Hubungan antara banjir dengan kerusakan ekosistem: studi kasus daerah alliran Bengawan Solo Hilir

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Abstrak

ABSTRAK
Fluktuasi debit sungai di daerah aliran Bengawan Solo Hilir sangat tinggi, hal ini mengakibatkan terjadinya banjir pada musim penghujan dan kekeringan pada musim kemarau. Debit sungai yang tinggi akan menyulitkan dalam pemanfaatan sumber daya air baik secara kuantitas maupun kualitas. Debit sungai di daerah aliran Bengawan Solo Hilir berbanding lurus dengan intensitas curah hujan artinya curah hujan yang tinggi akan mempengaruhi secara langsung terhadap besarnya debit sungai di daerah aliran Bengawan Solo Hilir. Dipihak lain kapasitas peresapan (infiltrasi) di daerah aliran Bengawan Solo Hilir sangat kecil.

Penggunaan lahan yang berbeda pada setiap daerah aliran sungai akan mengakibatkan perbedaan jumlah air hujan yang sampai dipermukaan tanah; hal ini akan mempengaruhi besar-kecilnya aliran air limpasan (water run off).

Adanya tanaman penutup lahan (cover crops) akan memperkecil volume dan kecepatan aliran permukaan dan dapat meningkatkan kapasitas peresapan suatu daerah aliran sungai. Penelitian ini dilaksanakan untuk mengkaji hubungan antara banjir dengan kerusakan ekosistem di daerah aliran Bengawan Solo Hilir. lndikator kerusakan ekosistem yang diukur adalah : debit banjir pada sungai utama (Bengawan Solo) dan cabang-cabang sungai, kapasitas sungai, curah hujan, kapasitas peresapan, sedimen terangkut dan luas tata guna lahan di daerah aliran Bengawan Solo Hilir. Data yang terkumpul dianalisis untuk mencari hubungan antara kerusakan komponen ekosistem dengan bencana banjir yang terjadi di daerah aliran Bengawan Solo Hilir.

Dari hasil analisis tersebut diperoleh suatu bentuk hubungan komponen ekosistem dengan bencana banjir sebagai berikut :

1) semakin tinggi curah hujan akan semakin besar debit banjir,

2) semakin sempit luas vegetasi penutup lahan (cover crops) semakin kecil tingkat peresapan air ke dalam tanah,

3) semakin meningkat debit banjir semakin meningkat pula erosivitas lahan dan semakin tinggi tingkat sedimentasi serta semakin menurun kapasitas sungai.

Dalam upaya menurunkan debit banjir agar sesuai dengan kapasitas sungai (full bank flow) maka perlu dilakukan upaya peningkatan kapasitas peresapan, penurunan kecepatan dan volume aliran permukaan (run

of]) dengan mempertebal profit tanah di daerah aliran Bengawan Solo Hilir, memperluas lahan bervegetasi (cover crops) dengan pepohonan yang mempunyai fungsi konservasi.

Dari hasil perhitungan debit sungai pada setiap sub daerah aliran sungai (Y), pengukuran luas sub daerah aliran sungai (Xl), curah hujan (X2), pengukuran luas vegetasi penutup lahan (cover crops) (X3), pengukuran peresapan (X4) serta mengevaluasi kegiatan manusia di setiap sub daerah aliran sungai (C), maka banjir di daerah Bengawan Solo Hilir merupakan fungsi dari (X1,X2,X3,X4 dan C) dari hasil hubungan tersebut didapat bentuk hubungan sebagai berikut :

(1) S.Wulung : Y = 0,1156X1 + 0.0016X2 - 0.0011X3.- 0,0405X4 + 0,9244C

(2) S.Grabagan : Y = 0,0320X1 + 0,0040X2 - 0.0219X3 - 0,02323X4 + 0,970C

(3) S.Tinggang : Y = 0,0212X1 + 0,0040X2 - 0.0086X3 - 0,0140X4 + 0,953C

(4) S.Batokan : Y = 0,0509X1 + 0.0024X2 - 0.0051X3 - 0,0358X4 + 0,9031C

(5) S.Gandong : Y = 0,0630X1 + 0,0019X2 - 0.0066X3 - 0,0440X4 + 0,8830C

(6) S.Tidu : Y = 0,02673X1 + 0,0020X2 - 0.0056X3 - 0,0018X4 + 0,944C

(7) S.Kening : Y = 4,1870X1 + 4,0013X2 - 0.0057X3 - 0,0113X4 + 0,6865C

(8) S.Pacal : Y = 0,0967X1 + 0,0018X2 - 0.0083X3 - 0,0727X4 + 0,8205C

(9) S.Besuki : Y = 0,0276X1+0,0024X2-0.0092X3 - 0,0285X4 + 0,9414C

(10) S.Merkuris : Y = 0,2183X1 + 0,0026X2 - 0.0099X3 - 0,01653X4 +

(11) S.Ingas : Y = 0,02574X1 + 0,0020X2 - 0.0067X3 - 0,0179X4 + 0,946C

(12) S.Cawak : Y = 0,0191X1 + 0,0020X2 - 0.0058X3 - 0,0107X4 + 0,9601C

(13) S.Serning : Y = 0,0594X1 + 0,0014X2 - 0.0029X3 - 0,0415X4 + 0,8889C

(14) S.Brangkal : Y = 0,0685X1 + 0,0013X2 - 0.0037X3 - 0,0414X4 + 0,8857C
(15) S.Semarmendem: Y = 0,0614X1 + 0,0013X2 - 0.0030X3 - 0,043X4 + 0,8882C

Dari persamaan tersebut di atas dapat disimpulkan bahwa banjir di daerah Bengawan Solo Hilir sebagian besar disebabkan oleh kegiatan manusia yang berada di sub daerah aliran sungai. Untuk menurunkan debit banjir dan meningkatkan kapasitas resapan perlu dibuat sumur resapan sebanyak 272 (dua ratus tujuh puluh dua) unit sumur resapan.

Pustaka : 41 literatur dan artikel terbitan 1968 - 1994
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ABSTRACT
The fluctuation of the water flow in Bengawan Solo Lower Stream catchments area is very high. This is the reason why flood is encountered during the wet season and dryness in the dry season. The flow of the river causes difficulties in utilizing the water resources, both in quality as well as in quantity. The river water flow in Bengawan Solo Lower Stream catchments area is directly proportional to the rainfall intensity, which means that the higher the rain fall intensity the higher river flow in Bengawan Solo Lower Stream catchments area. On the other hand the infiltration rate of the water in Bengawan Solo Lower Stream catchments area is too low. The difference of land use in the Bengawan Solo Lower Stream catchments area causes a difference in the rain water volume reaching the land surface, affecting the rate of water run off. The existence of cover crops can reduce the volume and velocity of water run off and increase the infiltration rate of a catchments area. This study is conducted to assess the correlation between flood and ecosystem destruction in the Bengawan Solo Lower Stream catchments area. The indicators of the ecosystem destruction which will be measure are : the main stream (Bengawan Solo Lower Stream) and its tributaries discharge, river capacity, rain fall, infiltration capasity, sediment loads, and land use area at each sub catchments area. All the data collected will be analyzed to be use as parameters of the correlation between flood and the ecosystem destruction at bengawan Solo Lower Stream catchments area. The result of the data analysis at Bengawan Solo Lower Stream catchments area are as follows :

1. The higher the rain fall intensity, the higher the flood discharge.

2. The narrower the cover crops area, the lesser the infiltration capasity.

3. The higher the discharge the higher the erosion and the higher sedimentation rate, resulting in the decrease of the river capacity.

In order to reduce the peak river discharge so as to match the river capacity (full bank flow) the infiltration capacity needs to be enhanced, the velocity and volume of water run off needs to be reduced by thickening the soil profile at Bengawan Solo Lower Stream catchments area, widening the cover crops area and planting vegetation which have conservation function. Based on the calculation of river discharge (Y) at each sub catchments area, area measurement of the sub catchments area (Xl), measurement of the rain fall intensity (X2), measurement of the cover crops area (X3), measurement of the infiltration capasity (X4) and by evaluating the human resources activity (C) the result of calculation as follows:

(1) S.Wulung : Y = 0,1156X1 + 0.0016X2 - 0.0011X3.- 0,0405X4 + 0,9244C

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(15) Semarmendem River : Y = 0,0614X1 + 0,0013X2 - 0.003030 - 0,043X4 + 0,88820

From the above equations it can be concluded that floods at Bengawan Solo Lower Stream catchments area is more due to human resources activities in the sub catchments area. Bengawan Solo Lower Stream catchments area is characterized by many meanders, high sedimentation, and the horizontal erosion which more intensive than the vertical erosion. Most of rain water (90%) falling in Bengawan Solo Lower Stream becomes run off water while (10%) will infiltrate into the ground. The land use in the Bengawan Solo Lower Stream catchments area may be divided into 6 (six) groups i.e. forest, bushes, dry land, rice fields and swamps. Floods normally occur in December up to March.

In order to limit floods discharge and increase infiltration capacity reforesting is required in each sub catchments area of rivers which is estimated as follows :

(1) Wulung R : 311 km2 (72,66 %),
(2) Grabagan R: 79 km2 (72,48 %),
(3) Tinggang R: 80 km2 (66,12 %),
(4) Batokan R: 147 km2 (70,33 %),
(5) Gandong R: 176 km2 (69,74 %),
(6) Tidu R: 91 km2 (69,74 %),
(7) Kening R: 512 km2 (62,21 %),

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(10) Merkuris R: 81 km2 (75,70 %),
(11) Ingas R: 97 km2 (69,78 %),
(12) Cawak R: 61 km2 (69,78 %),
(13) Serving R: 237 km2 (69,91 %),
(14) Brangkal R: 232 km2 (65,91 %),
(15) Semarmendem R: 230 km2 (65,71 %) .

Foods can be reduced so as to match the river capacity (full bank flow) if 55,95 % to 75,70 % of the Bengawan Solo Lower Stream catchments area which is in the form of forest with conservation function, while in the settlement areas 272 infiltration well are required.

References : 41 Textbooks an articles, published during period 1986 - 1994;ABSTRAK
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