The Laloala's Customary Forest Development as Mitigation and Adaptation of Climate Change in the Binongko Island Wakatobi District, Indonesia

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ABSTRACT--This study aims to analyze: change in customary forest land cover, factors that cause changes in customary forest land cover, forms of temporary customary forest management and recommendations for sustainable management of the Laloala's customary forest in Binongko District, Wakatobi Regency. The research was conducted in Laloala's customary forest with an area of ± 172.48 ha using Arc GIS 10.3 to assess changes in land cover based on vegetation conditions and interview methods. The results of the study show that: the condition of land cover based on spatial data analysis from 2003 - 2015, namely primary dry land forest, has decreased in area from 36 ha to63% or 50% to 50.21%. The mixed dry land agriculture of 8 ha or 11.14%, an increase of 10 ha or 8%. Factors causing changes in land cover conditions are natural factors and human action factors. The current form of management, namely customary institutions that are still non-formal in nature and do not have written customary rules and social sanctions and local wisdom on the use of timber and non-timber forest products. The recommendations for sustainable forest management, namely: efforts to conserve the Laloala forest must be carried out in situ conservation and ex situ conservation, It is necessary to designate and designate Laloala forest as a customary forest area, regional regulations are made, formally form customary institutions, formulate written customary rules, restore forest functions, increase local knowledge and wisdom so that the Lalola indigenous forest remains sustainably sustainable.

Keywords--- Change in land cover, development, customary forest management, sustainable forest

1. **Introduction**

Climate change in the world, which was preceded by an increase in global warming as indicated by an increase in world temperature, has resulted in many climate changes leading to an extreme [1]. An increase in temperature between 1^0C-2.5^0C in 2030 has an impact mainly in tropical areas on changes in cropping seasons, reduced yields and distribution, and the risk of increased pest and disease attacks on plant populations [2].

The main cause of temperature increases on the earth's surface is the accumulation of greenhouse gases such as: H_2O (*Hydrogen monoxide*), CO_2 (*Carbon dioxide*), N_2O (*Dinitro oxide*), CH_4 (*Methane*), SF_6 (*Sulfur hexafloride*), PFC (*Perfluorocarbons*), HFC (*Hydro Fluoro Carbons*) and CFC (*Chlorofluorocarbons*) in the atmosphere [3]. These greenhouse gases come from human activities in the form of using fossil fuels and cutting down trees in the forest, both legally and illegally [4]. As a result of this human activity, it is believed that it causes greenhouse gases to

accumulate and the most in the atmosphere is CO_2 [5]. The existence of leaf-green trees in the forest is very useful, especially in preventing global warming along with the activity of capturing CO_2 in the photosynthesis process [6].

One of the forests that is currently still maintained according to its status is customary forest [7]. Customary forests are forest areas that are located in customary territories which are an integral part of the life cycle of their resident customary communities [8]. Indigenous peoples have a life that is very dependent on the existence of forest resources, so the existence of forest ecosystems should be managed with good local wisdom and prevent it from various damage factors [9]. The various factors that cause damage to forest ecosystems can lead to changes in land cover that have an impact on environmental degradation if indigenous peoples are not involved in managing forests in their customary law areas [10]. Forest management must involve the community, both those who live in and around the forest [11]. The fact that is relevant to various things, the statement explains that in rural areas, there is a belief that humans are part of the environment and environmental damage will have an impact on the surrounding community [12].

Binongko Subdistrict is one of the areas in Wakatobi Regency, Southeast Sulawesi that still has Laloala customary forest and has been used for generations. The indigenous people are aware that the Laloala customary forest is their source of life, so that its ecosystem needs to be preserved and managed wisely and wisely according to customary rules. Based on the description above, it is necessary to conduct research "Development of Laloala Customary Forest as Efforts to Mitigate and Adapt to Climate Change in Binongko Island, Wakatobi Regency".

Location and Time of Research

The research was conducted in Laloala Indigenous Forest, located between $5^0$55'13.92 "latitude and $124^0$2'7.49" east longitude at an altitude of 1-107 m asl which is administratively located in Binongko District, Wakatobi Regency, Southeast Sulawesi Province. The time of the research was April to August 2018. The Laloala Customary Forest has an area of ± 172.48 ha. The condition of the soil surface is dominated by a stretch of rocks and plants that grow on rocky soil structures (Lithosols) in dry climates. Land cover in Laloala Forest is primary dryland forest, savanna and mixed dry land agriculture.

The climate on Binongko Island is the same as the climate on other islands in Wakatobi Regency. The average annual rainfall reaches 1468.37 mm for 134 days, with an air temperature of 21.3^0C-35.4^0C, climate type C (Schmidt-Ferguson) and agro-climate type D [12], with wind direction consisting of two seasons namely Waha season or west season (rainy season: September – April) and East season or east season (dry season: April – August). The west wind season lasts from December to March and is characterized by frequent rain. The east wind season lasts from June to September where the wind blows from the east with high waves throughout the season. The season transition is called transition season which occurs in October-November and April-May.

Research variable

The variables observed in this study include:

1. The existence of Laloala customary forest includes: initial boundaries of customary law areas (customary forest), forest status and functions, and local wisdom regarding the use of timber and non-timber forest products in customary forests and changes in land cover.
2. Factors causing damage to customary forests, both natural and artificial.

3. Current forest conditions include: a) forest area and changes in land cover in Laloala customary forest. b) Forest management includes: whether there is a formal organization or institution for customary communities, written or unwritten customary rules the existence of customary communities in the form of an association.
4. Sustainable management efforts include: whether there are social sanctions or social institutions and legal instruments in forest management, regular planting efforts, whether there are in-situ and external conservation efforts, and whether or not there is local wisdom of indigenous peoples in managing and collection of forest products

Data analysis

The data obtained from the evaluation results then carried out data analysis, namely:

1. Analysis of Geographical Information Systems; the Geographical Information System analysis method was carried out to assess changes in forest land cover using land cover data for 2003, 2009 and 2015. Then an overlay was carried out on the Laloala Customary Forest land units in order to obtain changes in land cover, then conducted interviews and ground check at the research location.
2. Qualitative Descriptive Analysis; descriptive analysis method is used to provide an overview of a comprehensive assessment of the factors that cause changes in land cover of the Laloala Forest and what is the current state of management carried out by the community and forms of sustainable management.
3. Historical Analysis; data analysis was carried out chronologically history in the form of a descriptive presentation, which provides an overview of the boundaries of the sequence of activities and community involvement in the management of the Laloala customary forest from generation to generation.

2. Findings and Discussion

Status and Functions of Laloala Customary Forest Management

The Sara forest of the Binongko District community is a customary property which is managed as a place of protection and maintenance of various types of trees by the local community. The Sara forest is called Laloala, namely since they lived and is a legacy from their previous ancestors before the State of Indonesia became a Unitary State of the Republic of Indonesia which must be preserved.

The meaning of Laloala in the traditional language of Binongko (*mbedha-mbedha and cia-cia*) is the sara land in which there is a prohibition. Based on the research results, Laloala is a forest that has large trees and dense vegetation so that its management must be regulated by custom. Laloala forest resources are used for the needs of the general public. The status of land ownership according to the research results is such as tongkasi land, which is private property because it was the person who cleared the first land or the former community plantation. Ownership of custom has not changed its ownership rights, namely communal land which is jointly inherited from the previous ancestors. According to the type of the Binongko indigenous people, there are three types of land, such as Kaombo land in the Buton community [13,14,15,12], which are as follows:

a. Sara's land is land that is in a customary area that is managed jointly by custom and within it has natural resources such as forests in the form of wood which are useful for the benefit of many communities such as building mosques, baruga and others.
b. Owned land is a Tongkasi land that has been first managed by individuals and has been used for gardening or farming for generations for a long time.
c. State/Government land is land that is outside of Sara land and owned land that has never been touched or managed by the community since ancient times.

Changes in Land Cover in Laloala Customary Forest

The results of spatial data analysis using the Geographic Information System on land cover in 2003, 2009 and 2015 show that in the Laloala Indigenous Forest there has been a change in land cover [16]. The condition of existing land cover can be seen in Table 1 shows that overall from 2003 to 2015 the type of land cover for savanna (S) and mixed dry land farming (Pc) has increased in area while primary dry land forest (Hp) has decreased in size.

Table 1.Land cover in Laloala customary forest, Binongko District, 2003, 2009 and 2015

No.	Land cover	Land cover area (ha)			land cover change			
		2003	2009	2015	2003-2009		2009-2015	
					ha	%	ha	%
1.	Primary dry land forest	165.25	129.18	66.57	36	50.21	63	50
2.	Savanna/grassland	7.21	34.98	87.73	28	38.66	53	42
3.	Mixed dry land agriculture	0.02	8.31	18.17	8	11.14	10	8
Total Land Area (ha)		172.48	172.48	172.48	72	100	126	100

Source: Primary Data, 2018

Overall, changes in land cover that occurred from 2003 to 2015 were caused by natural factors and human factors. Initially around the Laloala Forest the people of Binongko often carried out their daily activities such as taking tree leaves for goat feed, collecting firewood and focused on other jobs such as collecting stones for farming roads and the houses of residents around the Laloala customary forest. An increase in population and an increase in community needs will have an impact on forest encroachment which can change the condition of land cover (Figure 1). The absence of formal customary institutions and the absence of written or unwritten customary rules also trigger the ease of forest encroachment.

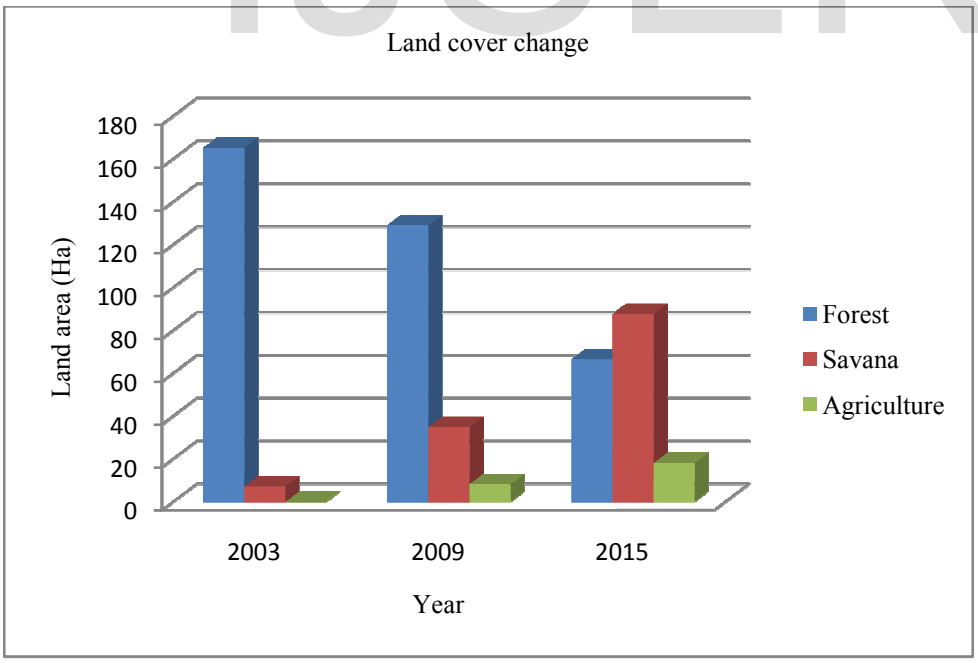

Figure 1.Graph of Change in Land Cover in Laloala Customary Forest per six years (2003 - 2015 period)

The Savana/shrubs (S) has increased in area every year, in 2003 - 2009 the area increased by 28 ha from the initial area of 7.21 ha to 34.98 ha with a change percentage of 38.66%. Then in 2009 to 2015 there was another increase in area of 53 ha from 34.98 ha of area, an additional area of 87.73 ha with a percentage change of 42%. Changes in land cover from forest to savanna or shrub land are caused by community non-compliance in utilizing forest products, starting with an increase in population accompanied by an increase in community demand for timber forest products and non-timber forest products, construction of agricultural roads that enter the Laloala Forest area, system dry land farming or shifting cultivation around the Laloala Customary Forest. The village government system has changed the habits of the community by ignoring the stories of the traditional chiefs or elders. The community assessed that forest resources are more useful if they are used according to their needs rather than just conserved, so that the forest area decreases.

Mixed dry land farming (Pc) experienced an increase in area in 2003 - 2009 by 8 ha from the initial area of only 0.02 ha to 8.31 ha with a percentage change of 11.14%. Then in 2009 to 2015 there was another increase in the area to 10 ha from an area of 8.31 ha to an additional 18.17 ha with a percentage change of 8%. Changes in land cover from forest and savanna to mixed dry land agricultural areas are caused by the shifting cultivation pattern carried out by the community by gardening until it enters the boundaries of the Laloala Forest with types of agricultural crops (food) such as maize, pumpkin, cucumber, cassava and others. Land management must be supported by good knowledge and application of appropriate technology in order to increase land productivity and shift traditional agricultural patterns to intensive farming patterns. A shift in agricultural patterns is necessary to restore the productivity of community land in order to balance the population growth in order to reduce forest damage.

Factors Affecting Changes in Land Cover

According to research results from the past until now, the extent of the Laloala Customary Forest has never changed its boundaries or its area has decreased only the vegetation has decreased due to the absence of customary institutions and customary rules in regulating forest management. The factors that cause changes in land cover conditions are disturbances to the forest caused by two factors, namely natural factors and human factors [17].

Natural factors include two forest fires that have scorched large logs, small logs and all the bush and drought or irregular climate change (monda hebhali-bhali). Meanwhile, disturbance to the forest caused by human actions can be in the form of a farm road that enters the Laloala Customary Forest so as to facilitate illegal logging, land grabbing, and plantation/agriculture. According to [18], changes in land cover occur due to human activities such as ineffective forest management and are closely related to climate change, which causes a decrease in land productivity in the region.

The increasing population in an area due to lack of employment opportunities has encouraged communities around the forest to open new land and use it as plantation lands and life support facilities. Then this can encourage residents to carry out land conversion continuously on various types of land cover in Laloala Customary Forest. The destruction of all aspects of life, including the Laloala Customary Forest, is because the current customary values are barely adhered to by the current generation due to their lack of understanding of the origins of the life of the Binongko people who depend on forest resources. Therefore, land management and development must pay attention to the sustainability of existing forests so that they do not have negative impacts, especially in relation to climate change. For this purpose, land suitability classification has an important role in determining crops suitable for soil and climatic characteristics. The term suitability relates not only to soil and

climatic conditions, but also to be ecologically suitable for the surrounding environment and economically viable and socially acceptable. The effective depth of the rock surface is one of the main limiting factors. Therefore, the need to break these barriers must be prioritized [18].

Forest Management (Elements of the Existence of Customary Law Communities)

The history of the early development of the life of the Binongko indigenous people who lived in the mountains until they were moved and started living on the coast in 1963 - 1972, they always adjusted to their environment, always making use of the resources available in Binongko's land. The Binongko indigenous people always interact with their daily environment to fulfill their long-lasting needs, at that time the indigenous people have begun to realize that their dependence on forest resources is something that cannot be separated. The Laloala Forest is a source of life that has revived the Binongko people from generation to generation, so it is important in preserving it, considering that the Laloala Forest is part of the culture of the community it self.

The Laloala Forest ownership system is shared property so that all communities can use it. This understanding resulted in uncontrolling community activities in utilizing forest products and causing damage. So that the idea or ideas that inspire the indigenous community today is that they have to regulate the management procedures for Laloala Forest because of their concerns about Laloala's function and its benefits such as the availability of timber and non-timber forest products in the future. The indigenous people realize that if the Laloala forest is damaged, there will be climate change, such as the area will be hot because the shade trees are gone, the shade trees will run out and the well water will taste salty due to the intrusion of sea water.

Dependence on forest resources is something that cannot be separated from the lives of indigenous peoples, such as wood for building materials to make their homes, general needs such as building mosques, Baruga, guard posts and so on. The customary law community realizes the importance of the forest for their lives in the future, so it is necessary to form a formal customary institution and must immediately formulate written customary rules and sanctions related to the management and use of forest resources to maintain the existence of Laloala Forest in a sustainable manner.

Society in the Form of a Community

Baruga is a gathering place for local institutions and the whole community deliberate or perform traditional ceremonies. The cultural rituals (customs) of the Binongko indigenous people are usually carried out by customary institutions, including: a) the riapa ritual (gratitude), b) welcoming the safar month: people are busy making tombole (Binongko's special food) and bathing in the sea known as Sauwara; and c) several ancient songs/rhymes (kabhanti) Binongko which contain messages about warnings of human life, advice, romance and longing. Binongko cultural elements that have been rooted in harrmonious daily life and need to be preserved, such as social service work, servants/helping, mutually reinforcing and staying in touch with each other.

Institutions in the Form of Customary Rulers

The customary institution (tudu ako) in managing the Laloala Customary Forest in Binongko District is still informal and there is no formal customary institution that regulates the management of the Laloala Forest. Customary institutions are very important, because they are a forum for uniting opinions, for compiling customary rules and for examining the development of all forms of customary activities in the region. According to the research results, customary institutions are very important in regulating the village as well as mediating in the event of conflict in the community by holding customary deliberations.

Indigenous Peoples' Legal Territory

The boundary of the sara land area owned by the Binongko customary law community, which consists of both ethnicities/communities, is from Loko Kampaam-Mpaa on the East coast of Haso to Loko Mosombu (Cia-cia) or Fatu Molombu/Fa'angku (Mbeda- mbeda) on We'e beach in the western part of Binongko Island. The Laloala customary forest is located on the western part of the Haso coast which extends across the administrative area of Rukuwa Village to Kampo-Kampo Village with an area of ± 172.48 ha.

Customary Law and Justice Institutions that Are Still Obeyed

Customary rules are written and unwritten and are adhered to by the indigenous community on an ongoing basis (interview results: Ibrahim Muslihi, La Rabu Mbaru and La Sarahi, 2018). Customary regulations are based on myths and are usually reinforced by stories or tales of parents and elders. According to belief, the words of the elders are usually lucky, so they must be listened to [19]. Management of the Laloala Customary Forest in Binongko District does not have written or unwritten customary rules, but there is still community belief about what parents say and the habit of not taking actions that destroy customs for fear of being punished (*bala*). It is necessary to make customary rules and sanctions in its management, both for Laloala customary forest, mangrove forest and so on. Currently, customary rules in forest management are only issues in the community or only verbally and unwritten, which do not have legal force in their implementation because there is no formal customary institution that becomes a forum for implementing them. These customary rules and social sanctions in customary communities that are only verbal must be agreed upon in the future and immediately made in writing so that they have clear legal force.

The customary leader in the customary law community has a community role model in each region. The customary leader has the right to admonish and advise Lakina Wali in the customary government of *Sarano Wali, Jau Palahidu* in the customary government of *Sarano Jou Palahidu and Bonto Popalia* to the customary government of *Sarano Bonto Popalia* in accordance with the customary government system on Binongko Island. For those who violate customary rules or rules of decency (both big and small) and order both according to religious rules and especially those who are arrogant and arrogant, the customary leader has the right to advise him. If someone commits acts of destruction and destruction who have been repeatedly given advice, but are still repeating it, then the customary leader has the right to swear and pray in his heart and accompanied by words (*batata* in the local language of Binongko).

Local Wisdom in Utilizing Timber and Non-Timber Forest Products

Local knowledge is the personality, cultural identity of the community in the form of values, norms, ethics, beliefs, habits, special rules accepted by the community and proven abilities to last. Soil fertility indicators according to the local wisdom of the Binongko indigenous people, such as vegetation diversity, soil depth, and the amount of soil attached to rocks. The presence of vegetation from *Lantana camara* L. is characterized by fertile soil, and the presence of *Imperata cylindrica* L. and *Eupatorium odoratum* L. vegetation is characterized by less fertile soils [12]. It is further explained that local knowledge is, in principle, a good value and a local culture of excellence related to broad geographical conditions.

Customary forest management must be carried out wisely. Communities who want to take wood from the forest according to its designation should first ask the customary head for permission. The use of wood must also be limited to a certain amount and should not be taken care lessling, both for the

needs of making houses and certain things that are allowed by custom [20]. The people of Binongko Subdistrict have local knowledge in determining the actions to be determined regarding the right or the right time at each phase in the tree planting conservation system and plant maintenance called *kutika*. The *kutika* is used in determining the exact time calculated based on astronomical and climatological knowledge by taking into account natural phenomena such as animal behavior, wind direction, hue colors during sunrise and sunset, cloud situations, location of constellations and others. This case is in accordance with Pranoto Mongso, the local wisdom of the Javanese community to determine the date of each plant or Parabela in the Buton community. The *kutika* is always applied by the community when carrying out a cropping pattern with a mixed farming system, such as planting various types of food crops, agricultural crops and forestry plants.

Management to prevent pests on plants is known as homali ritual. Homali is Pemali or Taboo in Indonesian which is a strong social prohibition against unwanted objects, words, actions by groups, cultures or societies [12]. The importance of Laloala Forest for the Binongko community is very real because the people always use Laloala forest products in their daily life. The management of the Laloala Customary Forest that is carried out by the Binongko community still has local wisdom values in it, but currently, not all of the Binongko people believe it. Local wisdom in the use of the Laloala Customary Forest is as follows.

Utilization of Timber Forest Products

Timber forest products in the Laloala Forest consist of various tree species such as taepa (*Mangifera indica*), ritta (*Alstonia scholaris* (L.) R.Br.), tolie (*Terminalia catappa* L.), koto (*Shorea* sp.), Turubau (*Swietenia macrophylla* King.), kafu-kafu rompo (*Bombax ceiba* L.), kau mohute (*Vitex cofassus*), Kosambi (*Schleichera oleosa* (Lour) Oken) and other tree species that do not have an Indonesian name, only the local name in Binongko is *solliti/cicipulu, talili/koru-koru, sangia/fou, you keme/kipi*, *koboha, you bae, you fande* and *you sumpe*. Timber forest products such as trees can be used by the community for their needs when there are people who want to build houses and also used for public facilities such as for the construction of mosques, baruga (places for holding customary activities), guard posts and other public interests. Including dead wood and wooden branches can also be used by the community from generation to generation either for individuals or other people who will carry out a celebration as firewood so as to reduce kerosene use and save community expenses.

Forest products should only be used for the benefit of the general public, but in reality at this time the wood is taken and traded as firewood and other private interests. Communities take forest products for various personal interests, resulting in forest destruction due to excessive or unlimited exploitation.

Utilization of Non-Timber Forest Products

The Laloala customary forest contains not only timber forest products, but also various non-timber forest products that are useful for the community, for example edible forest tubers such as kaufi-ufi or kandoa, the Indonesian names are gembolo tubers or hanging tubers (*Dioscorea bulbifera*) and kabhulu or hondo with Indonesian name is tuber gembili (*Dioscorea esculenta* L.). The types of fruit such as mango (*Mangifera indica*), kesambi (*Schleichera oleosa*) and other tree fruits. The types of traditional medicinal plants based on local wisdom of the Binongko customary law community such as tolie (*Terminalia catappa* L.) leaves for rheumatism, ritta (*Alstonia scholaris* (L.) R.Br.) sap, bark for ulcers, diabetes. The leaves of kambaragi (*Lantana camara* L.) are used for treating new wounds, diabetes, bambakuru (*Passiflora foetida* L.) the leaves are for diabetes medicine, Noni (*Morinda citrifolia* L.) leaves are used for jaundice and swelling in the stomach, puka (*Cassytha filiformis* L.) all of these plant organs are used to treat blood urine [21].

Sustainable Laloala Forest Management

Communities have to increase land productivity to keep pace with the increasing population in an area, this can be done by applying a more intensive agricultural system, namely the agroforestry system. Apart from that, land processing technology can be adopted that does not violate customary regulations as well as institutional roles that must exist so that in Laloala forest management there is more emphasis on paying attention to forest sustainability, not just productivity. This process must be supported and facilitated by the Wakatobi Regency Government by providing socialization or counseling on land management techniques. Counseling on the cultivation and processing of horticultural crops can also be provided to increase community income from their gardens outside customary forests to restore the condition of the previous forest.

Management in an effort to restore Laloala Forest to its original function, land rehabilitation measures can be carried out by implementing in-situ conservation and ex situ conservation. The conservation is carried out in the original place where the plant or animal is located, one of which is in a protected forest. Protection forest is a place that functions to protect plants from various factors that cause forest destruction.

3. Conclussion

Based on the research results, it can be concluded as follows.

1. Changes in land cover in Laloala Indigenous Forest are classified into three types of land cover, namely primary dry land forest in 2003 - 2009, which decreased in area to 36 ha or 50.21%, then in 2009 - 2015 it experienced another decline of 63 ha or 50%. Savana in 2003 - 2009 increased to 28 ha or 38.66%, then in 2009 - 2015 increased by an additional 53 ha or 42%. Mixed dry land agriculture in 2003 - 2009 increased to 8 ha or 11.14%, then in 2009 - 2015 increased by another 10 ha or 8%.
2. Factors causing changes in land cover conditions are natural factors including forest fires and irregular climate change. Factors caused by human actions can be in the form of construction of agricultural roads, illegal logging, land grabbing and shifting cultivation. Forms of change occur as a result of human responses to markets, technology, population growth, land degradation and community socio-economic factors, as well as the absence of formal customary institutions.
3. Management of the Laloala Customary Forest up to now there is no limit in the extraction of both timber and non-timber forest products as well as traditional medicines that benefit the community because there is no formal institution that regulates forest management, there are no customary rules written. Timber forest products are used to build boats or boats, mosques, new houses, offices, guard posts and community houses as well as for people who perform celebrations so they must be managed properly.
4. Restoring the status and function of the Laloala Customary Forest so that it is necessary to form a formal customary institution in forest management, customary rules and social sanctions in writing, community non-compliance can be carried out by extension efforts on forestry in order to increase the motivation of the community to manage the forest. Rehabilitate the Laloala Customary Forest to restore its function by implementing in-situ conservation and ex-conservation both in and around the Laloala forest. Increase local knowledge and wisdom in the use of timber and non-timber forest products in accordance with the culture of the indigenous people.

4. References

[1] Pringle, P. (2018). Effects of Climate Change on 1.5° Temperature Rise Relevant to the Pacific Islands. Pacific Marine Climate Change Report Card: Science Review, pp. 189-200.

[2] Setiawati, W., N. Sumarni, Y. Koesandriani, A. Hasyim, TS. Uhan dan R. Sutarya. (2013). Implementation of Integrated Pest Management for Mitigation of Climate Change on Chili Peppers. J. Hort, 23(2):174-183.

[3] Sudarman. (2010). Meminimalkan Daya Dukung Sampah terhadap Pemanasan Global. Profesional, 8(1):51-59.

[4] FAO. (2010). Impact of the Global Forest Industry on Atmospheric Greenhouse Gases. FAO. Rome. http://www.fao.org/3/i1580e/i1580e00.pdf

[5] Darkwah, W.K., B. Odum, M. Addae & D. Koomson. (2018). Greenhouse Effect: Greenhouse Gases and Their Impact on Global Warming. Journal of Scientific Research and Reports, 17(6):1-9. DOI: 10.9734/JSRR/2017/39630.

[6] Tkemaladze, G.Sh. & Makhashvili, K.A. (2016). Climate Changes and Photosynthesis. Annals of Agrarian Science, 14(2):119-126.DOI: 10.1016/j.aasci.2016.05.012.

[7] Nugroho, W. (2014). Konstitusionalitas Hak Masyarakat Hukum Adat dalam Mengelola Hutan Adat: Fakta Empiris Legalisasi Perizinan. Jurnal Konstitusi, 11(1):109-129.

[8] Ubbe, A., M. Karyandani, M. Fadli, R.J., Uno, S. Sedjati, M. Junef, dan Taufik, A.I. (2013). Peran Masyarakat Hukum Adat dalam Penanggulangan Pembalakan Liar. Laporan Penelitian Hukum. Pusat Penelitian dan Pengembangan Sistem Hukum Nasional, Badan Pembinaan Hukum Nasional Kementerian Hukum dan Hak Asasi Manusia RI. Jakarta.

[9] FAO. (2018). The State of the World's Forests 2018 - Forest pathways to sustainable development. FAO. Rome. http://www.fao.org/documents/card/en/c/I9535EN/

[10] Berrahmouni, N., Regato, P. and Parfondry, M. (2015). Global Guidelines for the Restoration of Degraded Forests and Landscapes in Drylands Building Resilience and Benefiting Livelihoods. FAO. Rome. http://www.fao.org/3/a-i5036e.pdf.

[11] Zaenuddin, D., A. Hidayat, dan T. Lesmana. (2014). Pengelolaan Hutan Berbasis Masyarakat. Pusat Penelitian Sumberdaya Regional Lembaga Ilmu Penelitian Indonesia. Bogor. Policy Brief 02. Bogor. http://psdr.lipi.go.id/images/download/Policy%20brief%2002%20hutan.pdf.

[12] Kandari, A.M., Hidrawati, U. Rianse, Muhidin, M. Iswandi dan N. Arafah. (2017). Local Wisdom as Adaptation Strategy in Suboptimal Land Management at Binongko Island, Wakatobi Indonesia. Biosciences Biotechnology Research Asia, 14(1):129-136.

[13] Adil, L.O. (2013). KAOMBO (Kearifan Lokal Buton tentang Hutan dan Lingkungan). Jurnal Sosiologi Dialektika Kontemporer, 1(1):1-3.

[14] Husain, M. Najib. (2014). "Kepemimpinan Parabela terhadap Sikap Masyarakat dalam Menjaga Kelestarian Hutan Kaombo di Kabupaten Buton". Disertasi Program Studi Penyuluhan dan Komunikasi Pembangunan, Universitas Gadjah Mada. Yogyakarta, Indonesia.

[15] Zalili, F. (2016). Hak Ulayat Masyarakat Hukum Adat (MHA) Rongi di Kabupaten Buton Selatan Provinsi Sulawesi Tenggara. Tesis. Program Magister Kenotariatan Universitas Gadjah Mada. Yogyakarta, Indonesia.

[16] Kolanus, F. (2011). Analisis Perubahan Penutupan Lahan di Hutan Adat Lekuk 50 Tumbi (Lempur), Kabupaten Kerinci Provinsi Jambi. Departemen Konservasi Sumberdaya Hutan dan Ekowisata, Fakultas Kehutanan IPB. Bogor.

[17] Mon, M.S., Mizoue, N., Htun, N.Z., Kajisa, T., and Yoshida, S. (2012). Factors affecting deforestation and forest degradation in selectively logged production forest: A case study in Myanmar. Forest Ecology and Management, 267:190-198. DOI: 10.1016/j.foreco.2011.11.036.

[18] Kandari, A.M., S. Kasim, M.A. Limi dan J. Karima. (2015). Land Suitability Evaluation for Plantation Forest Development Based on Multi-Criteria Approach. Agriculture, Forestry and Fisheries, 4(5):228-238.

[19] Cahyanti, I., Sukatman dan F. Husniah. (2017). Myth of Ritual Ruwatan in Madura Society in District Gending Probolinggo. Jurnal Edukasi, 4(1):13-19.

[20] Hermawati, D. (2016). Persepsi, Motivasi dan Perilaku Masyarakat AdatTerhadap Pengelolaan Kawasan Hutan (Kasus Kawasan Hutan Sekitar Desa Sindanglaya Banten). Departemen Manajemen Hutan, Fakultas Kehutanan, Institut Pertanian Bogor. Bogor.
[21] Indrayangingsih, W.O.I., N. Ibrahim dan S. Anam. (2015). Ethno Pharmacy Study of Herbal Plant in Buronese, Binongko Sub-District, Wakatobi Regency of South East Sulawesi. GALENIKA Journal of Pharmacy, 1(2):79-84.