

Dampak Kegiatan Masyarakat Pada Kualitas Air Danau Buyan, Kabupaten Buleleng, Bali = Impact of Community Activities on The Water Quality of Buyan Lake, Buleleng Regency, Bali

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Abstrak

Pemasukan nitrat dan fosfat dapat meningkatkan kadarnya di air melebihi kebutuhan minimal organisme perairan sehingga menyebabkan pertumbuhan secara berlebihan. Pemasukan nitrat dan fosfat pada kadar tertentu yang melebihi baku mutu dapat menyebabkan pencemaran sehingga menurunkan kualitas air. Keadaan ini dapat mengurangi nilai sumber daya air, nilai estetika, pariwisata, dan perikanan. Secara umum, menurunnya kualitas air danau terutama disebabkan oleh proses alami disamping kegiatan masyarakat. Permasalahan yang diakibatkan oleh kegiatan masyarakat lebih mungkin ditangani dengan melakukan pengelolaan dan pengurangan penyebab pencemaran pada sumbernya. Danau Buyan telah mengalami degradasi kualitas lingkungan yang cukup tinggi di antara keempat danau yang ada di Propinsi Bali. Bagian timur, selatan dan barat daya telah mengalami pendangkalan dan pertumbuhan eceng gondok yang berlebihan. Pendangkalan terjadi terutama karena tingginya tingkat erosi saat musim hujan. Tanah yang berasal dari lahan di daerah tangkapan terbawa air larian. Tanah yang mencapai air danau mengandung sejumlah unsur hara. Keadaan ini makin diperburuk oleh kondisi danau karena tidak terdapat aliran air keluar sehingga pencemar akan mengalami akumulasi.

Penelitian bertujuan untuk:

1. Mengetahui kegiatan masyarakat sebagai sumber yang potensial dalam memberikan pemasukan total Nitrogen (N) dan total Fosfor (P) berdasarkan penggunaan lahan di daerah tangkapan sehingga dapat dilakukan tindakan pencegahan, pengendalian dan minimisasi terjadinya pencemaran serta prioritas penanganan permasalahan
2. Mengetahui kualitas air parameter N dan P dan menentukan tipe tingkat trofik Danau Buyan sehingga dapat digunakan untuk menentukan arah pengelolaan sumber daya air.

Hipotesis penelitian adalah kegiatan masyarakat di daerah tangkapan Danau Buyan, menyebabkan kadar N dan P di air danau menjadi tinggi.

Penelitian lapangan dilaksanakan selama Bulan April-Juni 2003 di Danau Buyan Kabupaten Buleleng, Bali. Metode penelitian yang digunakan adalah survei dan ex post facto. Penentuan lokasi dilakukan secara cluster dan purposive. Penentuan lokasi kegiatan masyarakat berdasarkan penggunaan lahan di daerah tangkapan Danau Buyan. Pengambilan sampel air danau sebanyak 9 lokasi pengukuran. Pengambilan sampel air di saluran masuk sebanyak 11 lokasi sepanjang tanggul pembatas danau.

Variabel penelitian adalah:

1. Pemasukan total N dan P dari penggunaan lahan di daerah tangkapan.
2. Kualitas air Danau Buyan dan air yang masuk, parameter N (nitrat, nitrit, amonia dan total N) dan P (fosfat dan total P).
3. Tipe tingkat trofik danau (kriteria hidrografi, trofik dan higienis).

Data primer diperoleh dengan melakukan pengukuran sampel air sedangkan data sekunder diperoleh dari instansi-instansi terkait.

Analisis penelitian dilakukan secara deskriptif dengan pendekatan kualitatif dan kuantitatif. Pemasukan total N dan P dihitung berdasarkan metode yang dikemukakan dalam Jorgensen (1990) dan faktor erosi (Dinas PtJ 2000). Kadar N dan P limbah cair domestik dihitung berdasarkan jumlah penduduk dan konversi nilai dalam Sugiharto (1987), Soeparman & Suparmin (2002) dan Ryding & Rast (1989). Penentuan status mutu air menggunakan Keputusan Menteri Negara Lingkungan Hidup Nomor 115 Tahun 2003 tentang Pedoman Penentuan Status Mutu Air. Baku mutu yang digunakan terdapat pada Peraturan Pemerintah Nomor 82 Tahun 2001 tentang Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air dan serta melakukan telaah pustaka. Tipe tingkat trofik danau ditentukan berdasarkan modifikasi Technical Standard (Ryding & Rast 1989).

Hasil perhitungan memperlihatkan bahwa pemasukan total N dari penggunaan lahan pertanian sebesar 22,46 ton/tahun (62,15%), tegalan dan semak 0,08 ton/tahun (0,22%), serta kawasan lindung 13,60 ton/tahun (37,64%). Kadar total N air rata-rata yang daerah sekitarnya dimanfaatkan untuk pertanian (0,41 mg/I), lebih tinggi dibandingkan dengan lahan tegalan dan semak (0,31 mg/I), serta kawasan lindung (0,29 mg/I).

Pemasukan total P yang berasal dari kegiatan pertanian adalah sebesar 2,44 ton/tahun (78,56%), tegalan dan semak 0,01 ton/tahun (0,35%), serta kawasan lindung 0,65 ton/tahun (21,09%). Kadar total P air rata-rata danau yang daerah tangkapannya dimanfaatkan untuk pertanian lebih tinggi (0,90 mg/I) dibandingkan dengan lahan tegalan dan semak (0,72 mg/I), serta kawasan lindung (0,76 mg/I). Selain itu, sistem pembuangan dari permukiman menggunakan tangki pembusukan dan bidang resapan sehingga limbah yang dihasilkan merembes bercampur dengan air tanah. Setelah melalui proses penguraian di tangki pembusukan dan bidang resapan, jumlah N anorganik dan total N masing-masing sekitar 0,85 ton/tahun. Jumlah P terlarut dan total P masing-masing sekitar 0,30 ton/tahun. Jumlah total N dan P yang mencapai danau masing-masing sebesar kurang dari 0,38-0,68 ton/tahun dan 0,18-0,22 ton/tahun.

Kualitas air Danau Buyan memenuhi baku mutu kelas III, indeks pencemarannya (IP) sebesar 0,3202-0,5211 sedangkan bila dibandingkan dengan baku mutu kelas II maka tergolong cemar ringan (IP=1,9482-2,7153). Kualitas air danau memperlihatkan kadar nitrat (<0,01 mg/l) dan nitrit (<0,001-0,006 mg/I) rendah tetapi kadar amonia (0,025-0,23 mg/l) telah melebihi kebutuhan minimal pertumbuhan alga. Kadar fosfat (0,44-0,72 mg/I) dan kadar total P (0,66-1,02 mg/l) telah melebihi kebutuhan minimal pertumbuhan alga. Rasio N (amonia) dan P (fosfat) air adalah 1:6, yang berarti hara N sebagai faktor pembatas pertumbuhan. Kualitas air yang masuk memenuhi baku mutu kelas III (IP=0,3251-0,8522) sedangkan bila dibandingkan dengan baku mutu kelas II maka tergolong cemar ringan (IP=3,3575-1,9818). Kualitas air yang masuk memperlihatkan bahwa kadar nitrat (<0,01-1,00 mg/I), kadar amonia (0,15-0,73 mg/I) dan total N (0,60-1,31 mg/I) telah melebihi kebutuhan minimal pertumbuhan alga, kecuali kadar nitrit (<0,0025-0,021 mg/I). Kadar fosfat (0,45-1,09 mg/l) dan kadar total P (0,72-2,12 mg/l), telah melebihi kebutuhan minimal pertumbuhan alga. Tipe tingkat trofik Danau Buyan termasuk mesotrofik (nilai 2,32).

Kesimpulan penelitian ini adalah:

1. Kegiatan masyarakat yang memberikan dampak pada pemasukan total N dan P, berturut-turut berasal dari lahan pertanian, kawasan lindung, tegalan dan semak, serta permukiman.
2. Kualitas air Danau Buyan memenuhi baku mutu kelas III, rasio amonia dan fosfat adalah 1:6 yang berarti hara N sebagai faktor pembatas. Tipe tingkat trofik Danau Buyan adalah mesotrofik.

Saran yang dapat diberikan adalah:

1. Pemerintah daerah sebaiknya melakukan sosialisasi untuk mengendalikan penggunaan lahan di daerah

yang sudut miring lerengnya mencapai di atas 40% dan jenis tanah regosol serta pemanfaatan daerah bekas rawa untuk kegiatan pertanian.

2. Pemerintah daerah dapat melakukan penyuluhan dan pembinaan untuk mengembangkan budidaya pertanian sesuai dengan kondisi lingkungan.
3. Pemanenan eceng gondok seharusnya dilakukan secara partisipatif dan rutin oleh masyarakat. Pemerintah daerah dapat melakukan penyuluhan, pelatihan dan pembinaan untuk memanfaatkan eceng gondok.
4. Pemerintah daerah sebaiknya melakukan pemantauan kualitas air dan menentukan tipe tingkat trofik secara rutin sesuai dengan musim.
5. Pengembangan wisata tirta sebaiknya memperhatikan kondisi Danau Buyan yang tidak memiliki aliran air keluar.

.....Input of nitrate and phosphate can potentially increase the concentration in aquatic system greater than the minimum requirement, as it triggers the overgrowth of organisms. Input of nitrate and phosphate in certain level exceed the quality standards can potentially cause pollution and degradation of water quality. Such condition could reduce water resources and esthetical value, tourisms and fishery potencies. In general, the degradation of water quality mainly occurs as a result of natural process as well as community activities. Problems arouse from this community activities are more likely handled by managing and lessening the pollution from its source. Environmental quality degradation in Buyan Lake is higher than the other four lakes in Bali and there has been a silting up process over the east, south and northwest sides of the lake, not to mention the overgrowth of water hyacinth. This process is generally begins by high level of erosion in rainy season. Runoff will sweep away the topsoil of catchments that consist of very rich nutrition to the lake. This condition is worsen by lack of outgoing stream, therefore result in the accumulation of pollution substances.

Research are aiming at:

1. Finding community activity as potential source to input of total amount of Nitrogen (N) and Phosphorus (P) based on land utilization at the catchments area; therefore we can take preventive and control action, minimize the pollution and set up the priority of solving problem.
2. Finding out water quality in term of the amount of N and P and determination of Lake Buyan's type of trophic level, therefore it can be used to determine model of water resources management.

Research hypothesis is community activities within catchment area of Buyan Lake, causes the high content of N and P in water.

Field research has been carried out from April to June 2003 at Buyan Lake, Buleleng Regency, Bali Province using survey and ex post facto method. Location was determined based on cluster and purposive approaches whereas determination of location of community activities was conducted on the basic of land utilization in catchments area. Samples of lake water were taken in 9 stations and of inlet water were taken from 11 stations along the lake bank.

Research variables are:

1. Input of N and P nutrients from land utilization at catchments area.
2. Water qualities of lake and inlet water, parameter used are N (Nitrate, Nitrite, Ammonia and total of N)

and P (Phosphate and total of P).

3. Type of Buyan trophic level (criteria: hydrograph, trophic and hygienic).

Primary data were developed by sampling measurement where the secondary data got from related institution.

Data were analyzed descriptively with qualitative and quantitative approach. Input of nutrient N and P were calculated based on method in Jorgensen (1990) and erosion factor (Public Service 2000). Total amount of N and P from domestic waste were calculated by the number of population and value conversion such as know by Sugiharto (1987), Soeparman & Suparmin (2002) and Ryding & Rast (1989). Determination of water quality status used Ministry Decree No 115/2003 re Water Quality Status Manual Determination. Quality standards of water were compared to Government Act No 82/2001 re Water Quality Management and Water Pollution Control and studies such as mentioned in the literature. Type of trophic level was determined by modification of Technical Standard (Ryding and Rast 1989).

Result through calculation showed that input of N nutrient from agricultural utilization is 112.27 tons/year (62,15%), dry land and bushes is 0.39 tons/year (0.22%), and protected area is 68.00 tons/year (37,64%). Total average of N in the water from agricultural land (0.41 mg/I), was higher than dry land and bushes (0.31 mg/I), and protected area (0.29 mg/I). Input of nutrient P from agriculture activities is 8.13 tons/year (78.56%), dry land or bushes 0,04 tons/year (0.35%), and protected area of 2.18 tons/year (21.09%). Total average of P in water which catchments were used for agriculture was higher (0.90 mg/I) compare to dry land and bushes (0.72 mg/I), and protected area (0.76 mg/I). Unfortunately, the sewage system of the residential areas still use septic tanks and catchments wells. A consequence, it could leak out and mix with groundwater. Through septic tank and catchments wells, it was estimated that the amount of N organic and total of N each was 0,85 tons/year while the amount of dissolved P and total of P each was 0,30 tons/year. Total of N and P input from domestic waste are less than 0,38-0,68 tons/year and 0,18-0,22 tons/year.

The water quality of Buyan Lake fulfill quality standard grade III, pollution index (PI) value is 0,3202-0,5211, while if compare with quality standard grade II, pollution index value is 1,9482-2,71.53 (light pollution). Water quality measurement showed that the levels of nitrate (<0,01 mg/I) and nitrite (<0,001-0,006 mg/I) were low; on the contrary, the level of ammonia (0,025-0,23 mg/I) was greater than the minimum requirement for algae growth. Level of phosphate (0,44-0,72 mg/I) and total amount of P (0,66-1,02 mg/I) exceeds the minimum requirements for algae growth. Ratio of N (ammonia) and P (phosphate) of the water is 1:6, meaning that N as nutrient is a limiting factor. The inlet water quality fulfill quality standard grade III (PI=0,3251-0,8522), while if compare with quality standard grade II, pollution index value is 3,3575-1,9818 (light pollution). The inlet water quality showed that level of nitrate (<0,01-1,00 mg/I), ammonia (0,15-0,73 mg/I), and total of N (0,60-1,31 mg/I) already exceeding the minimum requirement for algae growth, except nitrite level (<0,0025-0,021 mg/I). Level of phosphate (0,45-1,09 mg/I) and total amount of P (0,72-2,12 mg/I), were exceeding minimum requirement for algae growth. Type of trophic level is mesotrophic (with value of 2 32).

Research conclusions are:

1. Community activities that potentially contribute to input of total amount of N and P, came from, respectively are agricultural, dry land and bushes, protected area, and residential.
2. Water quality of Buyan Lake for parameter N and P are still conform with the quality standard grade III, ratio of N and P of the water is 1:6, meaning that N as nutrient is a limiting factor. Type of trophic level of Buyan Lake is mesotrophic.

Research recommendations are:

1. Local government had best to carry out socialization to control of land utilization on land with 40% slope and regosol type and swamp area for agricultural.
2. Local government had best to carry out explanation and assisting to development of land cultivation must respect environmental condition.
3. Harvesting of water hyacinth need to undertake in participatory and regular system by local community. Local government can carry out explanation, training and assisting to make use of water hyacinth.
4. Local government had best to carry out regular monitoring of water quality and type of trophic level from the lake at certain season.
5. Water ecotourism development had best to attention Buyan Lake condition lack of outgoing stream.