

KAJIAN SPASIAL EKOLOGI DINAMIKA KARBON ORGANIK AKIBAT KERUSAKAN LINGKUNGAN DALAM RANGKA PENGELOLAAN DAS BONTANG KALIMANTAN TIMUR

INTISARI

Daerah Aliran Sungai (DAS) Bontang yang luasnya sekitar 72,12 km² dan panjang sungai utama 24,20 km, terletak di wilayah sungai (WS) Karangan Provinsi Kalimantan Timur. Bagian hulu (*upland watershed*) DAS Bontang termasuk wilayah Kabupaten Kutai Timur, sedangkan bagian tengah (*midland watershed*) dan bagian hilir (*lowland watershed*) termasuk wilayah Kota Bontang. DAS Bontang selain berpotensi menyebabkan rawan banjir di Kota Bontang, juga berpotensi sebagai penyedia air baku. Dewasa ini, DAS Bontang sedang mengalami degradasi (kerusakan) lahan dan kecenderungan perubahan alih fungsi lahan pada kawasan hutan lindung di hulu DAS serta kondisi sistem drainase perkotaan yang buruk, sehingga secara simultan dapat memperluas lahan kritis, mengurangi fungsi resapan air, meningkatkan limpasan permukaan, erosi tanah, sedimentasi dan banjir, serta peningkatan kehilangan karbon.

Tujuan penelitian ini adalah untuk mengkaji tingkat kerusakan lingkungan DAS Bontang ditinjau dari aspek biogeofisik dan aspek sosial ekonomi budaya, menentukan tingkat kehilangan karbon dan peta sebarannya serta skenario penanganannya. Metode penelitian ini meliputi analisis kerusakan lingkungan DAS Bontang dari aspek biogeofisik yang diindikasikan oleh nilai limpasan permukaan, erosi tanah dan sedimentasi, sedangkan dari aspek sosial ekonomi budaya diindikasikan oleh nilai tekanan penduduk, kekritisian lahan dan konflik sosial. Selain itu, analisis spasial kerusakan lingkungan DAS Bontang didekati dengan perubahan penutup lahan antara dua waktu yang terjadi di DAS tersebut, besarnya kehilangan karbon dihitung dari luas perubahan lahan yang dirinci setiap tipe penutupan lahan, kemudian dikonversi menjadi volume karbon.

Hasil penelitian ini menunjukkan bahwa DAS Bontang mempunyai topografi datar dan bergelombang. Bagian hulu berbukit-bukit, bagian tengah dan bagian hilir berupa dataran. Jenis tanah didominasi oleh podsolik merah kuning, alluvial dan kompleks latosol, top soilnya tipis, peka erosi dan miskin unsur hara. Tutupan vegetasi DAS Bontang bagian hulu berupa hutan lindung dan tanaman keras, bagian tengah berupa tanaman ladang dan semak belukar, bagian hilir berupa tanaman mangrove. Tingkat kerusakan lingkungan DAS Bontang dari aspek biogeofisik diindikasikan oleh nilai limpasan permukaan sampai klasifikasi tinggi, nilai erosi tanah sampai klasifikasi berat dan nilai sedimentasi sampai klasifikasi sangat tinggi, sedangkan dari aspek sosial ekonomi dan budaya diindikasikan oleh nilai klasifikasi tekanan penduduk melebihi kapasitas lahan, kekritisian lahan sampai kategori kritis, serta adanya konflik sosial akibat alih fungsi lahan. Secara spasial tingkat kehilangan karbon di DAS Bontang akibat kerusakan lingkungan sebagian besar di bagian tengah dan bagian hilir yang penggunaan lahannya didominasi oleh penggunaan lahan tegalan, semak belukar dan permukiman, karena itu skenario penanganannya terutama dapat difokuskan pada penggunaan lahan tersebut dengan menerapkan teknik konservasi tanah dan air, rehabilitasi lahan (penghijauan), pembangunan Ruang Terbuka Hijau (RTH) dan hutan kota. Selain itu, penanganan kerusakan lingkungan DAS Bontang secara keseluruhan dapat dilakukan antara lain melalui revisi tata ruang DAS yang berwawasan lingkungan dan penyelesaian konflik alih fungsi lahan, memperkuat kerja sama dan komitmen antar pihak terkait (*stakeholders*), serta peningkatan pemberdayaan masyarakat, yang secara keseluruhan dapat dikemas dalam model pengelolaan DAS terpadu (*integrated watershed management*).

Kata kunci: *degradasi, lahan kritis, erosi, sedimentasi, banjir, kehilangan karbon*



SPATIAL STUDY ON ECOLOGY OF ORGANIC CARBON DYNAMICS
DUE TO ENVIRONMENTAL DEGRADATION FOR
BONTANG WATERSHED MANAGEMENT IN EAST KALIMANTAN

ABSTRACT

Bontang watershed is approximately 72.12 km² in area and 24.20 km long main river, is located in the Karangan river area in East Kalimantan Province. The upland of Bontang watershed including East Kutai regency, while the midland and low land of Bontang watershed including Bontang city area. Bontang watershed in addition to potentially causing flood prone in Bontang city, also has potential as a provider of raw water. Nowadays, Bontang watershed is occurring land degradation and changing trends over the land conversion in protected forest area in upland watershed, also the condition of poor urban drainage systems, thus simultaneously can expand critical lands, reducing the function of water infiltration, increasing runoff, soil erosion, sedimentation, flooding and carbon loss.

The objective of this study was to analyze the level of environmental degradation of Bontang watershed in terms of biogeophysical and socio-economic and cultural aspects, determines the level of carbon loss and map its distribution and handling scenarios. The methods of this study include the analysis of the environmental degradation in Bontang watershed in terms of biogeophysical aspects indicated by the value of the surface runoff, soil erosion and sedimentation, while the socio-economic and cultural aspects indicated by the value of population pressure, the criticality of land and social conflicts. In addition to the spatial analysis of environmental degradation of Bontang watershed approximated by changes in land cover between two times occurring in the watershed, the amount of carbon loss was calculated from the extensive changes in land specified every type of land cover, then converted to carbon volume.

The results of this study revealed that the Bontang watershed has a flat topography and undulating. The upland hilly, midland and lowland in the form of the plains. The soil type is dominated by red-yellow podzolic, alluvial and complex latosol, thin top soil, vulnerable to erosion and nutrient-poor. The upland of Bontang watershed is covered by vegetation of the protected forests and crops, the midland is covered by crops and shrubs, and the lowland is covered by mangrove plants. The level of environmental degradation of Bontang watershed in terms of biogeophysical aspects indicated by the value of runoff to the classification of high, soil erosion to the classification of weight and sedimentation to the classification of very high, while the socio-economic and cultural aspects indicated by the value of the population pressure exceeds the capacity of the land, the criticality of land until the critical category, and the social conflicts due to land conversion. Spatially rate of carbon loss in the Bontang watershed due to environmental degradation mostly in the midland and lowland is dominated by the land use of dry land, shrubs and settlements. Therefore the scenarios handling can mainly be focused on the use of that land by applying soil and water conservation techniques, land rehabilitation (afforestation), development of green open space and urban forest. In addition, the handling of environmental degradation of Bontang watershed as a whole can be done through a revision of spatial watershed based on environment and a conflict resolution of land conversion, strengthen cooperation and commitment among stakeholders and increased community empowerment, which as a whole can be packed in the model of integrated watershed management.

Keywords: *degradation, critical land, erosion, sedimentation, flooding, carbon loss*