

Options for Land Conservation Practices Based on Land Uses in Kungkai Watershed, Bengkulu, Sumatera, Indonesia

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Abstract—This research aims to determine options for land conservation practices based on land uses and functions in Kungkai watershed, Bengkulu, Sumatera, Indonesia. The research was conducted from March to May, 2013 in the Kungkai watershed geographically lying on between 102°22'25" - 102°36'15" Lat., and on 3°48'25" - 4°07'37" Long. This area is involved of Seluma District, Bengkulu Province, Sumatera, Indonesia, with run-off along 45 km to Indian Ocean, covering of 33,134.04 ha.

The Kungkai watershed currently is under environmentally pressures in which 40% more categorizing poor conditions. The Semidang Bukit Kabu wildlife hunting area covering 2,275.35 Ha, or 6.88% of the Kungkai watershed almost all under poor conditions. This wildlife hunting area must be conducted reforestation. People living, and their activities on the wildlife hunting area have to re-settle. The Bukit Daun and Bukit Sanggul have any opportunities as an area of social forestry introducing agro-forestry cultivation models with planting of multi-purposes tree species. All areas of agriculture cultivation on the watershed need land conservation tillage and management with environmentally sounding for their sustainability productivities. Options for land management practices using cover crops, minimum tillage, till bench terrace implementation needed for sustainable agriculture on the Kungkai watershed.

Index Terms—Kungkai Watershed, Land Degradation, Land Conservation Practices.

I. INTRODUCTION

Watershed plays important rules on ecosystem sustainability interactions within, and surrounding of its, through of human life [1]. In watershed ecosystems, several land uses and functions, geo-morphological formations, plants and animals, physical infrastructures, social facilities, and human activities interact each other and together to form ecosystem balancing [2]. When watershed underwent degradation, all components to form and depending on the watershed, in short, are suffered [3]. Last decades, mostly watersheds in Indonesia have facing with pressures by human activities, down functions for whole components of its. And today, 62 unit of them have been undergoing deplete its functions [4]. Watershed degradation have been accelerated by increasing exploitation of natural resources because of doubling population, pushing economic growth, split

understanding of watershed management and practices [5].

Landforms and behavior of watersheds in Bengkulu are different characteristics with other areas in which distance between upstream and downstream relatively short, tens kilometers, and narrow boundaries [6]. Upstream of the watersheds lies on Bukit Barisan hilly ranges, and downstream of those are run-off to Indian Ocean. Short distances between upstream and downstream form steeply landform and short drainage systems on the watersheds, causing rain water fast release to outlet in Indian Ocean.

Some watersheds in Bengkulu, Kungkai watershed of ones, have been depleted their natural and social functions. Agriculture land and forest areas on the Kungkai, on the upstream also currently, under intensive cultivation practices by both traditional farmers and coming from out the area. The cultivation practices on the Kungkai have not considered good agricultural practices, and un-integrated planning for whole functions of ecosystem components of the Kungkai watershed. Future, integrated management planning and technical conservation practices should be involved in understanding the Kungkai; therefore, optimally empowerment of natural resources on the Kungkai could harvested in peak of productivities and in long run environmental sustainability values.

II. METHODS

Kungkai watershed lies on 102°22'25" - 102°36'15" Lat., and on 3°48'25" - 4°07'37" Long. The Kungkai is on District of Seluma, Bengkulu Province, Sumatera, Indonesia with length of 45 km, and wide areas of 33,134.04 ha. Research location showed in Fig. 1 a) and Fig. 1 b).



Fig. 1 a). Map of Bengkulu Province, Sumatera, Indonesia.

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TABLE I: WIDE AREA OF DEGRADED LAND ON KUNGKAI WATERSHED, BENGKULU, SUMATERA, INDONESIA [12]

Degraded Level	Wide Area of Forests (Ha)				Agriculture Area	Total	%
	Bukit Daun P.F.	Bukit Sanggul P.F.	Semidang Bukit Baku Wildlife Hunting Area	Enclave Padang Capo			
Potential Degraded	22,34	2,219.2	188.68	-	-	2,430.32	7.35
Light Degraded	2.149	338.56	1621.39	1,381.51	13,536.22	16,879.83	51.03
Degraded	-	47.37	465.28	3,348.68	9,257.47	13,118.79	39.66
Poor Degraded	-	-	-	173.08	475,472	648.552	1.96
Σ	24.49	2,605.22	2,275.35	4,903.27	23,269.16	33,077.494	100.00

TABLE II: OPTIONS FOR LAND CONSERVATION AND MANAGEMENT PRACTICES ON FOREST PROTECTED AREA OF BUKIT DAUN AND BUKIT SANGGUL, KUNGKAI WATERSHED, BENGKULU, SUMATERA, INDONESIA

Degraded Level	Wide Protected Forest Area (Ha)		Total Area (Ha)	%	Options for Conservation Practices
	Bukit Daun	Bukit Sanggul			
Potential Degraded	22.34	2,219.2	2,214.54	6.78	Social Forestry
Light Degraded	2.149	338.56	340.71	1.03	Social Forestry
Degraded	0	47.37	47.37	0.14	Social Forestry
Σ	24.489	2,605.22	2,629.62	7.95	Social Forestry

TABLE III: OPTIONS FOR LAND MANAGEMENT PRACTICES ON FOREST CONSERVATION OF SEMIDANG BUKIT KABU WILDLIFE HUNTING AREA, KUNGKAI WATERSHED, BENGKULU

Degraded Level	Wide Forest of Semidang Bukit Kabu Wildlife Hunting Area	%	Options for Conservation Practices
Potential Degraded	188.68	0.57	Reforestation
Slight Degraded	1,621.39	4.90	Reforestation
Degraded	465.28	1.407	Reforestation
Σ	2,275.35	6.88	Reforestation

TABLE IV: OPTIONS FOR LAND MANAGEMENT PRACTICES ON AGRICULTURE AREA IN KUNGKAI WATERSHED, BENGKULU, SUMATERA, INDONESIA

Degraded Level	Agric. Area of Enclave Padang Capo (Ha)	Agric. Area of Traditional Villagers (Ha)	Total (Ha)	%	Options for Conservation Practices
Slight Degraded	1,381.51	13,536.22	14,917.73	45.10	Minimum Tillage and cover crops
Degraded	3,348.68	9,257.47	12,606.15	38.11	Credit terrace and cover crops.
Poor Degraded	173.08	475,472	648.55	1.96	Bench terrace and cover crops
Σ	4,903.27	23,269.16	28,172.43	85.17	

This research related to previous research conducted, and this research concern with options of land conservation practices based on land management and environmental values. Analysis degraded land conditions written functions over the area observed in which the land on Kungkai was under degraded condition written by [7] based on Rules of Directorate General for Land Rehabilitation and Social Forestry, Ministry of Forestry, Republic of Indonesia No. SK.167/V-SET/2004 [8] shown in Table I.

Secondary data collected related with this research were validated through ground check in some location in field to perform the data. Options for land management practices were different between agriculture area [9] and forestry area [10], and other related references.

Figuring result for options of land conservation and management practices based on land uses and functions needed Map of Indonesia Landforms and digital ALOS photos from Badan Informasi Geospasial, Republic of Indonesia, spatial data of Kungkai Watershed from Badan Pengelolaan DAS Ketahun, Bengkulu, Ministry of Forestry, Republic of Indonesia.

III. RESULT AND DISCUSSIONS

Kungkai watershed plays some functions involving Bukit Daun and Bukit Sanggul as forest protected areas for water recharge, forest conservation for wildlife hunting area of Semidang Bukit Kabo, enclave (agriculture land) surrounding

wildlife hunting area, and agriculture cultivation area for traditional villagers.

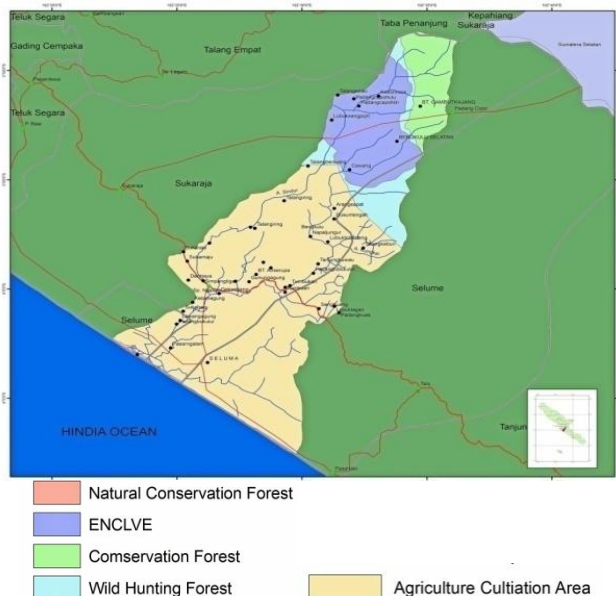


Fig. 1 b). Watershed lies on Bengkulu Province, Sumatera, Indonesia.

Level of degraded land condition on Kungkai watershed are more widespread, not only on traditional agriculture area, but also encroach to forest Conservation of wildlife hunting area Semidang Bukit Kabu and forest protected area of Bukit Daun and Bukit Sanggul. Based on degraded land conditions published options for land conservation and management

practices based on land functions was shown in Table II.

On forest protected areas of Bukit Daun and Bukit Sanggul have opportunities for social forestry development through empowerment of surrounding villagers as wide of 2,629.62 Ha, or 7.95% of the Kungkai. Increasing productivity of the forest by planting multi purposes tree species such as rubber, candle nuts, durian, and other plant products without logging.

Options for land management practices on forest conservation area of Semidang Bukit Kabu wildlife hunting area was shown on Table III.

Options for land management practices based on land functions of forest conservation of Semidang Bukit Kabu wildlife hunting area is re-forestation and re-vegetation with local seed and young trees species.

Agriculture cultivation area occupied by traditional villagers and enclave surrounding by forest of wildlife hunting area are categorized as degraded to poor degraded conditions. The degraded and poorer reached a wide of 28,172 Ha, or 47% of agriculture area, or 40% of the Kungkai watershed. The degraded agriculture land should be cultivated with environmental friendly, for the long run improving land productivities and sustainable agriculture. Options for land management practices on agriculture area involve planting cover crops with minimum tillage, with credit terrace, till applied bench terraces. Options for land management practices on the agriculture areas was shown on Table IV.

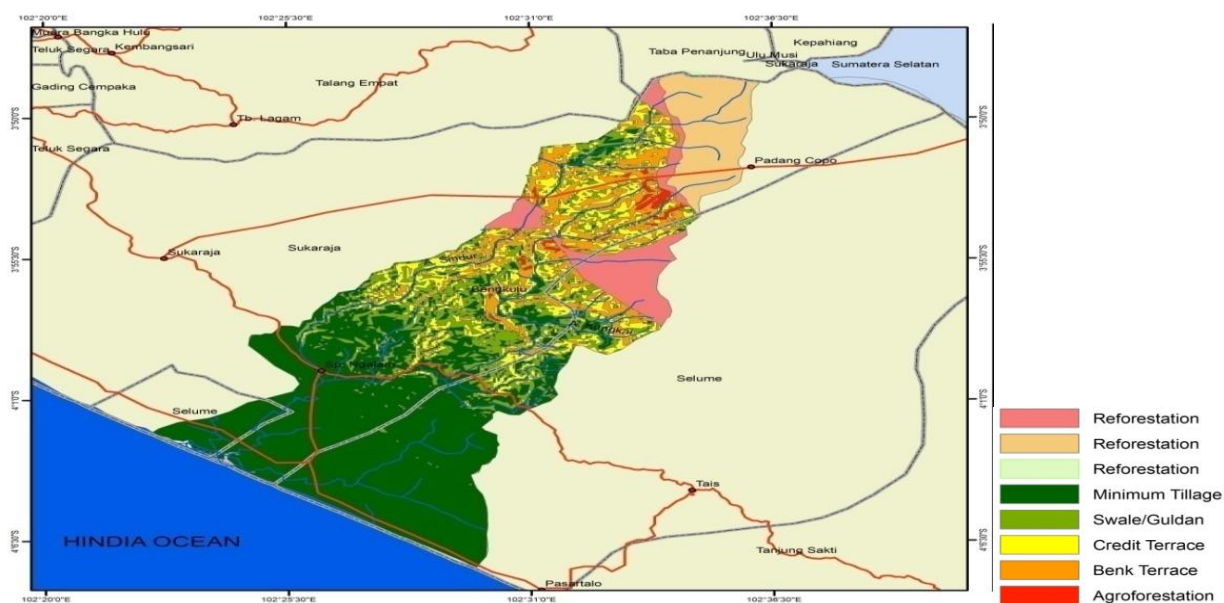


Fig. 2. Distribution of options for land conservation and management practices on Kungkai Watershed, Bengkulu, Sumatera, Indonesia.

Options for land conservation land management practices based on land uses and functions on Kungkai watershed, Bengkulu, Sumatera, Indonesia was depicted in Fig. 3.

IV. CONCLUSIONS

Forest Protection Areas of Bukit Daun and Bukit Sanggul which wide 2,629.62 Ha, or 7.95 % of the Kungkai watershed, only on small area was categorized degraded level on environmental values. These protections areas could be

developed as social forestry through empowerment societies surrounding the forest, and planting multi-purposes tree species.

Forest Conservation of Semidang Bukit Kabu Wildlife Hunting Area which wide 2,275.35 Ha, or 6.88% of Kungkai watershed mostly was categorized slightly degraded to degraded level of environmental values. Options for land conservation and management practices re-forestation and re-vegetation with local seed and young plant species. Agricultural and social activities within the wildlife hunting

area must be sent out this area.

The degraded agriculture land should be cultivated with environmental friendly, for the long run improving land productivities and sustainable agriculture. Options for land management practices on agriculture area involve planting cover crops with minimum tillage, with credit terrace, till applied bench terraces.

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