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Land cover dynamics and income of converting and non-converting farmers in the Rawas Sub-watershed, North Musi Rawas Regency

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ABSTRACT

The level of criticality of the watershed is closely related to the farming community's socioeconomic level around the watershed area, as indicated by changes in land cover. This study aims to analyze land cover change dynamics and compare the income of conversion and non-conversion farmers in Lubuk Kumbung Village, North Musi Rawas Regency. The method used to analyze land cover is ArcMap Ver. 10.2 with Landsat 8 for path/row 124/62 and 126/62 for image analysis, and the formulas of income (NR), revenue (TR), and production costs (TC) to produce the amount income. The results showed that the land cover dynamics of Lubuk Kumbung Village were dominated by the land cover of the national park, which reached 86.44% in the 2018 period. Inland national parks, protected forests, and limited production forests showed a decreasing trend, while the cover for fields and plantations was the opposite. The comparison of the income of conversion and non-conversion farmers showed that the income of non-converting farmers to rice and coffee had a lower income value than that of oil palm conversion farmers. Still, there was a large difference in rice crops, while the difference between coffee and oil palm income was small. Plants that do not convert to rubber have the highest income value compared to other commodities. Compared to oil palm conversion crops, the value of rubber income is greater than palm oil, with the difference reaching IDR 14,665,321.60/ha/year.

***Key words**: Land cover, Income, Conversion*

Introduction

Nowadays, the critical level of Watershed could be analyzed by the reduction of permanent vegetation and the expansion of critical land, so it could reduce the watershed ability to store the water (Priatna, 2011). Watershed areas can be implemented in anintegrated manner, both in rainfedareas, the environment, and ecologies such as deforestation and unsustainable agricultural changes to sustainable agriculture (Prabhakar *et al*., 2010). Most watersheds in Indonesia are increasingly critical due to the rapid population growth, which causes the demand for resources (water, land, and forest products) in the watershed area. Meeting the needs of the population causes the overexploitation of natural resources beyond sustainable capacity. The forestry sector has great potential to contribute to the integrity and future sustainability if the role of biodiversity in maintaining ecosystems is considered (Aronson and Alexander, 2013; Chadzon, 2014; Messier *et al*., 2014; Mori *et al.*, 2017; Sloan *et al*., 2016). Based on data from the Ministry of Forestry in 2012, the rate of deforestation in Indonesia in 2009-2011 was 0.45 million ha/year (Hastuti, 2016).

Research results in several countries such as Brazil, Guatemala, Cameroon, China, and Malaysia indicate that land cover changes are generally caused by political and economic imbalances (Barraclough and Ghimire, 2000). When viewed from bio-geophysical factors, changes in land use represent changes in an area's spatial layout. Changes in land use will affect changes in socio-economic conditions, and vice versa, changes in the economic structure of the population will affect changes in land use. This is in line with the research of Djaenudin *et al.* (2016) and Munteanu *et al.* (2014) that the dynamics of supply of goods and services are a derived demand for dynamics of land change. As the population of an area increases, the need for goods and services to satisfy needs will increase. Furthermore, Armanto and Wildayana (2016); Bucala-Hrabia (2017), and Sjarkowi (2017) explain that land conversion is a mechanism that brings together supply and demand for land with different production characteristics, where there is a change in use from one activity to another. Conversion of agricultural land will directly or indirectly affect the physical, social and economic conditions of the population and the environment (Harini *et al.*, 2012).

North Musi Rawas Regency has an area of 6,008.55 ha with a forest area of about 365,750.85 ha or 60.55% of the total area of North Musi Rawas Regency. The Rawas sub-watershed is included in the category of upstream Musi river basin, where about 121,585 ha of land in the Rawas production forest management unit consists of production forest (± 89,511ha) and limited production forest (± 32,074 ha) (KPHP Rawas, 2014). The sub-watershed ecosystem in the Rawas area is not managed properly. The conversion of forest land into land for communities to cultivate farming and land ex-gold mining still occurs. The land conversion is carried out by burning forest land. In the sub-watershed of the Rawas river, there is environmental damage resulting in erosion and prone to flooding or landslides, and conversion of forest land to plantations. Accordingto Pasaribu *et al.* (2010), there is the frequent conversion of agricultural land to non-agricultural areas in the downstream and middle areas around the watershed area. The upstream area is used for settlement and industry.

According to Kusnadi *et al.* (2015), the initial negative impact arising from the conversion of land to rubber or oil palm in North Musi Rawas Regency from an ecological point of view is the destruction of watersheds for small rivers and loss of habitat for various types of fauna such as birds, wild boar (*Sus scrofa*), tiger (*Panthera tigris*), bear (*Ursussp*), bottom chicken (*Gallus various*) and several types of primates. Besides, market forces that drive agricultural land conversion, of course, are not easy to control, but it is not appropriate to ignore them. There is a need for safeguards in carrying out land conversion so that the negative impacts that arise can be minimized and positively affect the community's socio-economic conditions Setyoko *et al.* (2014); Setiyowati *et al.* (2018); Sjarkowi (2019) and (Zais *et al*., 2019) also stated that the existence of land would be increasingly threatened due to pressure from demand due to increasing population. Still, the amount of available land does not increase. Based on these conditions, this study is focused on looking at the problem of land cover change on the income of conversion and non-conversion farmers. in the downstream and middle areas around the watershed area.

Materials and Methods

This research was conducted in NorthMusiRawas Regency (Fig. 1-2) in the sub-watershed area of Rawas, namely Lubuk Kumbung Village, Karang Jaya District. Geographically, North Musi Rawas Regency is located between $102^{0}4'0''$ BT-$103^{0}22'13''$ BT and $2^{0}19'15''$ LS- $3^{0}36'30''$ LS. This outermost regency is in the west of South Sumatra Province, so it is directly adjacent to other provinces (Jambi and Bengkulu). Lubuk Kumbung Village has a hilly topography with a slope of > 40% with road access that is relatively difficult to pass and is fed by the Rupit River (its big river) and 2 small rivers (Semelau River and Gayo River). With the existence of a large river and several tributaries that flow in this area, the village of Lubuk Kumbung is included in the sub-watershed area of the Rawas River, which is part of the Musi River Basin. in the downstream and middle areas around the watershed area.

Primary data collection and observation activities are carried out by setting representative observation targets. Village selection was determined purpo-

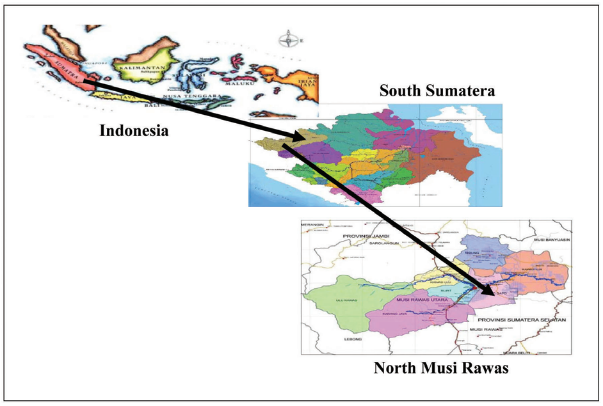

Fig. 1. Location of study

sively (purposive), and the sample (farmers) was determined using the Simple Random Sampling technique of 60 respondents (30 farmers who converted land and 30 farmers who did not convert land).

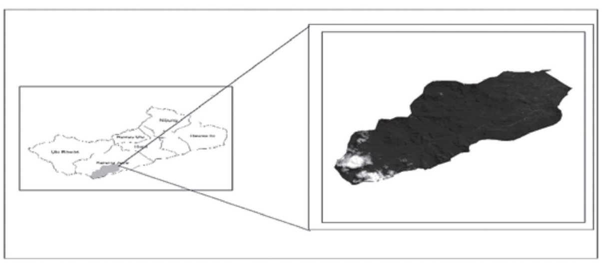

Fig. 2. Map of Research Location

Several stages are used in the processing of this research data, namely land use data processed with ArcMap 10.2 software with basic data in Landsat 8 images on path/row 124/62 and 126/62. Land use data is obtained from image interpretation results using the Supervised Analysis technique in the Geographic Information System (GIS). Socio-economic achievements (Listiani *et al*., 2019) (equation 1-3):

Income (NR) = TR – TC .. (1)

Acceptance (TR) = Q x Pq .. (2)

Total cost (TC) = TVC + TFC .. (3)

Where,

NR = Net Revenue (IDR)
TR = Total Revenue (IDR)
TFC = Total Fixed Cost(IDR)
TVC = Total variable cost (IDR)
TC = Total Cost (IDR)
Q = Total Production Rice (IDR)
Pq = Selling Price (IDR/kg)

Results and Discussion

Land cover dynamics

Land-use change is a complex dynamic process that is interconnected between the natural environment and humans, which directly impacts land, water, atmosphere, and other issues of global environmental importance (Kooman *et al*., 2007). Land cover refers more to the types of vegetation that exist on a particular land, while land use refers to human activities on that land. Furthermore, the land use system combines the two, including the cycle of vegetation change and management activities (planting, harvesting) (Dewi, 2011).

The dynamics of land cover change in Lubuk Kumbung Village are presented in Table 1. During 2009-2018, the largest land cover was the national park's land cover, followed by Field and Plantation cover. According to Chuzaimah *et al*. (2018), land use in North MusiRawas Regency in 2014 was mostly used as mixed plantations with 3,516.47 km² or reaching 57.99% of the district's total land area and spread across all sub-districts. The analysis results show that land cover in the form of protected forest tends to decrease from around 58 ha in 2009 to only around 43 ha in 2018. Likewise, limited production of forest cover tends to decrease from 360 ha in 1990 to 354 ha in 2013. However, it decreased

Table 1. Land Cover Dynamics (2009 - 2018) Lubuk Kumbung Village, North Musi Rawas Regency, South Sumatra, Indonesia

Land Cover Type	2009		2013		2019	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Field	1,735	8.50	1,741	8.53	1,743	8.47
Plantation	464	2.27	480	2.35	670	3.26
Protected Forest	58	0.28	56	0.27	43	0.21
Limited Production Forest	360	1.76	354	1.74	333	1.62
Land National Park	17,783	87.17	17,770	87.10	17,783	86.44

again to 333 in 2018. A different trend is seen in the field and plantation cover. This phenomenon is inversely proportional to field cover with an increasing trend from 2009 to 2018, from around 1735 ha to around 1743 ha. Likewise, with the plantation cover of 464 ha in 2009, the trend continued to increase to 480 ha in 2013 and increased to around 670 ha in 2018.

This situation is caused by most of the population cultivating rubber and clearing forests to make agricultural fields. In the early 2000s, the rubber price was still around IDR 25,000/kg, but when the research took place in August 2019, the price of rubber was around IDR 5,500/kg. This price reduction is one reason why farmers convert their land to oil palm plantations, where the income they earn is no longer able to cover the production costs they spend. However, it turns out that even at the time of the research, the price of palm oil was low at the price level of IDR 1000/kg, so that the farmers still lost money. To meet the staple food needs, namely rice, farmers have started farming to handle the staple food needs by themselves.

Color differences in different years indicate a change in land cover from one land cover to another (Fig. 3). In 2009, there were dark green areas indicating protected forest cover and light green showing limited production forest cover. Then, in 2018, the area slowly changed to cream and blue color that covered fields and plantations. This indicates a change in land cover in the area from protected forest cover to limited production forest cover. Areas dominate land cover in Lubuk Kumbung Village

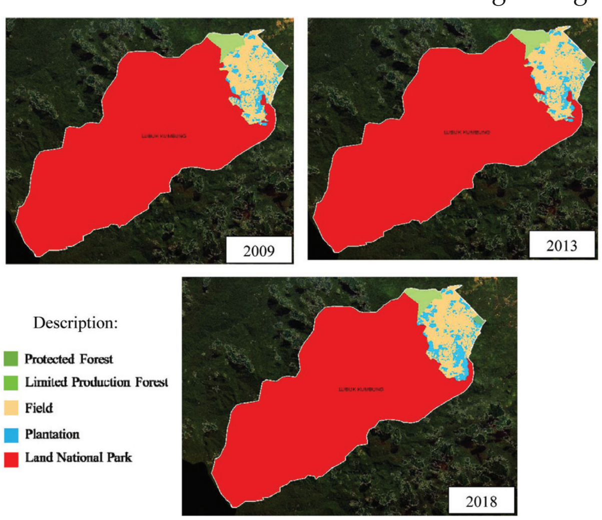

Fig. 3. Land cover in North MusiRawas Regency in 2009, 2013, and 2018

with land cover represented in red by 87.17% in 2009, which trend has decreased to 87.10% in 2013 and continues to decline to 86.44% in 2018. The trend of increasing plantation cover in this area is understandable because PT Citra Loka Bumi Bengawan (PT. CLBB) has been established as a palm oil company where many of the employees come from local villages, both as permanent employees (nursery, security guard, foreman, etc.) and not permanent (casual daily laborers).

Non-converting and converting farmer income

Land conversion can be interpreted as a change in the function of the land area from its original function to other functions that can cause environmental impacts or problems and land potential (Pramudiana, 2017). The process of converting agricultural land at the micro level can be carried out by the farmers themselves or by other parties which generally have a greater impact on the reduction of food production capacity because the conversion process usually covers a fairly large area. The conversion carried out by other parties takes place through the transfer of the rights of the farmer's land owner to another party (company). The narrowing of land will have a direct impact on the volume of production produced so far, so that it will have an impact on the economic conditions of farmers. Farmers who were originally owner farmers, gradually changed their position to become sharecroppers, farm laborers, even without a livelihood. Changes in land cover certainly have an impact on the economic life of farmers, make them miserable or even prosperous.

Production costs are all economic costs used by farmers, both rubber farmers, rice farmers, coffee farmers, and oil palm farmers, consisting of fixed costs and variable costs to generate revenue and are measured in rupiah units. Fixed costs are production costs whose value is not influenced by the production volume, and the results do not run out in one growing season. In this case, the depreciation cost is calculated. Depreciation expense results from a reduction between the total price and the residual value, then multiplied by the economic life. It should be noted that non-converting farmers are farmers who work on rice, rubber, and coffee commodities, while conversion farmers are oil palm farmers. Fixed costs for non-converting rice farmers consist of costs for hoes and sickles, rubber commodities, namely costs for hoes, machetes, sickles, tapping cups, printers, sharpens, buckets, knives and wires, and coffee is the cost for axes, hand sprayers and machetes. The fixed costs for smallholder conversion (oil palm) are hoes, machetes, sickles, egrek, and ganco. Egrek is used to harvest oil palm fruit, and ganco (tajok) is used to pick and transport fresh fruit bunches. The most fixed costs incurred were in exploiting the rubber commodity, amounting to IDR 18,124.80/ha/year. This is understandable because the equipment used in this farming is the largest number of other farms.

Variable costs are cost whose value is influenced by the value of production and will run out in one production process. The variable costs of farmers who do not convert to rice commodities consist of purchasing seeds, sacks, labor wages, harvester and transportation wages, rubber commodities, namely purchasing fertilizers, pesticides, and liquid alum. Rice commodities are purchasing seeds, herbicides, pesticides, fertilizers, sacks, baskets, planting, fertilizing, weeding, and payment of harvest labor. Variable costs for oil palm cultivation conversion farmers consist of fertilizers and fungicides. Table 2 shows the largest costs incurred by rubber commodity farmers due to using urea fertilizer and the purchase of fungicides used for white root disease caused by the fungus Rigidoporuslignosus. Symptoms that arise from this fungus are that the leaf tips look pale yellow and the edges or ends of dead twigs, then the roots of the plants are rotten. As a result, the rubber plants die and can be transmitted to other healthy rubber plants and the purchase of liquid alum as a rubber freezing material, so the total cost the variable that must be spent is IDR 528,159.84/ha/year so that the total cost that must be spent is IDR 546,284.64/ha/year.

Revenue is the number of production results multiplied by the total unit price of production, which is stated in rupiah units per hectare per one process. Price is the value expressed in currency units or a medium of exchange for certain goods. The selling price of farm production is the money that the farmer gets after selling his farm produce. Table 3 shows that the highest selling price for the coffee commodity is IDR 14,700/kg. However, because coffee production is not as high as rubber production because there are many newly planted coffee plants, the highest income is still a rubber commodity. For palm oil, the production is quite large and is supported by high prices so that the income is high. Likewise, rice production is also small, with a low selling price, so that the value of revenue is also low.

Income is the net income (profit) from the difference between the revenue and the business's total cost, which is stated in Rupiah (IDR). Based on Table 4, it can be seen that the average income of non-converting farmers for commodities of rice, rubber and coffee is smaller than the average income of oil palm conversion farmers. Farmers who do not convert to rice have the largest difference in income and farmers who do not convert to rubber have the smallest difference in income compared to palm oil conversion. Due to the higher income of conversion farmers compared to non-converting farmers, conversion activities can lead to an increase in the income level of farmers so that farmers are able to meet their needs, and it is hoped that the in-

Table 2. Average total production costs of non-converting and converting farmers in Lubuk Kumbung Village

Cost	Non-Conversion		Conversion	
	Rice (IDR/ha/year)	Rubber (IDR/ha/year)	Coffee (IDR/ha/year)	Palm (IDR/ha/year)
Fixed cost (TFC)	8,831.20	18,124.80	9,057.70	6,879.04
Variabel cost (TVC)	126,954.20	528,159.84	213,494.60	166,352.00
Total cost (TC)	135,785.40	546,284.64	222,552.30	173,231.04

Table 3. Average acceptance of non-converting and converting farmers in Lubuk Kumbung Village

Description	Non-Conversion		Conversion	
	Rice	Rubber	Coffee	Palm
Production (ha/year) (Q)	526.30	3,798.72	455.8	13,785.61
Selling price (IDR/kg) (Pq)	3,500.00	3,660.00	14,700.00	1,100.00
Acceptance (IDR/ha/year) (TR)	1,842,050.00	13,903,315.2	6,700,260.00	15,164,171.00

Table 4. Average Income of Non-conversion and Conversion Farmers in LubukKumbung Village

Description	Non-Conversion		Conversion	
	Rice	Rubber	Coffee	Palm
Acceptance (IDR/ha/year) (TR)	1,842,050.00	13,903,315.2	6,700,260.00	15,164,171.00
Total cost (IDR/ha/year) (TC)	135,785.40	546,284.64	222,552.30	173,231.04
Income (IDR/ha/year) (NR)	1,706,264.60	13,357,030.56	6,477,707.70	14,990,937.76

crease in income will have an impact on improving welfare.

Conclusion

Land cover dynamics describe how land cover changed over time during the analysis time period (2009-2018). There has been a change in that period, or there has been a reduction in land cover, especially forest cover, both protected and limited forest and land cover of national parks. Field cover and plantation cover expanded further during this period.The income of farmers who do not convert rice, rubber and coffee is lower than that of oil palm conversion farmers. Land conversion can increase farmer household income.

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References

Armanto, M. E. and Wildayana, E. 2016. Land degradation analysis by landscape balance in Lebak Swamp Jakabaring South Sumatra. *Journal of Wetlands Environmental Management*. 4 (1) : 1–6. https://doi.org/10.20527/JWEM.V4I1.24

Aronson, J. and Alexander, S. 2013. Steering towards sustainability requires more ecological restoration. *Natureza a Conservacao*. 11 (2) : 127–137. https://doi.org/10.4322/natcon.2013.021.

Barraclough, S. and Ghimire, K. 2000. Agricultural Expansion and Tropical Deforestation: Poverty, International Trade, and Land Use. London and Sterling, VA: *Earthscan* 2000 Xvii + 150 p 150 pp. 150 pp. BPS Provinsi Jawa Timur, 2011. Jawa Timur Dalam Angka. Badan Pusat Statistik Provinsi Jawa Timur. Surabaya.

Bucala-Hrabia, A. 2017. Long-term impact of socio-economic changes on agricultural land use in the Polish Carpathians. *Land Use Policy*. 64 : 391–404. https://doi.org/10.1016/j.landusepol.2017.03.013.

Chazdon, R.L. 2014. Second growth: The promise of tropical forest regeneration in an age of Deforestation. Chicago. University of Chicago Press.

Chuzaimah, C., Sjarkowi, F., Wildayana, E. and Yunita, Y. 2018. Prospects for agricultural land development as an effort to increase food security (Analysis of potential use of agricultural land to the level of community welfare in Musi Rawas Utara Village). *Sustainable Agriculture for Food Security and Sovereignty*. 200–206. http://jlsuboptimal.unsri.ac.id/index.php/jlso/article/view/272/174.

Dewi, S. 2011. Sistem Penggunaan Lahan dalam Analisis OppCost REDD+. World Agroforestry Centre. Bogor.

Djaenudin, D., Oktaviani, R., Hartoyo, S. and Dwiprabowo, H. 2016. Modelling of land allocation behavior in Indonesia. *Procedia Environmental Sciences*. 33 : 78–86. https://doi.org/10.1016/j.proenv.2016.03.059.

Harini, Rika, Yunus, Hadi Sabari, Kasto, Hartono, Slamet. 2012. Agricultural Land Conversion, Determinants and Imfact for Food Sufficency in Sleman Regency. Indonesian Journal of Geography.

Hastuti, D. Y. 2016. Permasalahan dan strategi pengelolan DAS Musi. In *Bulletin Forum Daerah Aliran Sungai (DAS)*.

Kooman, E., Stillwell. J., Bakema, A. and Scholten, H.J. 2007. Modelling Land-Use Change Progress and Application. Springer. The Netherlands.

Kusnadi, Danang. 2015. Strategi Pengeolaan Perkebunan Berbasis Kestabilan Ekosistem di Kecamatan Nibung, Kabupaten Musi Rawas Utara, Sumatera Selatan. Tesis. Pascsarjana Universitas Sebelas Maret.

Listiani Reka, Agus Setiyadi dan Siswanto Imam Santoso. 2019. Analisis Pendapatan Usahatani Padi di Kecamatan Mlonggo Kabupaten Jepara Income Analysis of Rice Production in Mlonggo District, Jepara Regency. AGRISOCIONOMICS Jurnal Sosial Ekonomi dan Kebijakan Pertanian. ISSN 2580-0566 EISSN 2621-9778.

Messier, C., Puettmann, K., Chazdon, R., Andersson, K., Angers, V., Brotons, L., Filotas, E., Tittler, R., Parrott, L. and Levin, S. 2014. From management to stewardship: viewing forests as complex adaptive systems in an uncertain world Messier C, Puettmann K, Chazdon R, Andersson KP, Angers VA, Brotons, L, Filotas, E, Tittler, R, Parrott, L and Levin SA. *Conservation Letters*. https://doi.org/10.1111/conl.12156.

Mori, A. S., Lertzman, K. P. and Gustafsson, L. 2017. Biodiversity and ecosystem services in forest ecosystems: a research agenda for applied forest ecology. *Journal of Applied Ecology*. 54(1) : 12–27. https://doi.org/10.1111/1365-2664.12669.

Munteanu, C., Kuemmerle, T., Boltiziar, M., Butsic, V., Gimmi, U., Halada, L., Kaim, D., Király, G., Konkoly-Gyuró, É., Kozak, J., Lieskovský, J., Mojses, M., Müller, D., Ostafin, K., Ostapowicz, K., Shandra, O., Štych, P., Walker, S. and Radeloff, V. C. 2014. Forest and agricultural land change in the Carpathian region-A meta-analysis of long-term patterns and drivers of change. *Land Use Policy*. 38 : 685–697. https://doi.org/10.1016/j.landusepol.2014.01.012.

Pasaribu, S.M., Kedi, S., Bambang, S., Ai Dariah; Irsal Las, Haryono, Effendi, P. 2010. Membalik Kecenderungan Degradasi Sumberdaya Lahan dan Air. Badan Penelitian dan Pengembangan Pertanian Kementerian Pertanian. ISBN: 978-979-493-299-5. IPB Press Bogor.

Prabhakar, K., Latha, K. L. and Rao, A. P. 2010. Watershed programme: Impact on socio-agricultural and socio-economic spheres of the farmers. *Journal of Agricultural Sciences*. 1(1) : 31–37. https://doi.org/10.1080/09766898.2010.11884651.

Pramudiana, Ika Devy. 2017. Dampak Konversi Lahan Petanian Terhadap Kondisi Sosial Ekonomi Petani Di Kecamatan Tikung. *Jurnal Asketik*. 1(2) Desember 2017 Kabupaten Lamongan.

Priatna, S. J. 2011. Penilaian kekritisan lahan, erosi dan sedimentasi berdasarkan energi yang bekerja (Studi Kasus: Di kawasan Hulu DAS Komering Sumatera Selatan). In *PhD Thesis*.

Setiyowati, I. L., Sasongko, S. and Noor, I. 2018. Farmer exchange rate and agricultural land conversion analysis to agricultural sector poverty in Indonesia. *Jurnal Ekonomi Dan Studi Pembangunan*. 10(1) : 35–43. https://doi.org/10.17977/um002v10i12018p035.

Setyoko, Bayu dan Purbayu Budi Santosa. 2014. Faktor-faktor yang Mempengaruhi Keputusan Petani Mengkonversi Lahan Pertanian Menjadi Lahan Non Pertanian. *Diponegoro Journal of Economics.* 3 (1).

Sjarkowi, F. 2017. Socio-entropic controlling interface (SECI) an applied theory on social partnership endeavo. In *Baldad Grafiti Press, Palembang*.

Sjarkowi, F. 2019. Pengelolaan usahatani vs agribisnis. Strategi kebijakan and manajemen niagaperta penguat fundamental ekonomi negeri. In: *Baldad Grafiti Press, Palembang*.

Sloan, S., Goosem, M. and Laurance, S. G. 2016. Tropical forest regeneration following land abandonment is driven by primary rainforest distribution in an old pastoral region. *Landscape Ecology*. 31(3): 601–618. https://doi.org/10.1007/s10980-015-0267-4.

Zais, I., Romano, and Nugroho, A. 2019. Conversion of Paddy Fields and Impact on Farmers' Income in Aceh Besar District of Indonesia: a Case Study of Darul Imarah Subdistrict. *Russian Journal of Agricultural and Socio-Economic Sciences*. 95(11) : 257–262. https://doi.org/10.18551/rjoas.2019-11.36.