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A MODEL OF ENVIRONMENTAL CONSERVATION FOR SAGARA ANAKAN

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Abstract

The decrease of agricultural land areas, which has an impact on the decrease of production and forest cover, is caused by human activities in fulfilling their needs. The activities cause changes in the ecosystem. The damaged ecosystem causes erosion, while landslide in the watershed has an impact on the sedimentation in the waters of Sagara Anakan. The issues and aims of this research were: to analyze the socio-economic influence of farmers in doing environmental conservation, the form of conservation conducted by the inhabitants by utilizing, an integrated conservation model, and the roles of the inhabitants in the conservation of the watershed and coastal region of Sagara Anakan. The research used a survey method, involving samples consisting of tershed and coastal areas. The analysis technique used statistics and geographic data to describe the characteristics of the watershed. The physical shallowing of Sagara Anakan is influenced by erosion and is quickened by human activities. The inhabitants conserved the watershed except for reforestation, while areas in the former swamp and coastal areas were not conserved. Because the physical conditions are different, the forms of conservations must be different. The socio-economic limitations of the inhabitants have a direct influence on conservation. Meanwhile, the areas that used to be swamps and the coastal area were not conserved, due to the impalpable physical conditions. To conserve the Sagara Anakan sea, the forms of conservation employed were tree planting, fishing restrictions, water dredging, waste disposal control, no use of chemical substances to catch fish and restrictions in the size of fish catched. Moreover, conservations had to be different and integrated, requiring the engagement of the inhabitants.

Keywords: *Environment; Socio-economy; Conservation model, Empowerment.*

Introduction

Population development causes a decrease in the agricultural land that has a direct impact on the decline of production and forest areas [1, 2]. It is a common knowledge that the life of human beings is inseparable from the environment because their needs are fulfilled by the environment through land utilization [3]. The major portion of the dominant theory of welfare economics is based upon the view that the wants of individuals are to be satisfied to the maximum extent made possible by the allocation of resources." An increase in the population is accompanied by an increase in the needs, resulting in a change in the environmental balance [4].

The main issues of the environment are water, deforestation, erosion, crisis in land, and destruction in natural resources [5]. The exploitation of the natural resources of the forest

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influences other natural resources. The forest is influential on three interrelated factors of the environment, namely climate, land, and water procurement for various areas. The ecological, economic, and social functions of the forest will be advantageous if the management of natural resources is accompanied by an effort of preservation in order to create a sustainable development [6]. The efforts of protecting the forest will be in vain if the farmers do not own a source of living [7, 8]. It means that the forest is useful for life if its existence is assured. Forest transformation to be made into mixed plantations and residences brings an impact on the increase of the dangers of erosion, causing a decline in the natural resources of the environment [9].

Physical development that will create a shift in the land function needs to be anticipated, so that land utilization can provide maximum results with minimum destruction; hence, a prosperous and responsible life will be achieved [10]. The environment as a totality of space with all materials, resources, situations and creatures, including human and their behavior that influence the nature, continuation of livelihood and human welfare as well as other creatures [11]. An environment as a totality of space (watershed) influences another space, namely coastal areas. Ecosystem is an environmental system that interacts with each other to form a unity [12]. In addition, the coastal area is a meeting of the land and the ocean. Because the condition of the coastal areas is influenced by the watershed, when the watershed experiences erosion, sedimentation will occur in the coastal areas [13].

The Sea of Sagara Anakan are the estuary of Tanduy and Beureum rivers that experience shallowing caused by a high level of sedimentation from the rivers and the level of sedimentation reached 1 million m^3/year [14]. Sagara Anakan has undergone a change in its area as an effect of mud sedimentation from Tanduy river, which contributes 740,000m^3 of mud out of the total 1 million m^3/year sediment that threatens the sustainability of the mangrove forest and causes a decrease in the productions of shrimps and fish bred there [15, 16]. While there have been changes in the area of Sagara Anakan sea, in 1984 Sagara Anakan had an area of 2,906hectares; in 1994 1,575 hectares, and in 2003 only 600hectares, which means that on average the area decrease is around 104.8182 hectares/year [17]. In 1974, the area of the mangrove forest was 15,551hectares, while in 2003 it became 8,506 hectares [18]. The mangrove forest in Sagara Anakan had an area of 13,500 hectares and experienced shrinkage due to land reclamation and mangrove wood logging [19]. The speed of the sedimentation has experienced an increase in 1931, when the inhabitants began converting the forests to agricultural land [20]. Meanwhile the mangrove forest is one of the potential natural resources and is significant for the society economically, ecologically, and biologically [21].

Erosion as the cause of land destruction is caused by the climate, organisms, parent material, relief, and time. the significant changes of the sedimentation process in Sagara Anakan is an effect of the flow of erosion of Tanduy river caused by the activities of the inhabitants in managing their lands from the upstream and the extension for new plantations in the steep slopes [22]. To restore the conditions, conservation is needed; hence, the functional relation between erosion and conservation is equal [23]. Conservation is a package of business farming technology aimed at increasing business farming production and income, and preserving land and water resources [24]. Soil transportation by the surface flow evokes land damage that disturbs the balance between farming and transportation processes. Land cover changes can have four major direct (or first order) impact upon the hydrological cycle and water quality; they can cause floods, droughts, and changes in rivers and ground water regime, and they can affect water quality [25].

The impact of the changes is on the decline in functions, ultimately Sagara Anakan sea, which experience shallowing and narrowing. The mangrove forest in Sagara Anakan is home to 85 species of mangrove forest birds: Centropusnigrorufus. Even the forest is frequently made a place for gathering by a flock of birds migrating from Australia. There has been a decrease in the number of fish species. In 1985, there were 45 species of fish, while in 1999 there were only

18 species and 15 new species [26]. In addition that, area of Sagara Anakan is home to a variety of birds protected under the law, such as hornbills, wood hawks, storks, egrets, and it is also a stopover for migrating birds, such as Asian kites (*Hirundorustica sp*), yellow bittern (*ixobrychus sinensis sp*) and sanderlings (*Calidris alba sp*). The mangrove forest has a significant role as the food source for sea animals [27]. The study of root system protects the beach from erosion, tides and waves, and also serves as a nursery ground and spawning ground for shrimp, fish, and snails [28]. The mangrove habitat is a place for the spawning of sea fish, so that the destruction of the mangrove forest will have an impact on the life of the fish [29]. The decrease in the quality of the environment causes a decrease in health and economic potentials and triggers transformations at the social levels [30]. The gap between the rich and poor is increasingly widened as a consequence of the decrease in environmental resources [31]. The degradation of environmental quality is increasingly felt-both directly and indirectly impacting on the economic, social, and cultural lives [32]. Conservation is conducted to lower land damage, especially one caused by erosion. Erosion has to be managed by developing the functions of the factors of erosion identical with conservation factors. The occurring erosion is a function of climate, relief, vegetation, soil, and human beings with the following formula:

$$E = f\,(c, r, v, s, h) \quad (1)$$

where E = Erosion, c = climate, r = relief, v = vegetation, s = soil, h = human being

To restore the environment, there need to be efforts in maintaining and protecting the environment. One of them is by conducting an integrated conservation. Conservation does not mean banning natural resources management and utilization, but the management is required to adhere to the principles of land conservation, so that natural resources can be inherited to the future generations [33]. Meanwhile, in the coastal areas, the conservation of fish resources is an effort of protecting, sustaining, and utilizing fish resources, including ecosystem, genetics for securing their existence, availability and their sustainability by continuously maintaining and improving the value quality and variety of sustainable fish resources.

Conservation in the watershed can be done by employing a method and form of conservation, which is different from the kind of conservation for coastal areas. Sagara Anakan sea needed to be limitations in conservation, so that suctioning, dredging, and monitoring are necessary for the dredged areas. To handle the impact can be done, to name a few, through environmental management planning using technological, socio-economical, and institutional approaches in the respective institutions. In addition, dredging in estuary of Meneng river at Sagara Anakan sea will also be conducted. In the restoration of the mangrove ecosystem, the society needs to be engaged in order for them to have a sense of belonging with the mangrove forest [34]. Their participation is related to the information on the condition of the inhabitants, their engagement in the development program - in its preparation and planning, because without their participation, the conservation will fail [35]. Meanwhile, the failure of conservation of coastal areas must be due to a lack of awareness of the nature of the fisherman communities and the cultures developing in the society. Society' awareness in protecting their coastal areas also requires initiatives of the government to empower the people, so that the society will have affection and a sense of belonging to their areas [36]. The factors influencing forest destruction are social and economic, comprising education, income, acreage, the frequency of socialization program, and intensity of farmers' activities [37]. Awareness of the importance of water resources commences from personal awareness, so that society will have an awareness to preserve and manage the resources [38].

The success of conservation program in the waters of Sagara Anakan is attributed to the inhabitants who live around it; hence, the program should involve the inhabitants utilizing the forests and the lands, namely farmers and fishermen respectively. Different regional conditions

mean that the conservation should be integrated, engaging various parties: the government, the institutions, and the inhabitants. The participation of the inhabitants in the conservation becomes a significant indicator for the success of the program. To improve inhabitants' participation, socialization can be done in order to make them understand the significance of the environment, so that they can maintain the quality of land and water and land resources for land sustainability and preservation [39]. Environmental preservation is achieved through conservation, because conservation is an attempt of sustainable maintenance and protection of resources existing in the watershed and Sagara Anakan waters. The environment is a totality of space with all materials, resources, situations and creatures, including human and their behavior that influence the nature, continuation of livelihood and human welfare as well as other creatures [11]. Conservation for watershed and coastal areas need to be integrated and varied according to the conditions of the regions, so that the level of erosion in the watershed can decrease and the coastal areas will not experience shallowing and narrowing.

Based on the fact that Sagara Anakan, which has multiple functions, is experiencing a decline in its functions, conservation is deemed necessary. Thus, the aims of this research are:

- To analyze the socio-economic influence of farmers in doing environmental conservation in Sagara Anakan.
- To analyze the form of conservation conducted by the inhabitants by utilizing the land and waters of Sagara Anakan.
- To make an integrated conservation model for the watershed and coastal areas of Sagara Anakan.
- To analyze the roles of the inhabitants in the conservation of the watershed and coastal areas of Sagara Anakan.

Methods

Geographically, the area under research is located between 108° 01'15.66" E – 109° 00'00" E and 7° 01'12.96" S – 7° 46'44.4" S. The area covers the watershed of Tanduy and Beureum rivers and the Sagara Anakan sea which will then be called Sagara Anakan environment. The area studied is a conservation conducted by the inhabitants who cultivate the land along the watershed and coastal areas of Sagara Anakan.

The upstream of Tanduy River is flowing from Majalengka Regency and Beureum river from Brebes Regency. In the estuary of the watershed, there is KampungLaut Sub-district, consisting of four village administrative units, Klaces, Ujungalang, Ujunggagak, and Panikel. It was previously named Kampunglaut because the majority of its inhabitants used to live in the Sagara Anakan sea. Today, the village is no longer erected on the waters; there are no longer houses standing on top of the water; instead, they all have transformed into houses standing on land due to sedimentation.

The research focused on land management by the inhabitants along the watershed of Tanduy and Beureum rivers that have an impact on the activities in Sagara Anakan, such as on fishery, trade, transportation system, and tourism, which are increasingly in decline. To analyze the influence of inhabitants' activities in the conservation of the watershed of Tanduy and Beureum rivers that flow through its delta in Sagara Anakan, a survey on the land cultivated by the inhabitants has been conducted. The large number of population with a relatively small sample prompts the use of survey method [40]. Survey method is limited to the understanding of sample under research, where the information is gathered from a part of the population to represent the whole population simultaneously [41]. The relatively small number of samples, nevertheless, can represent a large population, so the sample of respondents from the inhabitants managing the land in the upstream, middle, downstream, and coastal watersheds. Thus, the research employed survey method.

The population was the inhabitants who managed the land along the watershed of Citanduy and Cibeureum and Sagara Anakan waters. Due to the large area under research, the samples were taken from those living in the upstream, middle, downstream, and coastal watersheds. To determine the number of samples, Slovin's formula was used (Taro Yamane). The size of the farmer population is around 632,213 with the level of reliability of 5%, so that the number of samples taken consisted of 240 respondents spread in the four parts of the watersheds.

To gain data from the respondents who managed the land, research instruments were used. The instruments were developed based on the variables of research, such as:

- The socio-economic, comprised of income, knowledge, and land ownership.
- The form/model of conservation conducted by the farmers and fishermen.

To gain data from the respondents, the following steps were taken:

- Questionnaires were distributed so that the respondents could answer questions pertaining to the ways the inhabitants cultivated their agricultural land.
- Field survey was conducted to examine the form of conservation both in the land managed by the farmers and in the coastal areas by the fishermen.
- A documentary study of previous research, remote sensing image, research results, journals, regulations, and the like was done to support the research.
- A literary study was done by collecting data from various textbooks to support theoretical foundations that corroborate the issues studied.

The examined variables are divided into dependent and independent variables. The exigent variables are Income, Knowledge, and Land Ownership. This kind of variable has an effect on the endogen variable, namely participation. Statistical and geographical analyses using check-list were conducted based on the form of conservation conducted by the inhabitants in managing their land.

Results and Discussion

Sagara Anakan sea are the estuary of Tanduy and Beureum rivers, and the stream are bordered with Nusa Kambangan Island. Along the watershed to the estuary, there lies KampungLaut Sub-district, which consists of four village administrative units, namely: Klaces, Ujung Alang, Ujung Gagak, and Panikel. The activities of the inhabitants of this Sub-district are highly influenced by the potentials of Sagara Anakan Waters. The activities are pertaining to the livelihoods of the inhabitants; there are, for instance, fishing, transportation service, and trade. This means the sustainability of the lives of these inhabitants in the surrounding of Kampung Laut Sub-district is highly affected by the potentials of Sagara Anakan sea. What trigger the issues are shallowing and narrowing of the waters, which eventually impact on income earned (Fig. 1).

The degradation in the functions of Sagara Anakan sea is caused by sedimentation: shallowing and narrowing of the waters occur because of the materials from sedimentation derived from the rivers which flow to the waters as their estuary. Some of the inhabitants take advantage of and utilize the potentials of Sagara Anakan, while the activities of some other inhabiting the surrounding of the watershed are dominated by farming.

Climate is the average weather condition with the indicators of rainfall, temperature, moisture, altitude, vegetation and geographical location of an area. Based on geographical location, the area under research can be said to have a tropical climate. A rather complete set of data on rainfall can be found in Cilacap and Ciamis regencies with an average precipitation of

2219mm/year [42]. The rainfall is varied, and dry season is spread quite consistently between April and September. The distribution of rainfall becomes the guide for planting in farming.

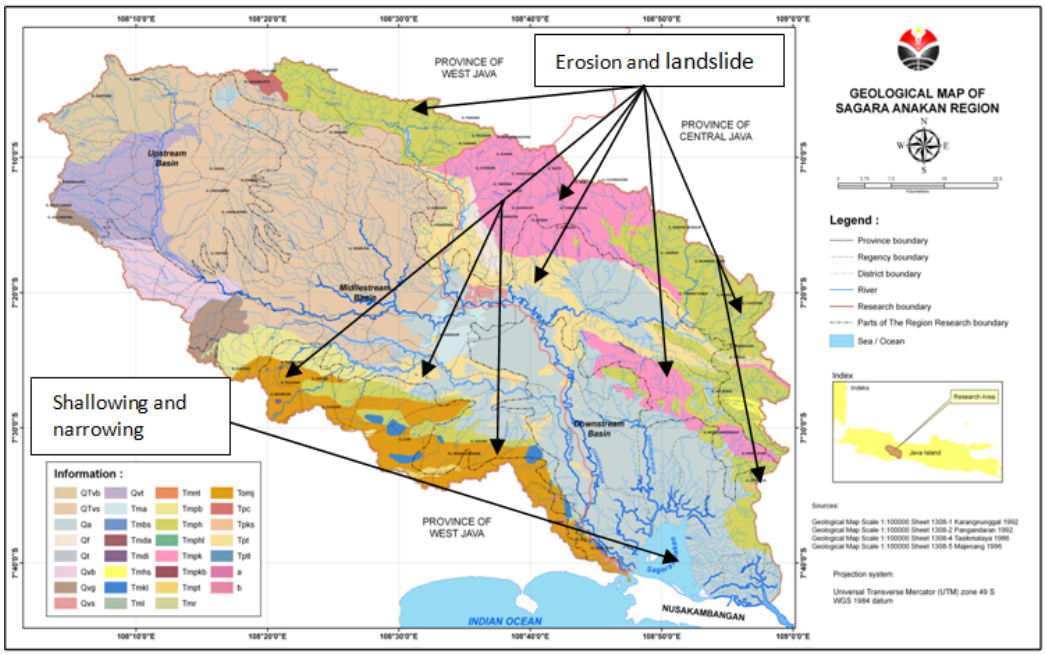

Fig. 1. The Geology of the research area [17, 43-46]

The types of rocks that can be foundin Tanduy and Beureum watershed [43-46] can be categorized into the following:

a. *Qvs* are rocks derived from the eruption of young volcanic mountain spread around the Peak of Galunggung Mountain. The materials produced by the eruption are volcanic breccia, lava, and tuff, composed of andesite and basalt.
b. *QTv* are rocks derived from the eruption of old volcanic mountains that can be divided into *QTvs, QTvk, QTvb, QTvd, QTvr, QTvc and QTvt*, with materials consisting of volcanic breccia, lava, and tuff, composed of andesite and basalt.
c. *Qa* and *Qf* are rocks formed because of the process of sedimentation with smooth materials, such as clay, sand, and gravel.
d. *Tpt* are categorized into Tapak formation, composing of materials, such as grayish-rough sandstone and interspersed with marl-sand; the rocks are yellowish, grayish and easily eroded.
e. *Tmph* are classified into Halang formation with turbidite, a combination of sandstone, clay stone, silt, with materials consisting of volcanic breccia and limestone (soluble).
f. *Tmpk* are categorized into Kumbang formation with materials of volcanic breccia, lava, dikes, and tuff, composed of andesite and basalt which are resistant to erosion.
g. *Tmnt* are included under Nusakambangan formation with materials of tuff, lapilli tuff; tuff sand, and gravels interspersed with sandstone; they are resistant to erosion.
h. *Tmkl* are categorized into Kalipucang formation with materials derived from the fossils of coral reef animal consisting of limestone reef. These rocks are resistant to temperature, but they are soluble, so that erosion can be expedited by human's activities.

i. *Tmr* are categorized into the formation of Rambatan, consisting of sandstone, limestone, and conglomerate, interspersed with marl layer and flakes on the bottom. The property of the flakes and marl is that they are prone to erosion, while limestone is soluble.
j. *Tml* are classified into Lawak formation with materials of greenish marl, interspersed with limestone. The upper part composes of globigerina marl with insertion of sandstone, and the properties of the material are prone to erosion and soluble.
k. *Tpc* are classified into Cijulang formation, consisting of volcanic breccia, lava, and dikes, consisting of andesitictuff and sandstone tuff. The materials are resistant to water, so that the potential for erosion is low.
l. *Tmhg* are categorized into Gununghurip formation composed of turbidities, volcanic breccia, sandstone, flakes, and conglomerate; and they are resistant to water.

The types of soil explained below are based on the data from Soil Research Center by using the system of Dudal Soepraptohardjo 1957 [47, 48]. The watershed of Citanduy and Cibeureum are layered by these types of soil.

Alluvial is a type of soil formed because of clay deposits that are spread in sloping plains, with a property of low absorption for water and is prone to be flooded, but resistant to erosion. Regosols are considered young soil with a rough texture, single grain with acrumb structure, loose consistency, a pH of 6.0-7.0, and is easily eroded.

Andosol develops up to the height of 3,000 meters from volcanic materials which are not integrated, with a pH of 4.5 to 6.0, a color of brownish-black, crumb structure, high organic materials, high erodibility, high porosity, and is spread in the upstream watershed. Gleysols are soils formed by a process of sedimentation with a solum less than 1 meter, grey in color, has a clay-loam texture, solid structure, solid and plastic consistency, a pH of 5.0-6.0, low organic materials, and are spread in the downstream of the watershed. Organosol is formed byfossils accumulated overtime, with the properties of a texture of clay, a lumpy structure, a pH below 6 and high with Bo that form gambit layer; they are spread in the area of the mangrove forest. Grumusol develops in an altitude of less than 300 meters with a clay-loam texture, granular surface structure, low Bo, experiencing wrinkling, and high consistency, causing weathering from limestone, marl, tuff, alluvial sediment, and volcanic ashes that are soluble. Latosol experiences intensive weathering, advanced development, and washing with a smooth texture, crumb structure, low Bo, a pH of 4.5-5.5, friable consistency, and silica washing. Mediteran develops from parent material of limestone with a rough texture, lumpy structure, low Bo, a pH of 6.0-7.5, and it contains lime concretion and iron and is easily soluble; it is spread in the middle-downstream watershed area and the hills. Litosol develops in the hills and is easily eroded, with a shallow depth, no profile development yet, and is generally caused by strong erosion; it is spread in the upstream and middle-stream watershed areas.

Sagara Anakan waters are the oceans, which are the estuary of Citanduy, Cibeureum, and other small rivers bordered with Nusa Kambangan Island. The ebb and flow of the sea affect the flow of water from the land; hence, all the flows from the land are blocked by the current from the Indian Ocean. The flow carries materials from erosion which are precipitated in the sea, so that the sea becomes shallow, and a delta is consequently formed. The waters become narrow because of sedimentation.

The land along the watershed is utilized for various activities of the inhabitants. The usage of the land based on the analysis of Landsat image in 2005 was classificated as follow [49]:

a. Forests and mangroves-containing various types of vegetation which serves to protect the balance of the ecosystem spread in the upstream watershed, mountains, and a minority of them is spread in the middle part of the watershed. Meanwhile, the mangrove forests are spread in the downstream part of the watershed and the coastal areas. Because erosion from the upstream is precipitated in the land that becomes flooded, mangrove develops.

b. Garden/plantation - both managed by the inhabitants and the government or private companies. The plantation managed by the inhabitants is not really appropriate with the rules of conservation; hence, the potential for erosion is greater than the one managed by the companies.
c. Moor - a dry farm managed by the inhabitants with seasonal plants, which is always managed routinely so that the land becomes fertile.
d. Residences are lands utilized by flattening the land, making it possible for erosion to occur from the flattened land and causing the absorptionto lower.
e. Paddy field - a land utilized for planting rice using a system of terracing, but with impermeable soil, so that the field will be flooded when it rains. Paddy fields are spread in the upstream, middle, and downstream watersheds.
f. Bushes - part of the land unmanaged by the inhabitants, even though they used to be.

Bushes are spread in the upstream, middle part, and downstream of the watershed. From the analysis of Landsat imaging data in 2005, the following were gathered:

Table 1. The Areas of Land Utilized in the Watershed of Citanduy and Cibeureum

No	Land utilized	Area (km^2)	Percentage (%)
1	Forest	697.30	15.79
2	Mangrove Forest	10.30	0.23
3	Garden/Plantation	2055.00	46.52
4	Field/moor	248.40	5.62
5	Residences	310.70	7.03
6	Paddy field	801.20	18.13
7	Rivers/bodies of water	284.50	6.44
8	Bushes	9.33	0.21
	The area of the watershed	4.417.13	100.00

The above table demonstrates that the area of the forest is only 697.30 km^2 (15.79%), whereas the forest serves the functions of water reservoir, water absorption, and soil foundation. The area of plantation and garden is 2,055 km^2 (46.52%). Lands utilized that are potential for erosion to occur are garden, moor, paddy field, and residences.

The main activities, which are daily routines of the inhabitants, are those pertaining to their livelihoods [50, 51]. The main sectors of employment are shown in table 2.

Table 2. The Livelihoods of the Inhabitants Based on the Areas of the Watershed

No	Regency/City	Percentage	Farming	Industries	Trades	Services	Total
1	Garut Regency	3.37	10,108	9,087	4,251	1,000	24,446
2	Majalengka Reg.	16.62	26,919	4,027	16,931	3,662	51,539
3	Sumedang Reg.	1.24	2,041	250	781	144	3,216
4	Kuningan Reg.	23.05	42,655	2,445	17,219	2,753	65,072
5	Tasikmalaya Reg.	12.52	35,772	16,834	14,201	2,944	69,751
6	Ciamis Reg.	64.28	176,814	38,672	70,074	6,130	291,690
7	Cilacap Reg.	64.39	172,254	112,434	85,522	59,825	430,034
8	Brebes Reg.	5.97	22,696	5,292	10,925	6,422	45,335
9	Banyumas Reg.	4.48	7,173	8,156	6,764	6,612	28,705
10	Tasikmalaya City	19.60	2,156	9,088	7,284	2,073	20,601
11	Banjar City	95.04	8,107	2,901	10,855	2,284	24,147
	Total		632,213	291,045	307,125	137,442	1,054,536

The above table demonstrates that the inhabitants who rely on farming for their lives predominate, and this predomination will have an impact on the potential for erosion. Kampung Laut Sub-district of Cilacap Regency consists of four village administrative units which are separated by a strait. The villages are connected with civilian-owned shipping, using boats and ships [52]. In 2004, ferries and large boats stopped operating because Sagara Anakan experienced shallowing. Therefore, they have been replaced by motor boats, connecting

Majungklak - Karanganyar - Ujunggalang only once, while the route of Majingklak to Cilacap and the other way around can only be done via chartered boats or ships.

Socio-economic influence

The result of statistical analysis shows that variable X_{123} (socio-economic) influences Y (participation). The result also demonstrates that there is an influence of X_1, X_2, X_3 on Y as much as 29%, and the rest 71% is influenced by other factors. This means that the conservation of the watershed will be conducted if it is made a requirement of land management, but the coastal areas are not conserved because it is not made a requirement. The lower the socio-economic life of the inhabitants, the higher their participation is.

The form of conservation

Vegetative, mechanic, and chemical methods were employed by the inhabitants because they are the requirements for land management in order to achieve maximum results. The form that was not applied was only reforestation because it will influence the production. Plants frequently lack sunlight, so that production is low and there is vulnerability for crop failure, particularly in the upstream watershed. Meanwhile, in the downstream watershed, the land that used to be swamps and coastal areas are more specifically difficult to be conserved with the method because of flat slopes and a number of basins, so that in the rainy season, the areas are always flooded and experience crop failure. The areas that used to be swamps and coastal areas should be preserved with a method different from the one used for Sagara Anakan.

Conservation model

The models of conservation are: a) tree planting, b) no fishing, c) dredging, d) no trashing, e) no using chemicals to catch fish, and f) catching certain types of fish only. With a unique form of conservation and disparate from the one applied for the watershed, the waters will thrive. The conservation must always be conducted both individually, in groups, and with the government. With the same reason that farming areas are to be conserved by farmers, conservation for coastal areas should also be done by the fishermen. But the absence of the equipment and technology owned by the inhabitants need the government's intervention and assistance for the conservation of Sagara Anakan waters.

The Roles of the Inhabitants in the Conservation

Conservation is closely related to the socio-economy of the inhabitants. If the land is damaged, the sustainability of the resources will decrease and eventually this will impact on the sustainability of life and development. To keep the resources sustainable, the roles of the inhabitants supported and empowered by the government are needed in doing the conservation. This means that conservation has to be done in the watershed and coastal areas with different models and integrated, involving inhabitants, private and public institutions.

Conclusions

The inhabitants managing the land for farming have done conservation activities in various methods and forms, except forestation, but erosion still occurred. Erosion was influenced by the physical condition of an area prone to erosion. Nonetheless, conservation still had to be done. Thus, our research has drawn the following conclusions:

- In managing the land, the inhabitants always conducted conservation activities, even in the steep and easily eroded slopes. Therefore, the area needs to be reforested. However, the socio-economic needs demand land cultivation in areas prone to erosion.

- The method and form of conservation was applied by the inhabitants along the watershed, because conservation was a requirement, but the inhabitants who cultivated the land that used to be swamp and the coastal areas did not do conservation optimally, because there was no requirement for that. The area has to be conserved by planting trees, no fishing, dredging, no trashing, no using chemicals to catch fish, and catching certain fish only.
- The conservation model has to be done both individually, in groups and with aid from the government. Because farming areas are conserved by farmers, coastal areas must be conserved by fishermen and the government. In addition, conservation of the watershed and the coastal areas must be integrated and with different models.
- Environmental sustainability has to support the sustainability of life and development. Hence, conservation must be done to support the attempt of preserving the sustainability of the ecosystem. Thus, an integrated conservation must be done, by involving the inhabitants, the private and public institutions.

For the sustainability of life in the waters of Sagara Anakan and in an attempt to conserve the waters, the following steps are recommended:

- For a land with a physical property of being prone to erosion, reforestation should be done through forest management by the inhabitants and monitored by the government through empowerment.
- The form of conservation in the watershed and in the coastal areas should be different, so that the government along with the private institution and the inhabitants must do conservation by dredging the waters in order to support the sustainability of the potentials of Sagara Anakan sea.
- Conservation must be integrated, involving the government, private institutions, and the inhabitants.

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