
	(0,028)	(0,031)	(0,038)
Higher Education Facilities (High School to College Level)	0,167**	0,155*	0,172*
	(0,075)	(0,083)	(0,089)
National Private TV Broadcasting (1 if receiving a national private tv broadcast, 0 otherwise)	0,078	0,170	0,069
	(0,093)	(0,106)	(0,119)
Overseas TV Broadcasting (1 if receiving overseas tv broadcasts, 0 otherwise)	0,247**	0,264**	0,221*
	(0,103)	(0,110)	(0,124)
Observation	6.016	4.687	5.051
Adj R-Squared	0,024	0,029	0,028
Village	2.490	1.664	2.426

Note: ***, **, * indicate statistically significant levels at 1%, 5%, and 10%, respectively. Robust standard errors are in parentheses. All specifications using secondary mangrove data are added to the same control variables as the last column in table 4.1.

5. Conclusion and Recommendation

The results showed that villages with higher education and broad global access to information are more concerned about mangrove forest resources. The findings show that villages that have higher education facilities (high school to tertiary level) and get foreign TV broadcasts are positively correlated by 18,17% and 28,02% and are statistically significant at the level of 5% to the area of mangrove forests. Thus, these findings support previous studies on the positive impacts of higher education and global access to information in villages in the mangrove forest area.

Thus, these findings support previous studies on the positive impact of higher education and global access to information in villages in the mangrove forest area. This shows that mangrove forests have more social and economic benefits for villages located around/forest areas.

The higher education and the broader access to information globally in the village, the more knowledge and concern the villagers have about the importance of mangrove forests. The government needs to take policy steps towards developing higher education facilities and expand the information network globally as a source of knowledge for the younger generation and residents in villages. In addition, it is necessary to conduct counseling and training for villagers to add insight into the importance of the existence of mangrove forests, especially in supporting their long-term and sustainable lives.

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