



THE RESTORATION EFFORT OF PEAT MOSS ECOSYSTEM POSTCONFLAGRATION OF THE FOREST AND THE LAND IN LUKUN VILLAGE OF TEBING TINGGI TIMUR REGENCY

Ashaluddin Jalil^{1*}, Yesi², Seger Sugiyanto³

^{1,2,3} Department of Sociology, FISIP, Universitas Riau, Indonesia

ARTICLE INFORMATION

Submitted : 17 October 2018
Review : 13 May 2019
Accepted : 06 June 2019

Available online: June 2019

KEYWORDS

Restoration, peat moss, conflagration, Lukun

CORRESPONDENCE

*E-mail: ashaluddin.jalil@lecturer.unri.ac.id

ABSTRACT

The conflagration continuously occurs with a different trend each year. Indonesian is especially an area that takes the root of peat moss labeled as the exporter of the smoke to the neighbor states and all at once it is not able to solve the conflagration completely because of various reasons. More or less 2 million hectares of the peat moss land has degradation and needs the recovery effort to be the job desk of the government to implement the restoration effort as soon as possible. Not only needing very big budget, that becoming the note is the society truly needs to support the activity to work well. The goal of this research is namely: 1). identifying the factor of the forest and the land conflagration cause and its impact, 2) analyzing the restoration efforts of post conflagration disaster of the forest and the land. And the location of the research is in Lukun Village of Tebing Tinggi Timur Regency of Kepulauan Meranti Subdistrict. This research uses the qualitative descriptive approach. The causing factor of the conflagration disaster of the forest and the land is namely the natural condition and the human activity. The impact that is caused by the conflagration disaster of the forest and the land can be divided to be: the impact against the peat moss ecosystem and the impact against the society's social economy. The effort that is implemented in the recovery of post conflagration disaster of the forest and the land is the ecosystem restoration and the revitalization of human's economy.

A. INTRODUCTION

The conflagration of the forest and the land is the disaster that is a financial loss. Since a long time ago, Indonesia especially Riau has been suffering because of the smoke threat. Almost every year the conflagration always come with the different extensive and leaves the deep sorrow. The cause is also different started from the factor of nature and the suspicion implemented by the human both intentionally and unintentionally. The conflagration doesn't only have an impact on the peat moss environment but also towards the economy social life of the local society.

The post conflagration 2014-2015 the smoke disaster started to decrease, but at the beginning of 2018 the conflagration of forest and land started to appear again, it was Lukun village of Tebing Tinggi Timur Regency that experienced

the great conflagration. The Crisis Centre Site of Health Minister of Indonesian Republic said that the land conflagration had occurred since 9 February 2019, until with 14 February 2018 noted the extension of the burnt land was as wide 100 Ha. The extinguishing was hard to be done because the wind that blew very fast and the conflagration had crept up to the sago palm garden (Health Minister, 2018).

The conflagration didn't only cause the disadvantage such as the broken peat moss ecosystem, but also against the social economic condition of the society. The disturbing means of livelihood system of society caused the economy activity paralyzed and the daily activity didn't work well. The seriousness of the government was being examined to solve seriously this problem. More or less two million of the peat moss land was done for the degradation and needs the restoration effort to be the homework

of the government to optimize the restoration effort. The big budget is not only needed but also the society truly needs to support that activity and stimulate again the local wisdom in daily life so that the restoration effort is succeeding and works well. And the goal of this research is namely: 1). identifying the factor of the forest and the land conflagration cause and its impact, 2) analyzing the restoration efforts of post conflagration disaster of the forest and the land in Lukun Village.

Indonesia is a fourth country with the wide land of the widest peat moss in the world (Euroconsult, 1984), namely around 20 million ha, after Canada (170 million ha), Uni Soviet (150 million ha), and United States (40 million ha). In Sumatera island, the spreading of the peat moss land generally is in the lowland along the east beach, namely with the domination order in a row is in the province area of Riau, South Sumatera, Jambi, North Sumatera, and Lampung. The spreading into the hinterland/headwaters reaches about 50-300 km from the line of the beach (Wahyunto et al., 2005). In the more narrow area, the peat moss is also found in the land of the west beach of the island, especially in the province area of Bengkulu, West Sumatera, and Aceh. The spreading into the headwaters generally reaches about 10-50 km from the beach line (The Working Group of The national Peat Moss Land Processing, 2006).

The forest conflagration is one of the main causes of the tropics forest damage in Indonesian. In 1997//98 about 2.124.000 ha the peat moss forest in Indonesian was burnt. Even many more cases of the same burnt location were found again in multiple fires. A big part of the conflagration that occurred in the peat moss forest is classified heavy upon thinking about the characteristic of the peat moss that is arranged from the manure of the organic material that has been moldy with the vegetation above is very potential as the fuel. A pile of moldy organics material that arranges the peat moss layer has potential to cause the ground fire, namely the conflagration under the surface meanwhile the surface of the flat peat moss eases the fire to hamper from one tree to other trees or among tree canopies when the conflagration occurs on the surface. The impact is in the peat moss land, the conflagration often occurs all together under and on the surface so the impact against the environment and the loss of biodiversity become worse. After the conflagration, the vegetation on the peat moss surface disappears and the layer of the peat moss land decreases and makes the cavity so it becomes stagnated in the rainy season like the lake.

Many types of research about the conflagration in the peat moss land and the impact that is caused have been done by many

sides. Among others by CIFOR, ICRAF, The Department of the Plantation, Wetlands International-Indonesia Programme, University, etc. From the researches known that the forest conflagration in the peat moss forest is generally caused by (1) land clearing by the burning for the plantation by the big companies, (2) the preparation of the agriculture land by burning by the farmer (generally the shifting cultivation), (3) the carelessness of the woodcutter in illegal in the forest that makes fire to cook the food and the drink (4) the fishing in the floodplain area in ht dry season where the grass that grows around the pond is burnt first of all so that the fish is easy to be harvested, and (5) the land conflict between the society and the side of the HPH holder (The Forest Authority Right) or the company of HTI (The Forest of Industry Plant).

B. METHOD

The research approach that is used is qualitative research with descriptive analysis method. The location of this research is in Lukun village of Tebing Tinggi Timur Regency of Meranti Subdistrict of Riau Province. This research uses the qualitative approach, so the informant taking is done based on a certain purpose, namely for obtaining the information involved the restoration efforts of post conflagration disaster of the forest and the land. For deciding the subject in this research, the purposive sampling method is used namely the method of sample taking that is chosen accurately so it's relevant with the research structure, where the sample taking by choosing the people based on the criteria that have been decided first of all by the researcher suitable with the research purpose.

C. RESULT AND THE DISCUSSION

The Lukun village is one of the villages that is in Tebing Tinggi Timur Regency of Meranti Subdistrict of Riau Province. This village has the distance of 12 km² to the office of regency with the radius through the land lane more or less about three hours more than Lukun village to the office of Tebing tinggi Timur Subdistrict. Lukun village in geography borders on directly with Batin Suir village from the west direction, direct borders on with Banglas village in the north direction, south direction borders on Kepau Baru village and east direction borders on Tohor River.

From the data of regency in the number in 2018 told that in Lukun Village, there were 2003 inhabitants, has wide 12460 km² with the level of population density 1296 soul/km². And the sum of Family Card as much 471 Family Cards. The majority of society that is in Lukun Village works

as a farmer, it's because the soil in this village is suitable for plants such as rubber, coconut and also sago palm, with the agricultural result of society of Lukun village such as the rubber with the wide area 433 ha with the sum of rubber farmer as much 272 people. For the agricultural result of coconut, there is a wide area of 181 ha with the sum of the farmer 197 people. And the agricultural result that is very dominant is the sago palm with the wide area 1953 ha and the society that works as the sago palm farmer is as much 179 people (Monografi Desa Lukun, 2018).

1. The Cause of the Conflagration of the Forest and the Land

The problem that causes the conflagration of the forest and the land is very complex so it's needed to be observed from the history side, the causal factor, the impact, until the local society's behavior. The assumptions of the emerged fire in the peat moss land indeed can come from everywhere, both nature factor or human factor and various interests behind it. The nature factor such as the weather, the climate, the temperature, had become one of the impetuses of emerged conflagration since a long time ago. The pressure or the intervention of the plantation company (HTI) and the land confession also join in supporting the peat moss land to be burnt besides the carelessness of society in the planting activity.

Deciding the subject who causes the conflagration and which side that will be responsible is a very difficult thing. Each side doesn't feel guilty and doesn't want to be blamed. But, the conflagration has very long chain eye. Many kinds of components of society, government and companies around are guessed to have contribution against the conflagration with the different portion. And the cause of the conflagration is: First, the internal factor that comes from Lukun village namely the nature condition, the human behavior, and the illegal logging. Second, the external factor that is like a pressure from the plantation companies or Industry Plant Forest that does the land conversion on a large scale and doesn't implement the rule about the forest process.

2. The Impact of the Land Forest Conflagration against the Peat Moss Ecosystem

After the conflagration occurs, the imbalance of peat moss ecosystem occurs. Besides it makes many flora and fauna died, the conflagration also makes the soil structure

experience infertility. The harmonization between the component of biotic and biotic is disturbed because of the conflagration. The peat moss becomes broken and needs many years to recover it. Meanwhile, the died flora clearly will inflict a financial loss the surroundings. The loss of animal and original plant or endemic that is very valuable. The significant change occurs against nature. It's the same with illegal logging; the conflagration has caused the migration and the great death against the animals that live in that burnt forest. The savage fire causes clearly the double impact if compared with the illegal logging.

The conflagration brings a negative impact against the loss of means of livelihood and the died flora and fauna in the forest. Meanwhile, for returning the fertility of peat moss land post conflagration needs a long time. It has to be let many years while lets the bushes grow by itself. According to the World Bank Group, the conflagration damages the diversity of natural genetic, that helps the species to adapt in order to endure against the parasite and the spread disease, biomass that is burnt makes precursor from ozone in the basic level (troposphere), that has impact against the growth of the plant and the photosynthesis and causes the long term effect in the ecosystem structure and function (Glauber, Moyer, Adriani & Gunawan, 2016).

3. The Impact of the Land Forest Conflagration against the Society's Economy Social

The Sector of Health, Environment, economy, and transportation is four main sectors that are affected the direct impact, besides that, because the smog impact also spreads to the neighbor countries, so the relation Indonesian with the neighbor countries of Malaysia and Singapore is also disturbed (Suryani, 2012).

The social impact of conflagration is more emphasized against what society feels like the victim from the ferocity of the smog. It's seriously that the smog has inflicted a financial loss many sides. Like it or not the society breaths the smog that contents the dangerous particle inside and threatens the body health. The effect of the smog maybe will be felt when the conflagration occurs with the difficulty breathing, but more dangerous is the long term effect namely causing various kinds of chronic diseases such as cancer.

Other various activities are disturbed, even more; the children that want to go to school are forced to get a holiday in undecided clear timing until the smog starts to decrease. Although many sides do the action to give the mask the smog of

the conflagration is too tight so the mask also becomes ineffective. The children lose their world, when they should play freely and cheerily, they have to be surrounded in the house because of the smog. Every getting up in the morning, the weather changes to be the fog that is wrapping their house and the surroundings. The range of visibility is disturbed and causes society difficult to activate. Such as revealed by the lukun's society as followings:

"It's difficult for children who want to go to school outside. Using the canoe, the water is not visible, so the school gets a holiday. And it's also afraid for the wrong stream flow; it looks thick on the water." (Interview of Respondent I, 2018)

"Its impact is very dangerous and of course it makes doubt to work. The road is unseen whereas the motorcycle lamp is on. For meanwhile going out, the body has not been comforting." (Interview of Respondent II, 2018).

Society loses the means of livelihood that they finally have to adapt to the new environment of post conflagration. The means of livelihood has experienced the change. The productive lands that are had by the society that becomes the victim of the conflagration will become the critical land and need several times in order to be processed again to be planted various kinds of productive plants. The society whole life depends on processing the forest result will be disturbed and the work productivity experiences descent. The farmers have to struggle again to manage their life that has been disturbed because of this smog disaster. The loss of means of livelihood and forced to struggle to look for the source of the new life because the plant in the garden that they have planted can't be harvested.

Moreover, the fisherman experiences the impact of the conflagration besides the range of the catch is more and farther and the decrease of the income happens, this thing is aggravating with the technology of fish caught that is simple. So the limitation also makes the minimum catch result. But, it must be thanked God that the local fisherman doesn't use the instant way to catch the fish such as large trawling net, they still use the net and a plaited rattan fish trap that is made

by themselves to catch the fish. The high demand of fish can't be balanced with the fisherman's productivity. The impact, society's need for fish is not fulfilled well.

"The fisherman's income is less, one catch can usually be for two days of eating but after the conflagration can't be because the range of catch gets more and farther and with the simple equipment so it can't get much fish". (Interview of respondent I, 2018).

4. The Efforts of Post conflagration Restoration

The society and various institutions of government and society self-supporting group have contributed towards the peat moss restoration in Lukun village with various kinds of programs. This thing gives a positive impact on society because it causes awareness for keeping again the environment of the peat moss. The involved institutions give the program that is set aside for the environment aspect and social aspect. Example The Peat Moss Restoration Body, coordinating with the society and the educational institution, making many observe related with an aspect of 3R, namely rewetting, revegetation, and revitalization (the maximum effort of society's economy source) through the potential in the local area.

a. Rewetting (dampening)

Avoiding the conflagration that can inflict a financial loss the society's life so the peat moss land needs to be kept and maintained its existence in various ways. But, the most important is keeping the peat moss in order to be in wet and humid condition. This thing is meant if the peat moss is wet so the risk of the conflagration occurs almost nil. The way that can be done is by making the canal partition. The making of canal partition in a simple way has the function to restrain the stream flow or dam up so the canal's water is fully free to flow. The canal blocking is one of way to solve the dryness and the conflagration of the forest or the peat moss, the canal blocking that we often find namely those are made from the sack and filled the sand/the wood have the weakness such as the resistance that is low and easy to be broken (Putra Ricca, Rinaldi, & Fauzi, 2018).



Picture 1: The Building of The Stuck Canal and The Monitor Well by Involving the Society Group of Lukun Village

One of the principles of empowerment is emphasizing the active participation of the community. In accordance with the definition of community participation, namely the active involvement of the community in activity by supporting the achievement of goals through the decision-making process, implementing the program, utilizing the results and evaluating the program (Ermayanti, Hendrawati dan Lucky Zamzami, 2018). The development of the canal partition is done by involving the society of Lukun village. It's meant so the partition that is made is suitable with the local nature condition and accommodates the local knowledge of the society about the good technique of canal getting stuck fast so it doesn't disturb the society's activity. The main purpose of canal stuck making is returning the hydrology function from the peat moss land. More or less two years since the first time, the canal stuck was made; it can be told that the purpose has been succeeding although it's not been maximum yet. But, on the whole, the difference between before and after the condition of the canal stuck has been seen. One impact that is started to be felt is the condition of society's plantation gets better. If compared, there was no canal stuck before, admitted by the society that the plant in the society's garden is less healthy marked by the reddish leaves and growing dwarf. There has not been yet the research that is done about the impact of the canal stuck against the society's plantation, only based on the visual observation that they see daily.

The building of monitor well has also function as the control effort of the peat moss wetness level. It's also the part from the activity of the peat moss dampening that will keep the peat moss dampening level so when the peat moss in the dry condition is monitored that is easy to decide what step will be done.

b. Revegetation (planting)

The same thing with the kind of other soils, the peat moss also has the potential to be made

the plantation land. But, society needs to understand well how the characteristic of the peat moss in order to find the kind of suitable plant. The peat moss is the kind of soil that has a high acidity level so it sometimes needs special treatment in farming. The kind of the plant on friendly environment plant in the peat moss land that is not only taken its result but the existence of the plant doesn't damage the peat moss land. The kind of the plant on friendly peat moss that can be cultivated is those have economic value. It means that it's not only for their own interest but perhaps to be sold to other places. These plants also have a function to keep the peat moss land and don't damage the soil structure.

The plant of the sago palm in the peat moss land is the kind of the plant in a friendly environment. The planting is simple and doesn't need much attention. In traditional, the sago palm has been used as the main food for a big part of Indonesian people of east side namely in Maluku and Papua, and in some other areas such as Kepulauan Mentawai, Riau, a part of Kalimantan, and Southeast Sulawesi (Herman, 2016).

The sago palm is not only a friendly environment; almost all parts from the sago palm can be made use. The sago can be flour, its stem of palm can be used for the hut floor, and its leaf also can be used for the roof. The sago palm is the area potential that is needed to be developed in maximum because it becomes the source of means of livelihood of the majority of people. The sago palm has safe taste to be consumed and doesn't contain the sugar so it's suitable for the diabetes patient. The sago palm can be processed to be various kinds of hereditary products such as sago flour, sago noodle, sago sugar or fickle food like lempeng sago, etc.

The government really hopes so the local society incites again to plant the life tree or the forest tree but upon thinking about the more less sum (extinct) because of the conflagration disaster or illegal logging. The kind is various, such as tree, mahogany, timber tree, trees bearing similar timber, punak, etc. The planting of

the tree forest can be done by the societies' self or the group through the village organization, the result can be harvested and enjoyed together. But upon thinking about the waiting time for the harvest of the tree plant is relative long, meanwhile, the daily needs keep on walking so many villagers of Lukun don't refuse to cultivate the kind of the tree plant and choose another commodity alternative whose the harvest time is shorter.

c. Economy Revitalization

Besides it can be made use for the agricultural activity, another sector is also

potential such as the agricultural in the peat moss land. The high consumption interest is not balanced with the production result of local fisherman. Through various considerations, the peat moss starts to be tried to be the cultivation place of local fish and the intrusion of the insipid fish. Basically, the kind of local fish that comes from the local area is given priority.

The model of making use of the peat moss land to increase the society's economy can be determined with the system of the pond and the embed net. The system of the simple pond can be the media of fish proliferation.



Picture 2: The Economy Empowerment of Society through the fish cultivation of the peat moss swamp

The fish pond can be with the simple material by using the board and the tarpaulin as the main material. The pond model is the fish proliferation media that is generally used by society in many places. For guarding the pond against the pest like beaver or monitor lizard, the safeguard net is put on the pond as the cover. The safeguard net is not only for saving the fish from the threat of beaver or monitor lizard but also it can be used to avoid the leaves garbage into the pond of the fish. Thus, the pond will be kept from the threat of the pest and its condition will be clean because the garbage will be hard to enter into the pond.

The harvest result with the measure of the freshwater catfish can reach about 40 cm long with more than 1 kilo heavy when the woof need is enough. Although the beach society is identical and likes with the consumption of the sea water fish among them still likes the local freshwater

catfish or big freshwater catfish but they don't have more appetite like sea fish. The fish still exist and tastes good in the tongue of the society is taking fish. This kind of fish is the original fish that can live both in the pond and the free watery. But, its measure is not the same. If they live in the pond, they will be slower, but if they are free in the wild nature, they will grow big. Taking fish have included the kind of the active fish and likes to be in the free watery therefore the fish is cultivated in the wild nature by using the embed net model. The embed net is made simply based on the local knowledge and the scientific technique combination of fish cultivating.

Besides initiating the pond, so the empowerment of the society is also needed to minimize the outcome for the fish maintenance namely by making the own woof from the available materials in the surroundings.



Picture 3: The Society Empowerment through The Making Training of fish woof/flatter

That picture is the activity of flatter making that is done by the mothers of the fish flatter working group. The fish platter is made with the local material that consists of sago flour, mixed of rice and bran, the head of crunchy fish, corn flour, and the shrimp head. The ingredients are chosen intentionally to use the local product so the production budget is not big. Besides that, the local material is used for easing the society to obtain flattering material when it will be produced.

This activity is sponsored by The Peat Moss Restoration Body and The Disaster Study Centre of Riau University. The activity of the flatter making is part of the program of 3R namely the third R (revitalization), the society's empowerment and an effort to create the new job vacancy. The flatter that is made for being used by own self for the next time to give the feed of the cultivated fish. But, if the latter may be sold for the whole society if the license and document are ready prepared.

D. CONCLUSION

The conflagration impact of the forest and the land for the human and the ecosystem is very big and disturbs the environment balance directly and indirectly. The conflagration of the forest and the land in Lukun has an impact on the peat moss ecosystem, the economy social, and social behavior. The society and various institutions of government and non-government have contributed and coordinated with the society and the education institution for

making effort the degraded peat moss restoration by doing many observations and activities related aspect of 3R, namely rewetting (dampening), revegetation (planting), and revitalization (maximum effort of society's economy source) through the potential in the local area.

The change that has happened against the structure of peat moss soil should trigger again the productive agricultural activity. The peat moss land now is not like some years ago that was dry. Now, the land condition has been better and wet again so it's potential to be developed to be the agricultural land with the note of cultivating the plant on the friendly peat moss like above for perpetuity of household economy and living space preservation.

E. ACKNOWLEDGMENT

The author wishes to thank the editorial board of *Jurnal Antropologi: Isu-isu Sosial Budaya (Janthro)* and the anonymous reviewers for their invaluable comments and constructive critiques, without which this paper would not be in its present form. Their valuable insights have helped to strengthen the paper. Many thanks to the Indonesian peat restoration agency (BRG) for the support and cooperation provided during the research process. The research is supported by Research University Grants: PNBP from Faculty of Social and Political Sciences of Universitas Riau.

REFERENCES

- Abdullah, T.S. (1997). Tanah Gambut. *Genesis, Klasifikasi, Karakteristik, Penggunaan, Kendaladan Penyebarannya di Indonesia*. Jurusan Ilmu Tanah Fakultas Pertanian IPB. Bogor.
- Adinugroho, W.C., Suryadiputra I N.N., E. Siboro dan B. Hero. (2005). *Panduan Pengendalian Kebakaran Hutan dan Lahan Gambut*. Wetlands International – Indonesia Programme (WIIP) dan Wildlife Habitat Canada (WHC).
- Alue Dohong, (2003). *Pemanfaatan Lahan Gambut untuk Kegiatan Pertanian Holtikultura: Belajar dari Pengalaman Petani Desa Kalampangan, Kalimantan Tengah*. Warta Konservasi Lahan Basah Vol 11 no.2 April 2003. Wetlands International - Indonesia Programme.
- Bambang Setiadi. (1993). *Pemanfaatan Gambut Untuk Pertanian dan Transmigrasi*. Tim Studi Pemanfaatan Gambut Kedepuitan Bidang Pengembangan Kekayaan Alam-BPP Teknologi, Jakarta.
- Burhan Bungin, (2016), Analisis Data Penelitian Kualitatif, Jakarta: Raja Grafindo Perkasa.
- CCFPI, Climate Change, Forests and Peatlands in Indonesia. (2005). *Pengelolaan lahan gambut berkelanjutan*. Seri prosiding 07. Bogor. Ditjen Bina Bangsa, Wetlands International-Indonesia Programme dan Wildlife Habitat Canada.
- Departemen Kehutanan. (2002). *Statistik Kehutanan Indonesia 2000/2001*. Biro Perencanaan Departemen Kehutanan. Jakarta.
- Departemen Dalam Negeri. Kelompok Kerja Pengelolaan Lahan Gambut Nasional. (2006). *Strategi Dan Rencana Tindak Nasional Pengelolaan Lahan Gambut Berkelanjutan*. Jakarta.
- Euroconsult. (1984). *Nationwide study of coastal and near coastal swampland in Sumatra, Kalimantan, and Irian Jaya*. Vol. I and II, Arnhem.

- Ermayanti, Hendrawati dan Lucky Zamzami. (2018). Studi Partisipasi Masyarakat Terhadap Pelaksanaan Program Pnpm Mandiri Di Sumatera Barat, JURNAL ANTROPOLOGI: Isu-Isu Sosial Budaya. Juni 2018, Vol. 20 (1): 33-43.
- Glauber, A. J., Moyer, S., Andriani, M., & Gunawan, I. (2016). Kerugian dari Kebakaran Hutan Analisa Dampak Ekonomi dari Krisis Kebakaran Tahun 2015. Jakarta: The World Bank.
- Harry Hikmat, (2006), *Strategi Pemberdayaan Masyarakat*, Bandung: Humaniora Utama Press.
- Herman. (2016). Upaya Konservasi dan Rehabilitasi Lahan Gambut Melalui Pengembangan Industri Perkebunan Sagu. Prosiding Seminar Nasional Lahan Basah Tahun 2016 Jilid 1 (pp. 54-61). Bogor: Lembaga Penelitian dan Pengabdian kepada Masyarakat, Universitas Lambung Mangkurat.
- I Nyoman N. Suryadiputra. (2003). *Nasib Penebang Liar di Rawa Gambut Sumatera Selatan*.Warta Konservasi Lahan Basah Volume 11 No 1 januari 2003. Wetlands Internasional.
- Inubushi, K. A. Hadi, M. Okazaki, & K. Yonebayashi. (1998). *Effect on converting wetlands forestto sagopalm plantations on methane flux and carbon dynamics in tropical peat soil*.Hydrological Processes 12: 2072 – 2080.
- Isbandi Rukminto Adi, (2008), *Intervensi Komunitas. Pengembangan Masyarakat sebagai Upaya Pemberdayaan Masyarakat*, Jakarta : Rajawali.
- Jaya, A. (2001). *Carbon storage in tropical peatlands*. Tropical Peatlands 1: 11 – 15.
- Kelompok kerja Pengelolaan lahan gambut Nasional, (2006). *Strategi dan Rencana Tindak Nasional Pengelolaan Lahan Gambut Berkelanjutan*. Departemen Dalam Negeri.
- Jonathan H Turner, (1978), *The Structure of Sociological Theory*, Illinois : The Dorsey Press
- Kementerian Kesehatan RI. (2018). *Lindungi Diri Dari Bencana Kabut Asap*. Jakarta.
- Najiyati, S., Agus Asmana, dan I Nyoman N. Suryadiputra, (2005). *Pemberdayaan Masyarakat di Lahan Gambut*.Bogor: Wetlands International – IP.
- Putra Ricca, R. R., Rinaldi, & Fauzi, M. (2018). Model Fisik Cannal Blocking Bentuk Tabung. Jom Fteknik Volume 5 No. 1 April, 1-11.
- Sri Najiyati, (1996). *Studi Verifikasi dan Pengembangan Lahan Gambut di Karang AgungTengah*. Puslitbang Transmigrasi, Jakarta.
- Sri Najiyati, Agus Asmana dan I Nyoman N. Suryadiputra. (2005). *Pemberdayaan Masyarakat di Lahan Gambut*. Proyek Climate Change, Forests and Peatlands in Indonesia. WetlandsInternational – Indonesia Programme dan Wildlife Habitat Canada, Bogor.
- Suryadiputra dan AdiJaya. (2004). *Petunjuk Lapangan Pendugaan cadangan Karbon pada lahan gambut*. Kerjasama antara Wetlands International, Wildlife Habitat Canada, Habitat FunniqueCanada, dan Ditjen PHKA.
- Suryadiputra, (2004), Keanekaragaman Jenis Tumbuhan di Hutan Rawa Gambut, Kerjasama Wetlands Internasional, CCFPI, dan Wildlife Habitat Canada.
- Suryani, A. S. (2012). Penanganan Asap Kabut Akibat Kebakaran Hutan di Wilayah Perbatasan Indonesia. Aspirasi Vol. 3 No. 1, Juni, 59-75
- Wahyunto, S. Ritung dan H. Subagjo. (2005). *Sebaran Gambut dan Kandungan Karbon Pulau Sumatera/ Peat Distributions and Carbon Contents of Sumatera Island (Buku 1)*. Wetlands International-Canadian International Development Agency (CIDA) – Wildlife Habitat Canada.Bogor.
- Wibisono, I.T.C., Labueni S dan I N.N. Suryadiputra. (2004). *Rehabilitasi Hutan/Lahan Rawa Gambut Bekas Terbakar*, Leaflet Seri Pengelolaan Hutan dan Lahan Gambut. Kerjasamaantara Wetlands International, Wildlife Habitat Canada, Habitat Funnique Canada, dan Ditjen PHKA.