Development Model of Community Forest in Bulukumba Regency, South Sulawesi, Indonesia

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Abstract. Forests as a model of national development have significant benefits for the living and livelihood of society. It gives balance and dynamic benefits in either ecological, socio-cultural or economic sides. The study aims to develop a development model of community forest in Bulukumba Regency, South Sulawesi, Indonesia. The selection of respondents was carried out purposively, namely selecting respondents who were involved in community forest management. Methods of data collection in this study were conducted through interviews, discussions, questionnaires and field surveys. The respondents came from various experts and stakeholders related to community forest development activities. The secondary data collection was obtained from literature sources and documents from related institutions with this research. The analytical method used is a dynamic system analysis method for community forest development in Bulukumba Regency consisting of needs analysis, problem formulation, system identification and model simulation. The research result showed that the dynamic model of community forest management was built with three (3) sub-models, namely; community forest area, community forest production, and economics of the community forest. The scenarios built in this community forest development model are a combination of four (4) aspects, namely the policy of community forest development, the effectiveness of the nursery, the management system and the existence of counselling. The simulation result of the community forest development model in Kajang District was the optimistic scenario..

1. Introduction

Forests as a national development model have real benefits for the living and livelihood of the Indonesian society. It happens either ecological, socio-cultural or economic benefits are balanced and dynamic. For these reasons, the forest must be sustainably managed, protected and utilized for the welfare of Indonesian society, for both present and future generations.

Community forests are generally recognized as a successful program in rehabilitating forest condition and contributing to the development of local communities. A research was done by Chapagain, and Banjade [1] indicated that community forest is significant in increasing the income of communities around the forest. It needs collaborative action between government, community, and stakeholders in reducing the poverty of community living around the community forest.

Cronkleton, at all, stated that reducing emissions from deforestation and degradation will depend on rural communities to manage forest resources. Thus, forest management by the local community can be an option by recognizing the factors that influence the institution in community forest management [2].

Community forest management in Indonesia has developed since many years ago. It is cultivated by Indonesian people; even the management is still done traditionally. Community forest management conducted by the community is still self-supporting with pure self-service without any government

intervention, either done in monoculture pattern or with mixed cropping pattern with agroforestry system [3]. Besides producing wood, the community forest in Indonesia also producing nontimber or wood which has economic value and can support food security. The areas of community forests in South Sulawesi Province are about 295,000 hectares scattered in all regencies/cities [4]. Moreover, the vast forest in Bulukumba District ± 22,148,04 Ha spread in ten districts.

One of the patterns of forest vegetation rehabilitation is by developing community forests. Therefore, community forest management by involving the community should be supported by a proper understanding of the function and role of forests for the living and life itself. A research done by Nuraeni et al. [5] showed that the variables of community knowledge about the benefits of forests have a direct and significant effect on people's behavior in managing community forests. It was found that the higher the knowledge of farmers about the benefits of forests, the better the behavior of farmers in managing community forests.

The communities managing forests are profoundly influenced by their traditions and cultures, where the kinship system is integrated with local knowledge and wisdom that matches the way of life and community needs. The concept of conservation is instilled in youth through various activities, and leaders act as good examples of the way of living their life [6].

Race & Millar stated that stakeholder analysis is being used in identifying communities or group of society most affected by the impact of development activities [7]. This analysis also gives massive benefit in determining priorities about the community or community groups needed in the implementation of activities and beneficial to their development. An activity can benefit some people, but it can also harm other people. It is inline that the stakeholder analysis is usually associated with several elements, such as; the existence of community groups, the impacts, and consequences that arise from the implementation of development programs. Thus, this study aims to develop a model of community forest area development in Bulukumba Regency, South Sulawesi, Indonesia.

2. Materials and Methods

This research was carried out in the community forest area of Kajang District as one of the districts that have the most extensive community forest in Bulukumba Regency, South Sulawesi, Indonesia. The respondents are community forest communities and stakeholders involved in community forest management in the region.

The selection of respondents was carried out purposively, namely selecting respondents who were involved in community forest management. Methods of data collection in this study were conducted through interviews, discussions, questionnaires and field surveys. The respondents came from various experts and stakeholders related to community forest development activities. The secondary data collection was obtained from literature sources and documents from related institutions with this research. The analytical method used is a dynamic system analysis method for community forest development in Bulukumba Regency consisting of needs analysis, problem formulation, system identification and model simulation. The formulation of alternative design or scenario of community forest development model was constructed from three sub-models, namely; community forest area, community forest production and economic sub-model of the community forest.

3. Results and Discussion

3.1. Design and Model Structure

3.1.1. Sub Model of Community Forest Area.

The sub model of community forest area includes components that cause changes in community forest area, namely; conversion of plantation land to community forest which causes the increase of community forest area. Component of land utilization of nursery and conversion of forest land to other function is an aspect which caused the decreasing of community forest area. This sub-model is heavily influenced by community forest development policies and nursery effectiveness. The width of the

community forest affects production through the number of trees planted. It was based on available land capacity and varies by type of timber and commodities.

3.1.2. Sub Model of Community Forest Production.

The community forest production sub-model described the dynamics of the production of various timber and other commodities. This sub-model includes aspects of growth, as factors that increase production (inflow) and the proportion of natural dies and harvest as an aspect that causes the decrease in production (flow). This sub-model is strongly influenced by the management system due to the management system itself and the existence of extension agencies. It is as a result of the management system affects the proportion of land use per type of timber and commodities whereas counseling can affect the annual production. The harvest component is part or fraction of production appeared in the form of a volume of processed wood and fruit or rubber latex. The harvest rate is directly influenced by the economic sub-model because it determines the amount of income.

3.1.3. Sub Model of the Economics of Community Forest.

The sub-model of the economics of community forest shows the dynamics of revenue generation based on the difference between revenue and expenditure. In this sub-model, the harvest receipt component and expenditure component are included which consisting of nursery cost, tax, and maintenance cost. Besides explaining the change in income and expenditure, in this sub model, it is also calculated per capita income from the amount of income and the number of farmers managing the community forest.

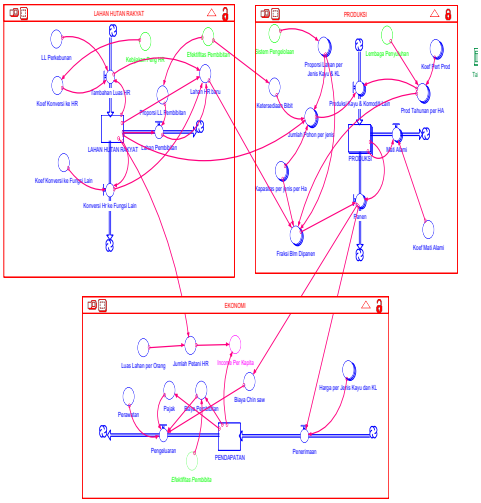

Figure 1. Structure of Dynamic Model of Community Forest Development in Kajang District, Bulukumba Regency

3.2. Scenario and Model Formulation

The scenarios built in this community forest development model are a combination of four (4) aspects, namely; community forest development policy, nursery effectiveness, management system and counseling presence. The policy of community forest development consists of two (2) categories, namely: (1) Without the widening of community forest area and (2) Widening community forest area for about 5-10%. The effectiveness of the nursery consists of three (3) levels, namely; (1) To supply about 25% of the land capacity, (2) To support about 50% of land and (3) To support 100% of the land. The management system consists of three (3) levels, namely; (1) Monoculture (bitti), (2) Polyculture (mixture), i.e., bitti, local teak, white teak and mahogany, sengon; and (3) Agroforestry, i.e., bitti, local teak, white teak, mahogany, sengon, cocoa, langsat, and rubber. The counseling consists of; (1)

Ineffective counseling and (2) Effective extension. The combination of four (4) factors that are scenarios will be simulated with a 35-year time rime with an interval (time state) each year.

3.3. Scenario Simulation of Model Dynamic

Based on the dynamic model simulation results, the estimation result within 35 years in four (4) aspects, namely; community forest management policy, nursery effectiveness, management system and extension existence. The combination of these aspects resulted in four scenarios for the development of community forests:

1. The pessimistic scenario, it was done without widening the community forest area, supplying about 25% of the land capacity for nursery effectiveness, monoculture, and ineffective counseling.
2. The optimistic scenario, it was done with widening the community forest area, supporting 100% of nursery land, agroforestry, and effective counseling.
3. The Moderate scenario 1, it was done without widening the community forest area, supporting about 50% of nursery land, polyculture, and effective counseling.
4. The Moderate scenario 2, it was done by widening the community forest area, supporting about 50% of nursery land, polyculture, and ineffective counseling.

3.3.1. Pessimistic Scenario.

The simulation results of pessimistic scenario 1 indicated that the policy without widening the land area, then the forest area will decrease. The effectiveness of bitti seed breeding from year to year will also decrease due to ineffective counseling. Bitti plants are produced in the 12th year and will decline until the 35th year so that will affect the farmer's income which will decrease as well.

3.3.2. Optimistic Scenario.

Scenario simulation results showed that the widening of the community forest area about 25% will increase income and income per capita, which is the 16th year per capita income becomes 103,810,626 with the widening of the community forest area up to 259.39 Ha. The number of timber trees, i.e., local teak, white teak, bitti, mahogany, and sengon increased up to the 25th year as well as other commodities such as cocoa, rubber, and langsat. The income per capita and community forest farmers' income increase as well. The number of community forest farmers increased until the 25th year. Similarly, incomes increased until the 34th year, and income per capita increased until the 16th year (103,810,626.60). The Bitti plants were produced in the 12th year of 3,430 which experienced peak increases compared to other plants. The local teak is harvested in the 15th year with a production of 1,542.16. Sengon is produced in the 9th year (220.82), white teak is produced in the 7th year (1,379.87) and mahogany in the 10th year (1,265.85).

In other commodities, such as; cocoa, rubber, and leachate show that the highest commodity is rubber, compared to cocoa and langsat commodities. It appears where the rubber commodity produced 545,275.97 in the 6th year followed by cocoa harvested 41,166.12 in the 5th year and langsat 3,066,920.92 in the 10th year. Harvest for the white teak, local teak, bitti, mahogany, sengon, rubber described the bitti harvest 3,235.22 in the 12th year; the local teak harvested 1,581,66 in the 16th year. It was followed by white teak harvested 1,323.91 in the 8th year, sengon is harvested 206.12 in the 10th year, and mahogany was harvested 1,241.36 in the 11th year. For rubber commodities harvested 543,348.35 in the 6th year, cocoa is harvested 41,166.12 in the 5th year and langsat 2,454,489.55 in the 10th year. This indicates that the rapidly harvested white teak is in the 8th year, but the massive harvest of bitti is harvested in the 12th year. For the commodity of Multipurpose Trees Species (MPTS) that is cacao which is quickly harvested in 5th year but rubber with the more significant amount of harvest that is in 6th year.

3.3.3. The Scenario of Moderate 1.

The simulation result of scenario 3 is moderate 1 indicates that without widening the community forest area and the number of community forest farmers will decrease from year to year. Moreover, the peak increases in income per capita and income in the 16th year. It shows that the number of trees per timber decreases every year. This is because without widening the land area of the community forest.

The number of community forest peasants declined from year to year. The increase in per capita income and income increased in the 16th year and there was a moderate decline. The production of white teak, local teak, bitti, mahogany and sengon shows that the highest production can be seen on sengon up to 190.3 in the ninth year, bitti production up to 2,711.16 in the 12th year, white teak up to 1,240.04 in year the 7th, local teak up to 1,123.56 in the 15th year and mahogany up to 1,061.00 in the 10th year.

3.3.4. The scenario of Moderate 2.

The simulation result of the scenario of moderate 4 shows that the widening of community forest area about 5-10% per year is along with the increasing number of community forest farmers. The number of white teak, local teak, bitti, mahogany and sengon plants increased from year to year. Income and income per capita increase in the 16th year while the number of farmers from year to year increase.

The production of white teak increased in the 7th year, local teak at a the15th year, mahogany at 10th year, bitti at the 12th year and sengon at the 9th year. While harvest for a mahogany increase up to 979.31 in the 11th year, bitti up to 2565.31 in the 12th year, Sengon up to 164.48 in the 10th year, local teak up to 1,274.72 in the 16th year and white teak 1,064.49 in the 8th year.

3.4. The Ratio of Scenario Simulation

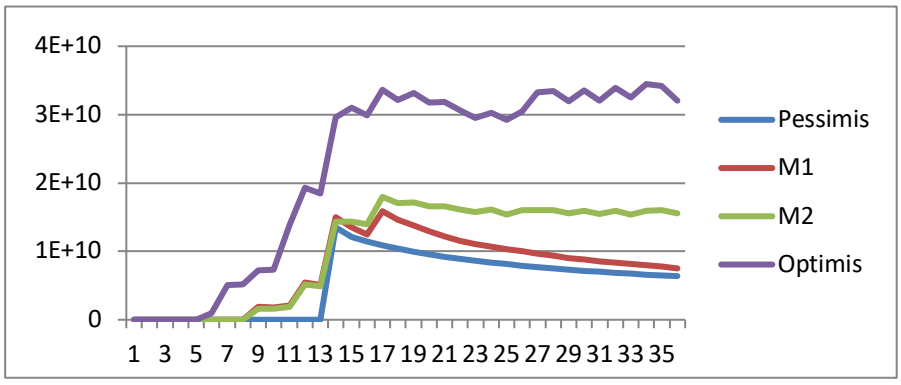

Figure 2. Comparison of Pessimistic, Moderate 1, Moderate 2 and Optimistic Scenario Simulation

Based on Table, there is a simulation comparison between pessimistic scenario, moderate 1, moderate 2 and optimistic. The optimistic model is increasing year by year and the highest in the 16th year. The effectiveness of 4 times from pessimistic simulation is 4,083564214; the increase happened because of the addition of variable of community forest area that is 296,34 Ha; income was in 32,003,793743,875.36, and income per capita was in 86,398,222,05 and amount of community forest farmers were equal to 370,42. As for moderate 1, the effectiveness numbered in 3.056895486 and for moderate 2 the effectiveness numbered in 2,133104684.

Table 1. Comparison Table of Community Forest Revenue Forecast over the next 35 years with Simulation in Pessimistic, Moderate 1, Moderate 2 and Optimistic Scenarios.

Year	Pessimistic	Moderate 1	Moderate 2	Optimistic
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	939,846,789.53
6	0	0	0	5,065,357,046.10.
7	0	0	0	5,180,755,112.04
8	0	1,917,717,820.31	1,644,577,944.82	7,205,349,178.34
9	0	1,793,398,511.56	1,567,651,773.18	7,290,476,747.96
10	0	2,118,161,470.30	1,864,683,842.21	13,906,574,440.40
11	0	5,494,245,459.88	5,126,230,523.75	19,278,222,065.25
12	0	5,085,953,788.46	4,913,655,576.99	18,427,093,965.52
13	13,514,144,358.57	14,995,030,564.64	14,363,324,746.52	29,572,451,787.31
14	12,110,257,208.15	13,500,362,862.41	14,315,256,365.17	30,969,352,150.58
15	11,475,064,019.66	12,504,765,821.87	13,964,402,340.92	29,847,874,097.43
16	10,915,760,542.14	15,872,868,592.29	17,971,234,560.19	33,659,406,417.77
17	10,398,601,894.80	14,665,430,754.30	17,087,910,331.52	32,101,049,418.96
18	9,939,683,578.88	13,791,402,745.43	17,110,867,732.80	33,209,748,801.12
19	9,563,137,350.72	12,898,975,805.61	16,637,951,155.58	31,797,652,479.79
20	9,214,721,010.72	12,208,561,038.57	16,566,444,605.65	31,877,043,140.29
21	8,917,718,651.00	11,548,014,882.01	16,162,503,120.41	30,642,390,562.54
22	8,632,147,083.01	11,048,840,229.75	15,752,485,655.70	29,540,956,560.31
23	8,369,830,095.23	10,654,779,314.08	16,118,983,726.30	30,225,630,689.69
24	8,132,244,744.29	10,279,088,622.57	15,389,492,502.27	29,245,019,915.46
25	7,899,200,518.38	9,992,896,387.04	16,042,111,721.12	30,472,894,681.01
26	7,686,996,261.48	9,701,380,328.28	16,021,298,878.51	33,235,422,168.85
27	7,495,611,312.07	9,381,769,708.22	16,000,489,736.53	33,488,625,789.63
28	7,334,866,945.00	9,016,396,186.30	15,545,919,908.99	31,906,857,375.65
29	7,164,266,111.31	8,785,214,456.33	15,944,056,398.60	33,579,368,885.12
30	7,020,039,853.25	8,531,268,462.81	15,481,648,340.40	32,066,325,198.28
31	6,866,990,201.77	8,341,673,655.09	15,951,690,609.99	33,898,316,336.21
32	6,722,035,218.24	8,182,456,317.82	15,406,835,985.59	32,478,139,054.85
33	6,580,700,794.25	7,994,474,072.79	15,954,910,562.94	34,470,177,384.77
34	6,467,680,842.89	7,743,637,242.33	16,040,177,302.72	34,157,800.337,45
35	6,360,512,024.89	7,495,126,140.82	15,597,079,176,13	32,003,743,875.36
TOTAL	1.98783E+11	2.65544E+11	3,80544E+11	8.1174E+11
			Effectiveness 4 times (O)	4.083564214
			M1	3.056895486
			M2	2.133104684

Source: The Analysis Result of Program Stella, 2017

4. Conclusion

A dynamic model of community forest management is built with three (3) submodels, namely; community forest area, community forest production and the economy of the community forest. *The best scenario of the simulation results of the community forest development model in Kajang district is*

the optimistic scenario. This is supported by the pattern of agroforestry management, availability of seeds, effective counseling and community forest development policy through the widening land area. Development of community forest in Kajang District, Bulukumba Regency can be developed if the government issues regional development policies and streamlines counseling and encourages farmers to create independent nurseries and agroforestry management systems.

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