ISSN: 2212-6708

ELSEVIER

APCBEE Procedia

2014 5th International Conference on Environmental Science and Development (ICESD 2014)

Edited by Li Xuan

General Information

Contents

Environmental Science and Development

Edited by

Mr. Li Xuan

PREFACE

Dear Distinguished Delegates and Guests,

The Organizing Committee warmly welcomes our distinguished delegates and guests to the 2014 5th International Conference on Environmental Science and Development (ICESD 2014) held on February, 19-21, 2014 in Singapore.

ICESD 2014 are sponsored by Asia-Pacific Chemical, Biological & Environmental Engineering Society (APCBEES), and supported by APCBEES Members and scholars from universities all round the world. If you have attended a conference sponsored by APCBEES before, you are aware that the conferences together report the results of research efforts in a broad range of Environmental Science and Development society. These conferences are aimed at discussing with all of you the wide range of problems encountered in present and future high technologies. ICESD 2014 are organized to gather members of our international community scientists so that researchers from around the world can present their leading-edge work, expanding our community's knowledge and insight into the significant challenges currently being addressed in that research. The conference Program Committee is itself quite diverse and truly international, with membership from the Americas, Europe, Asia, Africa and Oceania.

This proceeding records the fully refereed papers presented at the conference. The main conference themes and tracks are Environmental Science and Development. The main goal of these events is to provide international scientific forums for exchange of new ideas in a number of fields that interact in-depth through discussions with their peers from around the world. Both inward research; core areas of Environmental Science and Development and outward research; multi-disciplinary, inter-disciplinary, and applications will be covered during these events.

The conference has solicited and gathered technical research submissions related to all aspects of major conference themes and tracks. All the submitted papers in the proceeding have been peer reviewed by the reviewers drawn from the scientific committee, external reviewers and editorial board depending on the subject matter of the paper. Reviewing and initial selection were undertaken electronically. After the rigorous peer-review process, the submitted papers were selected on the basis of originality, significance, and clarity for the purpose of the conference. The selected papers and additional late-breaking contributions to be presented as lectures will make an existing technical program. The conference program is extremely rich, featuring high-impact presentations.

(HEPP) Musi. The existence of this hydropower has changed the flow direction of Musi Hulu river. The river was used to be flowed into Musi river and then emptied into the eastern coast of Sumatra Island. Nowaday, it is approximately 80% of Musi Hulu river heading its flow direction into Lemau river then it is emptied into the west coast of Sumatra.

The main problem for the Musi Hulu watershed is there so many forested area that had been converted for other uses such as farming plantation, settlements and others. Meanwhile, the main proponent of good or not the functionality of the watershed is the condition of forest area in the upstream of the Musi hydropower. Setianto et al (2007) stated that the deforestrated area at Bukit Daun Protected Forest had reached 66.64%. This also happened to Kerinci Sebelat National Park and Bukit Kaba Natural Tourism Park, where the total area that had been deforestrated in the region respectively is 14,08% and 49%. The forest conversion rate has caused the higher the degree of criticality of the water catchment areas and land criticality.

Deforestration that occured in the Musi Hulu sub watershed has caused a degradation of the forest area function, which then increased the number of critical lands. This is happened because the natural infiltration capacity of soil in that area has decreased. The bigger the damage of the forest, the more critical the land.

This problem must be taken into account seriously in order to take appropriate action in near future to save the Musi Hulu sub watershed. Therefore, it is necessary to do a study that aimed to examine the degree of criticality of recharge area and the criticality of land that occurred in that Musi hydropower catchment area. In this study, GIS (Geographic Information System) application will be used as a tool to determine the degree of catchtment area criticality and land criticality.

2. Methods

2.1. Research site

The research was conducted in the catchment area of Musi Hydro-Power Plant, lies on Rejang Lebong and Kepahiang Districts, Bengkulu Province, Indonesia. The site is at 102 ° 22'18 .98 "-102 ° 38'38 .93" Lat., And 3 ° 16'28 .873 "-3 ° 33'57 .441" long.

2.2. Collected Data

Primary data collected from the research site consisted of soil organic matter contents, soil structures, soil textures, and hydraulic conductivities.

Secondary data collected involved rain data in 10 years, topographical map, hydrological map, soil map, and land cover/land use map.

2.3. Data Analysis

2.3.1. Data Analysis for Regional Infiltration

Infiltration was determined by slope, soil type, amount of rain, and land cover. Those attributes were transformed to some values of potential infiltration, and levels of actual infiltration. Transformation values of the attributes followed Planning Procedures for Forest and Land Rehabilitation Engineering Watershed by Ministry of Forestry, Republic of Indonesia refer to P.32/MENHUT-II/2009. The process from identifying until determining recharge area conditition class is can be shown in Fig.1.

2.3.2. Data Analysis for Land Criticality

The high quality of the program – guaranteed by the presence of an unparalleled number of internationally recognized top experts – can be assessed when reading the contents of the program. The conference will therefore be a unique event, where attendees will be able to appreciate the latest results in their field of expertise, and to acquire additional knowledge in other fields. The program has been structured to favor interactions among attendees coming from many diverse horizons, scientifically, geographically, from academia and from industry. Included in this will to favor interactions are social events at prestigious sites.

We would like to thank the program chairs, organization staff, and the members of the program committees for their work. Thanks also go to Editor Mr. Li Xuan, Asia-Pacific Chemical, Biological & Environmental Engineering Society, for their wonderful editorial service to this proceeding.

We are grateful to all those who have contributed to the success of ICESD 2014. We hope that all participants and other interested readers benefit scientifically from the proceedings and also find it stimulating in the process. Finally, we would like to wish you success in your technical presentations and social networking.

We hope you have a unique, rewarding and enjoyable week at ICESD 2014 in Singapore

With our warmest regards,

The Organizing Committees
February, 19-21, 2014
Singapore

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APCBEE Procedia 10 (2014) 235 – 240

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ICESD 2014: February 19-21, Singapore

Criticality Analysis of Recharge Area and Land in the Catchment Area of Musi Hydropower Bengkulu Indonesia

Khairul Amri[a,b]*, A. Halim[a], Ngudiantoro[a] and M. Faiz Barchia[b]

[a]Sriwijaya University, Palembang-30139, Indonesia
[b]University of Bengkulu, Bengkulu-38125, Indonesia

Abstract

The aims of this study is to determine the criticality of recharge area and to assest criticality of land that occurred in the Musi hydropower catchment area. The criticality of recharge area had been analyzed by using geographic information system applications. Based on that application which covering the total catchment area of 60.369,97 ha of musi Hydropower catchment area, it has been shown that the condition of recharge area that still in good condition was 43.215,39 ha (71,58%), naturally normal condition was 6.857,31 ha (11,36), begin to critical was 2.560,28 ha (4,24%), rather critical was 5.506,40 ha (9,12%), and in critical condition was 2.230,58 ha (3, 69%). Assessment of the criticality of land was done by assessing the land cover factor, slope factor and the calculation of the erosion of Musi Hulu sub watershed land. The results of this assessment showed that the state of the land which in the state of not critical was 18.415,387 hectares (30,504%), potentially critical was 15.870,359 Ha (26,289%), rather critical was 18.073,017 hectares (29,937%), critical was 4.674,979 hectares (7,744%), and very critical was 443,170 ha (0,734%). From those analysis, it can be concluded that the recharge area and landof Musi hydropower catchment area is in the state of begin to critical.

Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society

Keywords: Criticality of Recharge Area, Criticality of Land, Musi Hydropower Catchment Area, Musi Hulu Sub Watershed

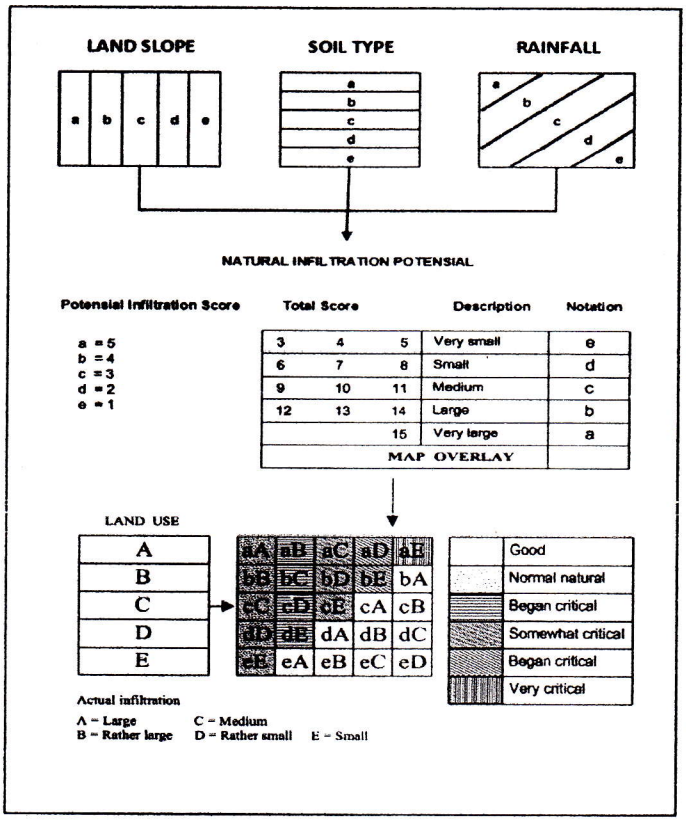
1. Introduction

Musi Hulu sub-watershed had been functioned as a water catchment area for Hydroelectric Power Plant

*Corresponding author. Tel : +62- 736- 345534 ; +62-813-67719694
E-mail address: donga_khairul@yahoo.com

Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society
doi:10.1016/j.apcbee.2014.10.045

Land degradation on the the Musi Hulu sub-watershed identified through land criticality levels. Those were determined by land cover, slope, soil erosion, land management. Soil erosion was calculated by USLE (Universal Soil Lose Equation). Method for find out the criticality levels of the area was using Planning Procedures for Forest and Land Rehabilitation Engineering Watershed by Ministry of Forestry, Republic of Indonesia refer to P.32/MENHUT-II/2009. Both, overlay of the attributes and mapping classes of water recharged levels and land criticality levels on the catchment area of Musi Hydro-Power Plant was used Arc GIS.



Source : P.32/Ministry of Forestry-II/2009

Fig. 1. Outline Approach Model Depreciation Infiltration Regional Assessment.

3. Results and discussion

3.1. Criticality analysis of Musi Hulu sub-watershed recharge area

Based on the assessment results of the criticality level of recharge areas at the Musi Hulu sub-watershed had shown that the state of area with rather critical condition is 5.506,40 ha (9,12%), good is 43.215,39 ha (71.56%), critical is 2.230,58 Ha (3.69%), starting to critical is 2.560,28 ha (4.24%), and natural normal is 6.857,31 ha (11.36%). The level of criticality of recharge area in the Musi Hulu sub watershed can be seen in Table 1.

Table 1. Criticality Levels of Recharge Area in Musi Hulu Sub Watershed.

No.	Criticality Level Regional Infiltration	Land Area (Ha)
1	Rather Critical	5.506,40
2	Good	43.215,39
3	Critical	2.230,58
4	Start Critical	2.560,28
5	Normal Natural	6.857,31
Σ	Total	60.369,97

Based on Table 1, the critical level of recharge area in Musi Hulu sub watershed, the distribution of recharge area criticality can be seen in Fig. 2.

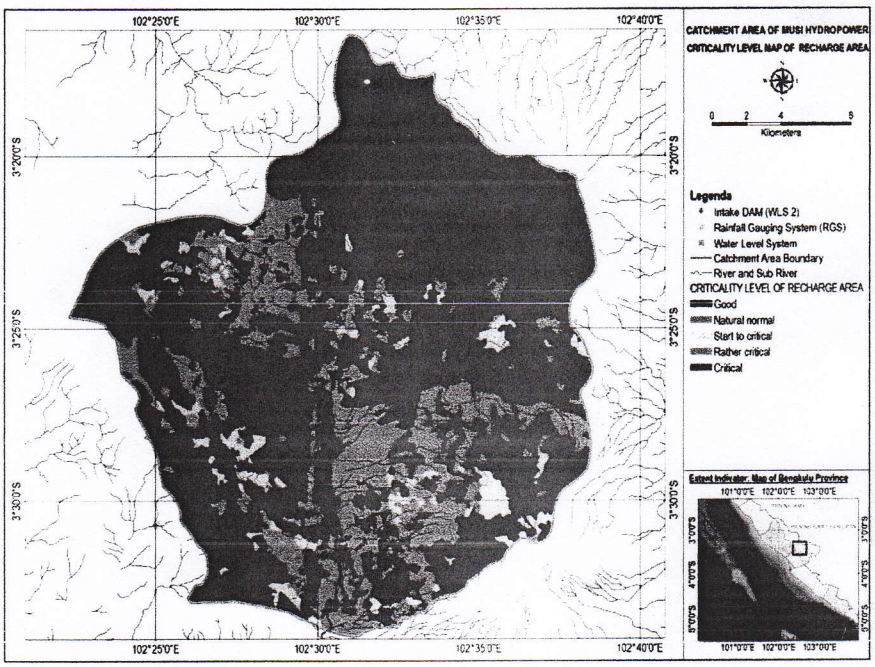


Fig. 2. Criticality Level Maps of Recharge Area in Musi Hulu Sub-Watershed Areas

3.2. Criticality analysis of Land of Musi Hulu subwatershed

Based on a land criticality assessment which assessed from land cover factor, slope factor and the calculation of erosion, on the Musi Hulu sub watershed, the area with the state in the critical state is 10237.89 hectares (16.96%), the critical potential is 34015.34 ha (56 , 34%), rather critical is 11542.00 ha (19.12%), critical is 3967.47 ha (6.57%), and very critical is 607.26 ha (1.01%). Calculated class and area of critical land in the Musi Hulu Sub Watershed can be seen in Table 2.

Table 2. Class and area of land Criticality in the Musi Hulu sub watershed

Critical Grade	Wide Area (Ha)			Total (CA Hydropower MUSI) Ha
	Cultivation (Ha)	Forest (Ha)	Protected Areas Outside the Forest (Ha)	
Not Critical	411,38	2.030,77	7.795,75	10.237,89
Critical Potential	10.670,46	16.420,11	6.924,77	34.015,34
Rather Critical	5.140,19	1.951,96	4.449,85	11.542,00
Critical	730,50	938,11	2.298,87	3.967,47
Fastidious	13,43	257,88	335,95	607,26
Total	16.965,95	21.598,83	21.805,18	60.369,97

Based on Table 2, class and area of critical land in Musi Hulu Sub Watershed, the distribution of critical land areas can be seen in Figure 3.

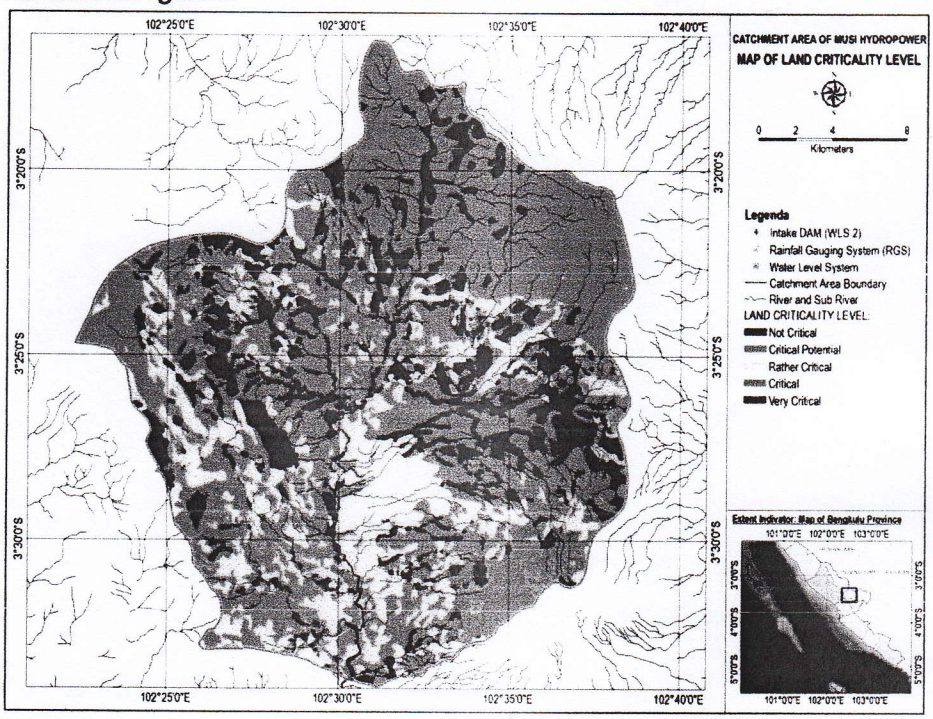


Fig. 3. Land Criticality Map in Musi Hulu sub watershed

4. Conclusions and Suggestions

4.1. Conclusion

1) Based on the assessment results of the criticality level of recharge areas at the Musi Hulu sub-watershed had shown that the state of area with rather critical condition is 5.506,40 ha (9.12%), good is

43.215,39 ha (71.56%), critical is 2.230,58 Ha (3.69%), starting to critical is 2.560,28 ha (4.24%), and natural normal is 6.857,31 ha (11.36%).

2) The assessment to criticality of land at the Musi Hulu sub-watershed had shown that the state of area with uncritical condition is 10,237.89 ha (16.96%), critical potential is 34015.34 ha (56. 34%), rather critical is 11542.00 ha (19.12%), critical is 3967.47 ha (6.57%), and very critical is 607.26 ha (1.01%).

4.2. Suggestion

1) Rainfall data should be used in the calculations obtained from the rain at least 3 stations located in the catchment area for the results to be more accurate calculation.
2) To suppress criticality catchment areas, areas of high level of criticality should be replanted with a fairly high density of plants particularly on the slopes.
3) To overcome land critical rate of land, reforestation and planting should be carried out on that area.

References

[1] Bennet, H.H. Soil conservation. New York. McGraw-Hill; 1939.

[2] Hardjowigeno, S. Soil Science. CV. Jakarta: Academic Pressindo; 2007.

[3] Hudson, N. Soil conservation. London. B.T Badsford Ltd.; 1971.

[4] Ministry of Forestry Republic of Indonesia. Planning procedures for forest and land rehabilitation engineering watershed (rtkrhl-watersheds). Number: P.32/MENHUT-II/2009

[5] Ministry of Forestry. Department of Forestry. Management Framework Watershed (watersheds) in Indonesia. Amanah Presidential Instruction 5, 2008 About Focus Economics Program Year 2008-2009. Jakarta. , 2008.

[6] Morgan, R.P.C. Soil erosion. London. Logman; 1979.

[7] Pamulardi, B. Forestry law and Forestry Sector Development. Jakarta: King Grafindo Persada; 1995.

[8] Setianto, J., MF Hidayat, KS Hindarto, BS Priyono, B Sulistyo, Yunilisiah. Potential Study Areas Around Watershed of Musi hydropower. Bengkulu: University of Bengkulu; 2007.

[9] Suharto, et al. Design of forest and land rehabilitation in the upstream watersheds Musi Hulu-Lemau based critical level of catchment areas and land: ecohydrology conservation efforts and community empowerment. Report of the National Strategic Research Grant University of Bengkulu 2010. Bengkulu: University of Bengkulu; 2010.