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SOIL EROSION AS A RESULT OF UPLAND TRADITIONAL CULTIVATION IN JAVA ISLAND *)

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Abstract

Soil erosion is one of the most important problems in the world. History, tradition, area condition, and differencies of the intensity of soil erosion measures cause differencies in quantity of erosion in one place and the other.

Also the variation of the kind of the occasion problems, will result differencies in the kind of prevention activities too.

Soil erosion in Java Island caused by specific reasons i.e. traditional agriculture cultivation pattern without taking into account any soil conservation measures and proper landuse, and influenced by the bad condition of the population pattern because of the intense increasing population density, and about 70 percent of the inhabitants have their living solely from agriculture cultivation.

From the knowledge of the quantity of erosion in Java based on the results of the available observations, and the problems causing it, can be expected to find a correct step and operational strategy of prevention.

The prevention of erosion in Java is not only an introduction effort and to create awareness and technical knowledge among the farmers, but this should be combined with other activities i.e. transmigration, birth control, increase of income, creation of new employment opportunity etc.

INTRODUCTION

The deterioration of the land in Java was strated as a result of the "Cultuurstelsel" during the colonial time through the introduction of sugarcane plantation and at that time nearly all sawah area was planted with sugarcane.

Because of the intense population increase it was frightened that there would be a food shortage and the plantation of cassava was introduced to overcome it.
And because of the cultuurstelsel crisis in the Netherlands, many of the plantations were leaved and cassava cultivation was extended into the plantations

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areas.

The intense annual population increase of 2.5 percent and the very dense population in Java about 690 inhabitants/ sq. km and the very small land ownership (0.3 to 0.7 ha / family), consequently extended agriculture into steeper areas, deforestation and cultivation on steep land which exactly should be covered with permanent vegetation.

Beside the population pressure on agriculture land there is only a very small employment opportunity in the other sectors of economy (or with other words there is no other choice than to depend solely on land for their livehood), with very limited knowledge and capability, agriculture cultivation pattern was conducted without any soil conservation measures.

So it happened, the upland traditional cultivation which causes severe erosion and its consequences.

At present there is about 4 million hectares of critical land in Java, or about 25 percent of the total number of critical land in whole Indonesia whereas the extent of Java is only 7 percent of the extent of Indonesia, so erosion in Java with the specific caused as mentioned above is really a serious frightening problem.

QUANTITY OF EROSION, FLOOD AND THE CONSEQUENCES

1. Quantity of Erosion

By neglecting soil conservation measures on agriculture land, the erosion took place, cause serious deterioration of the hydrologycal condition of all watersheds in Java.

This is logical because about 60 percent of the land in Java is Agriculture area as shown in table 1 below.

This circumstances resulting frequent floods, high number of erosion rate and reached already the stage to endanger the eternity of the environment.

The quantity of erosion is seen from the muddy water of the rivers in Java especially during the rainy seasons.

Table 1 : Land-use Pattern in Java Island

Land - Use	Area	
	Million Hectares	Percent
Forest	2,895	21.9
Agriculture	7,573	57.3
Plantations	304	2.3
Others	2,445	18.5
Total	13,217	100.0

Table 2 shows the total number of sediment transport and the periods of observation.

Observation done by the FAO/UNDP on the Solo River Basin gives an adequate frightened result i.e. the erosion rate on dryland cultivated by the farmers without any soil conversation measures reached nearly 4 cm a year (see table 3).

Table 3 : Annual erosion on dryland cultivated by the farmers without any soil conversation measures in Upper Solo Watershed (in cm).

Elevation (meters)	Land slope (%)			
	0-5	5 - 30	30-50	50
500	0.4	1.4	2.0	3.1
500- 750	0.5	1.9	2.5	3.8
750-1000	0.4	1.5	1.9	3.0
1000	0.3	1.3	1.5	2.3

2. Flood and the consequences

Flood causes many hazard, sacrifice, material damage and also decrease of agriculture production.

Estimation of losses caused by flood in Cimanuk Watershed (West Java) in 4 times floods are as follow :

November 1971 US $ 1.3 million
Januari 1972 US $ 2.3 million
March 1976 US $ 2.6 million
February 1977 US $ 3.9 million

During several days flood of the Citan-

Table 2 : Number Of Transported Sediment In Several Rivers In Java

River	Size of Watershed sq.km.	Transported mill.tons/yr.	Sediment Tons/yr/sq.km	Year of Observation
Cimanuk	3200	25	7810	1958-1969
Cipeles	410	2	4880	1948-1969
Cilutung	600	7.2	12000	1948-1969
Cikeruh	250	2.8	11200	1948-1969
Citanduy	2540	9.44	3740	1973-1974
Cimuntur	578	1.75	3030	1973-1974
Cijolang	382	0.73	1910	1973-1974
Cikawung	550	1.90	3450	1973-1974
Ciseel	190	0.28	1470	1973-1974
Bengawan Solo	5782	13.77	2280	1952-1971
Kali Madiun	3907	8.20	2100	1952-1971
Kali Brantas	8460	6.22	957	1951-1970

duy river in 1975, the losses was istimated about US $ 4.9 million and about 10.000 hectares of land was overflowed.

The losses caused by the flood of the Solo river (central Java) in 1973 was about US $ 17 million (Mc.Comb), and according the calculation done by the Overseas Technical Cooperation Agency of Japan the losses caused by the flood of Brantas river (east Java), concerning agriculture, houses and others was about US $ 4.6 million.

COMPARATIVE STUDY

Based on the watershed development plan and recommendation resulted from the trials done by the joint project FAO/UNDP and the Directorate General of Forestry Indonesia, a principal agreement was decided that to prevent the extend of critical area as a result of traditional cultivation practices, areas with more than 50 percent slope should be planted with permanent vegetation whereas areas with less than 50 percent dlope should be treated with bench terrace construction.

Erosian rate resulted from a comparative study between tradisional cultivated and bench terraced dryland or afforested area are as follow :

1. Study on small plots

The results of comparative study on small plots of about 0.1 hectare in Samin sub-watershed gives clear differences between traditional cultivated and recommended treated areas.

On an afforested area with 55 percent slope which is planted with Pinus merkusii combined with grass Pennisetum purpureum known as "sylvopasture" (two years after planting), the erosion rate is 0.06 cm/year and the run-off coefficient is 20 percent.

On a traditional dryland area near the above mentioned one with 40 percent slope and planted with cassava and maize, the erosion rate is 2.9 cm/year and the run-off coefficient is 80 percent whereas on a bench terraced area with 40 percent slope and planted with cassava and maize, the erosion rate is only 0.3 cm/year and the run-off coefficient is 40 percent.

A result obtained from an other observation in Citanduy watershed is that bench terrace construction on dryland reduces erosion from 247 tons / ha / yr (erosion rate on dryland without erosion control) becomes only 74 tons/ha/yr.

2. Study on small watersheds

Calculation and suspended load data analyses in 1977 on Temon sub-watershed shows rather big differences between treated sub-watershed (bench terraced and afforested) and untreated sub - watershed. Both area located close together, with the same soil type, rainfall and topography. Suspended load on treated sub-watershed (Duren river) is 45 tons/ha/year whereas on untreated sub-watershed area (Kiteran river) is 3 times higher, that is 132 tons/ha/year.

ALTERNATIVES OF PROBLEM SOLVING

From technical side, terrace construction and afforestation could reduce erosion.
These activities should be followed and completed with agriculture intensification, home garden improvement and also development of irrigation facilities, so that this comprehensive management on all kind of land-use could increase the land capability and the farmers income beside its function to prevent erosion.

A good socio-economic condition will change the farmers desire of cutting trees into good farming and will make them capable to maintain the soil conservation and irrigation structures and their participation could be expected to continue the watershed development activities.

But, is it possible to reach the expected results if the population of Java is very dense and the intense population increase goes on ?

A satisfactory result could be reached if it as accompanied by the other activities i.e. transmigration, birth control, extend and improvement of small industry in the villages to prevent urbanisation and to create new employment opportunities in the other sector of economy.

An integrated approach of several government agencies is very essential to create an interdisciplinary watershed management on the stage of preparation and planning as well as during the implementation.

Coordination between departements and or agencies should be cynchronous and effectively done.

CONCLUSION AND RECOMMENDATION

1. Quantity of erosion a result of Upland traditional cultivation in Java Island has reached an anxious point and should be faced seriously and immediately.
2. Trial of proper soil conservation and good land-use pattern shows feasible results to reduce the erosion rate.
3. To prevent erosion in Java Island to the optimum result, efforts to increase the land capability, farmers income and improvement of population pattern is essentially required.
   For this an integrated action is needed in the implementations of a multidisciplinary watershed management.

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