Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.8, No.20, 2018

The Influence of Deforestation on Vector Borne Disease in Siak Regency

Suwondo[1*] Riyadi Mustofa[2] Riati[2] Darmadi[1]
1.Lecturer at the Faculty of Teacher Training and Education, University of Riau,
Campus Binawidya KM.12,5 Simpang Baru, Tampan, Pekanbaru, Riau, 28296
2.Lecturer at STIE Persada Bunda, Diponegoro Street Number 42,
Suka Mulia, Sail, Pekanbaru, Riau, 28116

Abstract
This research aimsto know the relationship between deforestation and the spread of vector borne disease in Siak Regency, Riau Province. The purposive sampling was carried out that each selected area contained the samples representingthe smallholders ofoil palm plantations using*PIR*, *KKPA*, and self-helpaspects.Whilst, the implementation of this research took 6(six) months or 180days(March-August 2018)including reporting.This research usedboth primary and secondary data.The primary data were obtained by interviewing the communities around the oil palm plantationsand the farmers using questionnaires, while the secondary data were gained from various relevant agencies and data supply agencies.The results of this present researchare:(1)statistically the primary forest area variable has a significant influence at the level of 10 percent on the vector borne disease incidence (DHF incidence); (2)the plantation area variable has a significant influence at the level of 10 percent on the DHF incidence;(3)the health facilities variable has a significant influenceat the level of 10 percent on the incidence of DHF; and (4)the Clean and Healthy Life Behavior (CHLB) variable has a significant influence at the level of 10 percent on the incidence of DHF.
Keywords: Deforestation,Vector Borne Disease, Forest Area, Plantation Area, Health Facilities, CHLB, DHF

1. Introduction

Morphology of Siak Regency mostly consists of lowlands in the north, east and those extend from northwest to southeast, while the rest consists of highlands in the southwest part of the Siak watershed.In general, the soil structure consists of red yellow podzolic soils from rocks, alluvial and organosoland gley humus in the form of swamps or wet soils.Siak Regency is a wetland area and is very vulnerable to land fires in the dry season. Therefore, Siak Regency is also one of the hot spots in Indonesia becausethere are always land fires occur every dry season.

The soil structure in this regency generally is a relatively hard soil layer which is located on a thick layer of soft soil. It can be described as follows: On the surface of subgradeswith the depth ranging from 5 to 8 meters, there are relatively hard soils with conus tip resistance (qc) on the sondirranging from 20 to 50 kg/cm2. Meanwhile, at a depth of 8 to 15-20 meters there is a soft soil layer with a small qc of 20 kg/cm2. New hard soil layer can be found at a depth of 25 to 40 meters from the top soil.

The purpose of this research is to know the relationship between deforestation and the spread of vector borne disease in Siak Regency, Riau Province.The expected outcome of this research isto obtain information on the impact of deforestation onvector borne diseasein Siak Regency which includes: theavailability of information regarding deforestation occurrence and vector borne disease and the availability of information regarding the relationship between deforestation and vector borne disease.

2. Literature Review

2.1Deforestation

According to the Regulation of the Ministry of Forestry (2009), deforestation is a permanent change from forested areas to non-forested areas caused by human activities.Deforestation is a logging of forest or stand of treesto utilize lands fornon-forest uses,namely agriculture, livestock or urban areas.The term deforestation is often misinterpreted to describe logging activities where all the trees in an area are cleared.However, in temperate mesic climate,logging all the trees in accordance with the steps of sustainable forestry implementation precisely is referred to as the 'harvest regeneration'. In these areas, natural regeneration by forest stands will usually not occur without interference, both naturally and humanly.

2.2Vector Borne Disease

Infectious vector-borne diseases, such as malaria, dengue fever, yellow fever, and epidemics, cause most infectious diseases globally.Indeed, nearly half of the world's population is infected with at least one type of vector-carried pathogen.Plants and vector-borne diseases, including several newly recognized pathogens, reduce agricultural productivity and disrupt ecosystems around the world.Such diseases severely limits socioeconomic status and development in countries with the highest infection rates, many of which are in tropical and

subtropical regions.

2.3 Environment

Environment is anything outside of the host whether inanimate objects, living creatures, real or abstract, as an atmosphere formed by the interaction of all elements including other hosts.The environment consists of physical and non-physical. Physical environment consists ofgeographical state(high or lowlands, farmlands, etc.), humidity, temperature, and neighborhood.The non-physical environment includessocial (education, employment), culture (customs, hereditary habits), economics (micro and local policies) and politics (leadership succession that influences the policies of prevention and control of a disease).

3. Research Method

3.1Location and Time of the Research

Thisresearch took place in Siak Regency, Riau Province.It was chosen because the area of oil palm plantations in Siak Regency in the last five years has increased. Besides,morphology of Siak Regency also consists of lands and coasts containing wetlands.Furthermore, various government programs in plantation development have been carried out and entered the replanting period.

The samples were taken from the community in the selected sub-districts through purposive sampling. Thus, each selected area contained samples representing oil palm plantation smallholderswho used *PIR(Perkebunan Inti Rakyat)* or the core estate and smallholder, *KKPA* (*KredituntukKoperasi Primer untukAnggotanya*) or the primary cooperative credit for members, and self-help systems. In addition, the implementation of this research took 6(six) months/180days(March-August 2018)including reporting.

3.2Types and Sources of Data

This researchrequired primary data and secondary data.The primary data were obtained by interviewing the communities around the plantations and the oil palm smallholders by using questionnaires, whereas the secondary data were collected from various relevant agencies and data supply agencies.

3.3Operational Definitions

Here are operational definitions of the research variables:

- Vector Borne Disease (DHF) Incidence (Y). Vector Borne Disease is any type of diseases that is transmitted through vectors or intermediaries. Vector Borne Disease in this research is the incidence of dengue cases caused by *AedesAegypti* or *AedesAlbopictus* mosquitoes. The number of incidence of DHF was seen for 6 years, from 2012-2017.
- Primary forests (X1). Primary forests are forests that have reached old age and have certain structural characteristics that are in accordance with their maturity, and have unique ecological properties. The definition of primary forests in this research is a forest group which includes primary mangrove forest, primary swamp forest and primary dryland forest.
- Plantation (X2). Plantation is all activities that cultivate certain plants on soil and/or other growing media in suitable ecosystems; process, and market the products and services of the crops with the help of science and technology, capital and management to realize the welfare of plantation businessmen and the community. The plants are not staple food or vegetables to differentiate them from farming and horticulture and flower business, although fruit tree planting is still called a plantation business. The plants are generally large with a relatively long planting time in less than one year or annual planting. In this research, the intended plantations are smallholder oil palm plantations.
- Health facilities (X3). Health facilities are infrastructure provided by the government. Health facilities are one of the factors determining the level of public health. The existing health facilities seen in this research are primary health facilities located in the middle of the community's residence. The intended health facilities are*Puskesmas* or Public Health Center, *PuskesmasPembantu* or the Public Health Sub-Center,*Polindes* or the Village Maternity House, and *Posyandu* or the Integrated Services Center.
- Clean and Healthy Life Behavior(CHLB) (X4). Clean and Healthy Life Behavior are all health behavior carried out by the community on their own awareness that each family can help themselves in the health sector and play an active role in health activities in the community. Healthy Households are households that carry out 10 CHLB indicators, namely: (1) childbirth is assisted by health workers; (2) giving exclusive breastfeeding to babies; (3) weighing infants and toddlers; (4) using clean water (5) washing hands with clean water and soap; (6) using healthylatrines; (7) eradicating mosquito larvae at home; (8) eating fruits and vegetables every day; (9) doing physical activities every day; and (10) not smoking inside the house.

3.4Data Analysis Techniques

This researchemployed a modeling approach to see disease incidence data against changes in forest cover and

land use over the past ten years obtained from the Ministry of Environment and Forestry land cover maps.

Table 1.Variables, Symbols in Models, Units and Sources of Data

No.	Variables	Symbols	Units	Sources
1	Incidence of Vector Borne Disease (DHF)	**Y**	Incidence per 100,000 population	The Health Offices of Riau Province and Siak Regency (2008, 2012 and 2017)
2	Primary Forests	**X1**	Ha	Ministry of Environment and Forestry
3	Plantations	**X2**	Ha	Ministry of Environment and Forestry
4	Health facilities	**X3**	% per 100,000 population	The Health Offices of Riau Province and Siak Regency (2008, 2012 and 2017)
5	Clean and Healthy Life Behavior	**X4**	% population	The Health Offices of Riau Province and Siak Regency (2008, 2012 and 2017)

Table 1 shows that data analysis is a multiple linear regression model.Regression is done to explain the relationship between response variable Y(DHF) and the factors that influence X, namely primary forests, secondary forests, plantation forests, plantations, others, health facilities, healthy clean life behavior, healthy homes, density, and percent of poor population

The following is the first multiple linear regression equation:

$$Y = a + ß1_{X1} + ß2_{X2} + ß3_{X3} + ß_{4X3} + ß_{5X5} + ß_{6X6} + ß_{7X7} + ß_{8X8} + ß_{9X9} + ß_{10}X_{10} + ei$$

3.4.1Classical Assumption Test

Classical assumption test is a statistical requirement that must be met in multiple linear regression analysis based on Ordinary Least Square (OLS) or with the least squares system. To get a good model, it must meet the BLUE (Best Linear Unbiased Estimator)criteria and not violate the classical assumptions. The classical assumption test used are normality, multicollinearity, heteroskedasticitytest, autocorrelation test, and linearity test which are described as follows:

- Normality Test

Estimating equationusing multiple regression model must satisfy normality, because if it is not normal it can cause infinitive variance (infinite variety or very large variety). The results of the estimation that has an infinitive variant result inmeaningless predicted values. The purpose of normality testing is to test whether confounding variable has a normal distribution or not. One model used to test the normality is *Shapiro Wilktest* as follows (Thomas, 1997; Verbeek et al., 2000):

$$W = \frac{\left[\sum_{i}^{h} a_n \left(\tilde{e}_{(v-1+1)} - \tilde{e}_{(i)}\right)\right]^2}{\sum_{i=1}^{h} (\tilde{e}_i - \bar{\tilde{e}})^2}$$

v = T – K

h = n/n/2 for even numbers or (n-1) for odd numbers

where:

v = degree of freedom

T = number of observations

K = number of variables

a_{in}= parameter of *Shapiro-Wilk* statistics

- Multicollinearity Test

Multicollinearity test is used to determine whether there is a correlation between independent variables in the regression model.When multicollinearity occurs in the regression model it means that there is a perfect relationship between several independent variables indicating multicollinearity.Detectingmulticollinearity in a modelis done by looking at Variance Inflation Factor (VIF) with the equation VIF = 1/ tolerance.If the VIF value <10, it can be said that there is no perfect multicollinearity in the regression model (Widarjono, 2009).

- Autocorrelation Test

Autocorrelation is defined as the correlation between members of a series of observations sorted by time or space (Gujarati, 2003). The classical model assumes that elements of disturbance associated with observation are not influenced by elements of disturbance or interference related to other observations. To detect the presence of autocorrelation (serial correlation), the Durbin Watson (DW) test can be done. Where DW approaches 2, there is no autocorrelation problem.

- Heteroskedasticity Test

Heteroskedasticity is a condition where variant of the confounding variable is not constant for all observations. If heteroskedasticityoccurs in OLS usage, OLS estimation is no longer efficient in both large samples and small samples, and the t-test will lead to wrong conclusions (Widarjono, 2009).

Furthermore,Widarjono (2009) describes a regression model with heteroskedasticitycontaining serious consequences on OLS model estimator because it is no longer BLUE. To find out whether there is

heteroskedasticityor not, the White test can be administered. Manually, this test is done by regressing the squared residual (e^2) with the independent variables. The next step is getting the R2 value to calculate X2, where X2 = n*R2. The criterion used is if X2 table <Obs*R-squared value, the null hypothesis which states that no heteroskedasticity in the model can be rejected.

- F test, Coefficient of Determination (R^2)and Individual test (t test)

F test is used to determine the real level and variation of the independent variable on the dependent variable by comparing F critical value ($F_{table)}$with the F ratio ($F_{calculate}$) contained in the Analysis of Variance (ANOVA) table from the calculation results. If $F_{calculate}$> $F_{table,}$ the variation of the independent variable (X) is significantly different in explaining the dependent variable (Y), and vice versa. If $F_{calculate}$<$F_{table,}$ it means that it is not significantly different. To seek $F_{calculate}$, the following formula can be used (Alfigari, 2000).

$$F = \frac{R^2/(K-1)}{(1-R^2)/(n-K)}$$

Furthermore, to measure how large a proportion of the dependent variable variation explained by all the independent variables, itcan be analyzed through the coefficient of determination ($R^{2)}$.The equation of determination can be seen as follows (Widarjono, 2009).

$$R^2 = \frac{\sum(\hat{Y}_i - \bar{Y})^2}{\sum(\hat{Y}_i - \bar{Y})^2}$$

The value of coefficient of determination lies between zero and one.If the coefficient of determination (R^2) is small, it means that the independent variables are only able to explain the variation of the dependent variable in a limited manner.Conversely, if the value is close to one it means that independent variables are able to explain all the information needed to predict the variation of the dependent variable (Widarjono, 2009).

The fundamental weakness in the use of the coefficient of determination is the bias on the number of independent variables included in the model.Every additional one independent variable, the R^2 value also increases regardless of whether the variables significantly influence the dependent variable. Therefore researchers are encouraged to use adjusted R^2 when evaluating the best regression model (goodness-of fit) where both models have the same dependent variable. The model chosen is a model that has a higher R^2 than other models.

According to Ghozali (2005), t test is basically to show how far the influence of an independent variable individually in explaining the variation of the dependent variable. The t test aims to find out whether the regression coefficient is significant or not or to know which independent variables (X) have significant influence on the independent variable (Y) partially.

To prove the hypothesis, an analysis is carried out at a 95% confidence level. To find out what factors influence the palm oil productionthrough self-help based on the land typology in Indragiri Hilir Regency, t testis done. If the t_{table}>$t_{calculate,}$ then H_0 is rejected and $H_1$is accepted until the tolerance level *of significance* (α) of 20%.

4. Result and Discussion

4.1Deforestation in Siak Regency

The development of plantations, especially oil palm, is certainly very dependent on the availability of lands as a place for farming.At present, the availability of lands for agriculture isvery limited, thusextensification is difficult because it has to transfer the function of forests to plantations.As a consequence, land cover in the form of forest is decreasing due to the use for various needs by the community.Threats to the dangers of degradation and deforestation, hence, continue to be a concern by the community and the government.

Table 2. Development of Forest Areas in Siak Regency

Year	Area (ha)			
	Primary Forests	Secondary Forests	Plantations	Total
2012	11,881.07	121,082.13	122,357.65	255,320.85
2013	12,879.08	131,253.03	132,635.69	276,767.80
2014	13,960.92	142,278.28	143,777.09	300,016.29
2015	13,960.92	142,278.28	143,777.09	300,016.29
2016	12,788.21	130,326.91	131,699.81	274,814.93
2017	11,714.00	119,379.45	120,637.03	251,730.47

Source: land cover map from the Ministry of Environment and Forestry, processed in 2018

4.2 Identities of Respondents

Table 3shows the respondents, the oil palm smallholders,using the self-help patternbased on the peat, coastal, and mainland typologyare in the Sub-districts of Siak, Mempura, Sungai Apit, Minas and Tualang.Meanwhile, the respondents using *KKPA*pattern based on the peat and mainland typology are in Koto Gasib Sub-

district.Furthermore, the respondents using the Plasma patternbased on the mainland typology are inKerinciKanan and LubukDalam Sub-districts.

Table 3. Distribution of the Palm Oil Smallholder Respondents in Siak Regency

No.	Sub-district	Land Typology	Development Pattern	Number of Respondents	Percentage
1	Siak	Peat	Self-help	5	5.56
2	Mempura	Peat	Self-help	3	3.33
3	Sungai Apit	Coastal	Self-help	12	13.33
4	Minas	Mainland	Self-help	29	32.22
5	Tualang	Mainland	Self-help	13	14.44
6	Koto Gasib	Mainland, Peat	KKPA	9	10.00
7	KerinciKanan	Mainland	Plasma	14	15.56
8	LubukDalam	Mainland	Plasma	5	5.56
total				**90**	**100.00**

Source: 2018 Primary Data, processed

The number of respondents who are Diploma graduates, junior high school graduates, anduniversity graduates are relatively balanced.This shows that the respondents also have other jobs or other businesses besides being oil palm farmers.

Table 4.Identities of the Respondents in Siak Regency

Identities of the Respondents	Number of Respondents	Percentage
a. Gender		
- Male	44	48.89
- Female	46	51.11
Total	90	100.00
Age (Year)		
- Minimum	16	
- Maximum	70	
- Mean	38	
b. Religion		
- Islam	83	92.22
- Christian	7	7.78
Total	90	100.00
c. Level of Education		
- Junior high school graduates	16	17.78
- Senior high school graduates	18	20.00
- Diploma graduates	39	43.33
- University graduates	17	18.89
Total	90	100.00
d. Tribe/Ethnic Group		
- Malay	41	45.56
- Minang	9	10.00
- Javanese	32	35.56
- Batak	8	8.89
Total	90	100.00
e. Length of Stay		
- Minimum	1	
- Maximum	70	
- Mean	16.8	
- Modus	10	

Source: 2018 Primary Data, processed

The majority of respondents are migrants from the area around Siak Regency and from outside the regency even the province. They consisted of migrants who followed transmigration program, migrated and followed or were invited by relatives who first occupied and got a job.Therefore, the population who farms in the plantation sector is dominated by migrants compared to the local population.

Table 5. Respondent Employment Distribution in Siak Regency

No.	Jobs	Respondents	Percentage
1	Civil Servants	7	7.78
2	Private employees	5	5.56
3	Farmers	28	31.11
4	Farm workers	13	14.44
5	Merchants	2	2.22
6	Entrepreneurs	24	26.67
7	Others	11	12.22
Total		90	100.00

Source: 2018 Primary Data, processed

Table 6. Status and Families of Palm Oil Smallholders in Siak Regency

Status of Respondents	Total	Percentage
a.Marital Status		
- Married	83	92.22
- Single	7	7.78
Total	90	100.00
b.Family Coverage		
- 1 child and family	21	23.33
- 2 children and family	45	50.00
- 3 children and family	17	18.89
- Bringing family at home	7	7.78

Source: 2018 Primary Data, processed

The majority of respondents were found in surrounding *Puskesmas* undergoing treatment or taking their families to seek treatment.Other respondents were found in the Health Office and other places deliberately during the field survey in the areas that used to be forests.

Table 7. Areas of Respondents' Residence (m^2)

Description	Plantation Owners	Non Plantation Owner
- Minimum	36	36
- Maximum	200	150
- Mean	85	78
- Mode	80	120

Source: 2018 Primary Data, processed

4.3 Health Facilities

Health facilities are infrastructure provided by the government.Health facilities are one of the factors determining the level of public health.The existing health facilities seen in this research are primary health facilities located in the middle of the community residence.

Table 8. Number of Health Facilities in Siak Regency

No.	Health Facilities	Year					
		2012	2013	2014	2015	2016	2017
1	*Puskesmas*	8	9	14	14	15	15
2	*PuskesmasPembantu*	75	78	90	94	94	94
3	*Polindes*	94	102	103	103	103	103
4	*Posyandu*	363	364	367	384	392	400

Source: 2018 Primary Data, processed

4.4 Clean and Healthy Life Behavior

Clean and Healthy Life Behavior (CHLB) are all health behavior carried out by community based on their own awareness that makes each family can help themselves in the health sector and play an active role in health activities in their community.

Table 9. Clean and Healthy Life Behavior in Siak Regency

No	Sub-District	*Puskesmas*	% Clean and Healthy Life Behavior					
			2012	2013	2014	2015	2016	2017
1	Siak	1. Siak	53.37	54.01	51.57	63.47	63.47	63.47
2	Sungai Apit	2. Sungai Apit	76.12	74.99	70.61	42.3	42.3	42.3
3	Minas	3. Minas	54.89	54.89	50.44	79.25	79.25	79.25
4	Tualang	4. Perawang	55.14	54.89	83.43	79.72	79.72	79.72
		5. Tualang	92.34	54.89	83.43	77.47	77.47	77.47
5	Sungai Mandau	6. Sungai Mandau	50.75	62.44	62.91	52.08	52.08	52.08
6	Dayun	7. Dayun	84.92	51.27	13.23	82.08	82.08	82.08
7	KerinciKanan	8. Kerinci	5.24	6.35	6.35	50.62	50.62	50.62
8	Bunga Raya	9. Bungaraya	10.67	38.61	61.06	33.94	33.94	33.94
9	Koto Gasib	10. Koto Gasib	28.2	49.61	79.5	42.26	42.26	42.26
10	Kandis	11. Kandis	43.67	43.67	66.06	42.44	42.44	42.44
11	LubukDalam	12. LubukDalam	49.61	49.58	50.46	80.83	80.83	80.83
12	SabakAuh	13. SabakAuh	89.48	24.92	27.41	37.73	37.73	37.73
13	Mempura	14. Mempura	82.06	52.35	32.43	56.6	56.6	56.6
14	Pusako	15. Pusako	19.4	10.92	45.88	65.77	65.77	65.77
Siak Regency			**54.81**	**51.32**	**59.88**	**55.33**	**54.93**	**54.78**

Source: 2018 Primary Data, processed

4.5 Healthy Homes

Healthy Home is also an identity for its inhabitants that describes physical, spiritual and socio-cultural conditions.The better the condition of the house in terms of cleanliness, beauty, and environmental management, the better is the physical health condition and mental health of the residents.Therefore, a healthy home is desired by every human being to live a social life.

Table10. Percentage of Healthy Homes in Siak District in 2018

No	Sub-District	*Puskesmas*	% Healthy Homes					
			2012	2013	2014	2015	2016	2017
1	Siak	1. Siak	13.75	8.34	4.12	5.72	87.27	75
2	Sungai Apit	2. Sungai Apit	52.44	31.35	39.5	41.66	72.1	75.79
3	Minas	3. Minas	67.71	37.94	26.6	28.76	84.25	90.48
4	Tualang	4. Perawang	62	18.9	49.34	50.7	64.93	1.80
		5. Tualang	52.27	13.02	25.22	26.49	62.93	61.04
5	Sungai Mandau	6. Sungai Mandau	45.96	13.31	39.38	41.68	40.24	23.47
6	Dayun	7. Dayun	40.98	29.27	25.84	27.24	44.9	5.23
7	KerinciKanan	8. Kerinci	57.4	22.95	16.07	19.52	27.44	53.91
8	Bunga Raya	9. Bungaraya	32.68	4.68	4.62	7.08	17.61	8.73
9	Koto Gasib	10. Koto Gasib	49.94	25.75	24.43	26.26	43.41	6.20
10	Kandis	11. Kandis	76.73	8.88	9.46	10.15	29.18	84.23
11	LubukDalam	12. LubukDalam	57.96	22.63	55.04	59.83	67.87	84.68
12	SabakAuh	13. SabakAuh	36.72	7.15	7.89	9.77	48.56	27.12
13	Mempura	14. Mempura	53.63	8.05	9.56	11.28	18.66	52.1
14	Pusako	15. Pusako	38.23	9.11	15.42	17.27	30.78	60.22
Siak Regency			**51.87**	**17.81**	**25.48**	**27.24**	**81.29**	**35.09**

Source: 2018 Secondary Data

4.6 Density

Population density is the ratio of population to a land area.In general, the level of population density is the ratio of the number of population to the land area based on certain unit of area.The population density in Siak Regency is shown in Table 11 as follows.

Table11. Population Density in Siak Regency

Density	2017	2016	2015	2014	2013	2012
Siak	57.5	55.9	50.4	45.6	42.3	40.9

4.7 Percentage of the Poor Population

The poor are residents who have an average per capita expenditure below the poverty line.The percentage of

poor people in Siak Regency is shown in Table 12.

Table12. Percentage of the Poor Population in Siak Regency

Poor Population	2017	2016	2015	2014	2013	2012
Percentage	5.8	5.52	5.49	5.54	5.17	5.29

4.8 Dengue Hemorrhagic Fever (DHF)

With the rampant illegal logging, barren forests can have an impact on the environment, especially on human survival, such as ecological disasters or shocks. As a matter of fact, deforestation releases large amounts of greenhouse gases (GHG), thus contributes to dangerous climate change. Whereas, tropical forests work like sponges that can absorb carbon dioxide produced from burning fossil fuels as an energy source (Greenpeace, 2008).

Table13. Dengue Hemorrhagic Fever in Siak Regency

No	Sub-District	*Puskesmas*	2017	2016	2015	2014	2013	2012
1	Siak	1. Siak	7	84	17	50	10	12
2	Sungai Apit	2. Sungai Apit	5	57	68	6	6	1
3	Minas	3. Minas	5	18	23	34	5	16
4	Tualang	4. Perawang	63	88	40	84	43	51
		5. Tualang	9	31	12	25	7	13
5	Sungai Mandau	6. Sungai Mandau	0	0	0	7	0	0
6	Dayun	7. Dayun	4	50	22	67	5	7
7	KerinciKanan	8. Kerinci	1	18	19	12	4	10
8	Bunga Raya	9. Bungaraya	2	6	1	36	0	0
9	Koto Gasib	10. Koto Gasib	1	10	3	9	3	4
10	Kandis	11. Kandis	5	30	19	27	37	16
11	LubukDalam	12. LubukDalam	1	8	11	10	7	21
12	SabakAuh	13. SabakAuh	8	84	38	26	2	0
13	Mempura	14. Mempura	1	17	3	12	5	9
14	Pusako	15. Pusako	2	1	3	2	0	1
Siak Regency			114	502	279	407	134	161

Source: 2012-2017 Secondary Data

4.9 Analysis of the Influence of Deforestation and Vector Borne Disease in SiakRegency

This research focused on the influence of deforestation and vector borne disease inSiakRegency by using multiple linear regression analysis.The dependent variable was vector borne disease (DHF incidence) with 10 independent variables consisting of: primary forest area, secondary forest area, planted forest area, plantation area, other land area, number of health facilities, CHLB percentage, healthy homes percentage, population density and percentage of poor population.

4.9.1 Model Performance

The data processed with the help of a computer program SPSS Version 22 obtained the Coefficient of Determination *(R square)* of 0.997. It showed that 99.7% variation of Vector Borne Disease Incidence (DHF incidence) could be explained by the variables of primary forest area, planted area, health facilities, and CHLB while the rest 0.3 percent was influenced by other variables excluded in the model. This variation was significant at 1% significance level seen from F-calculate of 79.649 and probability <0.084. These results indicated that the model coefficientwas statistically significant at 10% level. In other words, the model can be used for prediction.

4.9.2Classical Assumption Test

This test was used to ensure that in thisresearch there was no deviation from classical assumptions such as residual normality, multicollinearity, heteroskedasticity, and autocorrelation.Thus prior data processing in the multiple linear regression analysis, the first classical assumption was done.

4.9.3 Residual Normality

To find out whether a variable had a normal distribution or not, a residual normality test was conducted.The results of the residual normality test using the One Sample Kolmogorov-Smirnov method obtained a significance value (Asymp.Sig 2-tailed) of 0.183.The significance value was greater than 0.05, thus it was declared that the residual was normally distributed.

- Multicollinearity Test

VIF values for primary forest area variable was 3.309, for plantation area was2.881, for health facilities was 1.516, and for CHLB was 1.504 Based on the results, the VIF values for all independent variables were less than 10. In other words, there was no multicollinearity in the model built.

- Heteroskedasticity Test

The results showed that the significance values for the primary forest area variable was 0.661; for the plantation area was 0.634;for health facilities was 0.909;and for PHBS was 0.741.Of the four independent variables, their significance values were greater than 0.05 indicating that the regression model had no heteroskedasticityissue.

- Autocorrelation Test

TheDurbin-Watson(DW) value in the model was 2.811.Based on the distribution table of DW, the DW value was unknown for 6 times of observations and for 4 independent variables.Since this research model used four independent variables with 6 times of observations. Then the autocorrelation could not be explained.

4.10 Dominant Factors InfluencingVector Borne Disease Incidence (DHFincidence)

DHF is a disease that can cause death.The disease is caused by *Aedesaegypti*and *Ae.Albopictus*mosquitosbites. The mosquito reproduction can increase the incidence of dengue.To overcome the reproduction of*Aedesaegypti*and *Ae.Albopictus*,it is necessary to determine the factors causing the increase of DHF incidence. The factors associated with the incidence of DHF into the analysis model in this research included: primary forest area, plantation area, health facilities and CHLB.To know the factors that influencedVector Borne Disease Incidence (DHFincidence),the data were processed using the SPSS Version 22 computer program. The results of data processing can be observed in the following table.

Table14.Estimates of Dominant Factor Models Influencing DHF Incidence

Description	Parameter	t calculate	Sig
Constants	10901.398	8.666	0.073
Primary Forest Area (X1)	192.568	15.548	0.041
Plantation Area (X2)	-568.230	-7.970	0.079
Health Facilities (X3)	-2.451	- 0.445	0.097
CHLB (X4)	-53.540	-13.380	0.047

Based on Table 14, the multiple linear regression equation can be made as follows:

Y = 10901.398 + 192.568 X1 – 192.567 X2 – 2.451 X3 – 53.540 X4

Based on the results of calculations by using SPSS V 22 computer program as seen in Table 14, they show the variables of primary forest area, plantation area, health facilities and CHLB havestatistically significantinfluence onVector Borne Disease Incidence(DHFincidence).

- Primary Forest Area

From the calculation results of the primary forest area variable (X1), the $t_{calculate}$value is 15.548 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.041, indicating that α> significance value.

- Plantation Area

The calculation results of the plantation area variable (X2) show that the obtained $t_{calculate}$value is -7.970 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.079, indicating that α> significance value.

- Health Facilities

From the results of the calculation regarding health facility variable, (X3) the $t_{calculate}$value obtained is -0.445 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.097, showing that α> significance value.

- Clean and Healthy Life Behavior (CHLB)

On the basis of the calculation results of CHLB (X4),the obtained $t_{calculate}$value is -13.380 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.047, meaning that α> significance value.

5. Conclusions and Recommendations

5.1 Conclusions

Based on the results of the research, the following conclusions are drawn:

- $t_{calculate}$is 15.548 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.041, this indicates α> significance value. Thus, statistically the primary forest area variable has a significant influence at the level of 10 percent on the vector borne disease incidence (DHF incidence). The regression coefficient for primary forest area is 192.568 indicating that the wider the primary forest, the higher is the DHF incidence.
- Based on the calculation results of the plantation area variable (X2),the obtained $t_{calculate}$value is -7.970 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.079, showing that α> significance value. Thus the plantation area variable has a significant influence at the level of 10 percent on the DHF incidence.
- The calculation results of the health facility variable (X3) also show that the obtained $t_{calculate}$value is -0.445 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.097, indicating that α> significance value. It can be said that the health facilities variable has significant influence at the level of 10 percent on the DHF incidence.

- From the calculation results of the Clean and Healthy Life Behavior (X4),the obtained $t_{calculate}$value is -13.380 with a confidence level of 90 percent (α = 0.10) and a significance value = 0.047, meaning that α> significance value. It can be summarized that CHLF variable has a significant influence at the level of 10 percent on the DHF incidence.

5.2 Suggestions

Here are several suggestions given from this research:

- The need for policy making by the government to reduce deforestation rates, especially those related to deforestation of primary forests and plantations.
- The need for additional health facilities, especially in remote areas in Siak Regency
- Carbon biomass stock in Siak Regency is a wealth of natural resources, therefore it is necessary to do regulation in its utilization in an effort to preserve nature in a social, economic and environmental manner.

References

Afifuddin, Sya'ad, (2007), *Analisis Struktur Pasar CPO: Pengaruhnya Terhadap Pengembangan Ekonomi Wilayah Sumatera Utara*, *Jurnal Perencanaan & Pengembangan Wilayah - Wahana Hijau*, Vol.2, No.3, April 2007.

Kiefer, and FAO,(1976). *Aframeworkfor land evaluation FAO Soil Bull*. No. 32, Rome, 72 pp; and ILRI Publication No. 22, Waginengen, 87 pp.

Manurung, E.G.T. *Mengapa Konversi Hutan Alam Harus Dihentikan? Makalah disampaikan pada acara Seri Lokakarya Kebijakan Kehutanan, Topik 1: "Moratorium Konversi Hutan Alam dan Penutupan Industri Pengolahan Kayu Sarat Hutang*." Diselenggarakan oleh Departemen Kehutanan dan Perkebunan bekerja sama dengan Natural Resources Management Program. Jakarta, 8-9 Agustus 2000.

Syahza, A. (2011). *Percepatan Ekonomi Pedesaan Melalui Pembangunan Perkebunan Kelapa Sawit*. Jurnal Ekonomi Pembangunan 12 (2) :297–310. Desember 2011 . Lembaga Penelitian Universitas Riau

Badan Pusat Statistik . 2017. *Siak Dalam Angka tahun 2017*. BPS Kabupaten Siak, Riau.

Surat Keputusan Menteri Pertanian No. 73/Kpts/OT.210/2/98

Surat Keputusan Bersama Menteri Pertanian dan Menteri Koperasi dan Pembinaan Usaha Kecil No.:01/SKB/M/II/1998

Undang-Undang Republik Indonesia Nomor 13 Tahun 2003 *Ketenagakerjaan*

Undang-Undang Republik Indonesia Nomor 18 Tahun 2004 *Perkebunan*

Undang-undang Republik Indonesia Nomor 22 tahun 1999 *Pemerintahan Daerah*

Undang-undang Dasar Republik Indonesia Tahun 1945