PEMODELAN SISTEM DINAMIK TERHADAP JASA DAN KERUGIAN EKOSISTEM DI SUB DAS KEMPO, DOMPU, NUSA TENGGARA BARAT

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ABSTRAK

Ekosistem Sub DAS Kempo telah terancam oleh meningkatnya tantangan terhadap kesejahteraan, ketahanan pangan, dan deforestasi. Permasalahan yang melibatkan banyak pemangku kepentingan, berlangsung lama, dan saling terkait, mengindikasikan kompleksitas sistem. Tujuan penelitian di antaranya, 1) menggambarkan hubungan sebab-akibat dalam ekosistem Sub DAS Kempo yang mendasari dinamika perilaku jasa dan kerugian ekosistem menggunakan *systems thinking*, 2) menganalisis perilaku komponen sistem secara sistemik dan dinamik terhadap keberlanjutan ekosistem Sub DAS Kempo, berdasarkan jasa dan kerugian ekosistem pada skenario *Business As Usual* menggunakan pendekatan sistem dinamik, 3) mensimulasikan skenario pengelolaan ekosistem Sub DAS Kempo yang berkelanjutan berdasarkan jasa dan kerugian ekosistem menggunakan sistem dinamik. Metode yang digunakan adalah *systems thinking* menggunakan *Vensim* dan analisis sistem dinamik menggunakan *Powersim*. Data tutupan lahan diperoleh dari digitasi *on screen* citra *Google Earth* tahun 2010-2019. Data primer diperoleh dari wawancara mendalam, rapat, dan survei, sedangkan data sekunder diperoleh dari instansi, serta webinar. Hasil penelitian menunjukkan bahwa jaringan sistem mampu menunjukkan umpan balik pada aspek karakteristik alami ekosistem, yang terjadi pada parameter dinamis seperti hidrologi, iklim, dan tanah, sedangkan secara statis pada morfometri, sebatas menunjukkan keterkaitan antar komponen sebagai mekanisme alami sistem. Umpan balik aspek manajemen lahan menunjukkan dampak aktivitas manusia terhadap sistem. Hambatan keterlibatan masyarakat dalam pengelolaan DAS disebabkan budaya manajemen *top-down*. Perlu adanya inisiatif keterlibatan pemangku kepentingan secara internal untuk menjamin kelestarian dan nilai ekonomi hutan. Keberlanjutan jasa ekosistem Sub DAS Kempo pada skenario *Business As Usual* cenderung rendah, akibat tren penurunan luas hutan dan persentase tumbuh tanaman hutan yang rendah. Sebagai akibatnya, timbul berbagai kerugian ekosistem, di antaranya peningkatan emisi, peningkatan limpasan permukaan, dan penurunan infiltrasi, meskipun terjadi peningkatan manfaat langsung pertanian. Simulasi skenario optimalisasi RHL menunjukkan kecenderungan keberlanjutan jasa ekosistem. Temuan berkaitan dengan karakteristik alami dan manajemen lahan sebagai sumber dari jasa dan kerugian ekosistem dapat memungkinkan untuk evaluasi yang lebih baik dalam pengelolaan DAS.

Kata kunci : Jasa ekosistem, Kerugian ekosistem, Pemikiran sistem, Sistem dinamik

SYSTEM DYNAMICS MODELING OF ECOSYSTEM SERVICES AND DISSERVICES IN KEMPO SUB WATERSHED, DOMPU, NUSA TENGGARA BARAT

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ABSTRACT

The Kempo sub watershed ecosystem has been threatened by increasing challenges to welfare, food security, and deforestation. Problems that involve many stakeholders, last a long time, and are interrelated between components, indicate the complexity of the system. The research objectives include, 1) describing the cause-and-effect relationship in the Kempo Sub watershed ecosystem that underlies the dynamics of ecosystem services and disservices behavior using systems thinking, 2) analyzing the behavior of system components systematically and dynamically on the sustainability of the Kempo Sub watershed ecosystem, based on ecosystem services and disservices in the Business As Usual scenario using a system dynamics approach, 3) simulating a sustainable Kempo sub watershed ecosystem management scenario based on ecosystem services and disservices using a system dynamics. The method used is systems thinking using Vensim software and system dynamics analysis using Powersim software. Land cover data was obtained from on-screen digitization of Google Earth images for 2010-2019. Primary data was obtained from in-depth interviews, meetings, and surveys, while secondary data was obtained from agencies, as well as webinars. The results showed that the system network was able to provide feedback on aspects of the natural characteristics of the ecosystem, which occurred in dynamic parameters such as hydrology, climate, and soil, while statically on morphometry, it was limited to showing the interrelationships between components as a natural mechanism of the system. Feedback on land management aspects indicates the impact of human activities on the system. Barriers to community involvement in watershed management are caused by a top-down management culture. There needs to be an initiative to involve stakeholders internally, to ensure the sustainability and economic value of the forest. The sustainability of the Kempo sub watershed ecosystem services in the Business As Usual scenario tends to be low, due to the downward trend in forest area and the low percentage of forest plant growth. As a result, various ecosystem disservices arise including increased emissions, increased surface runoff, and decreased infiltration, despite an increase in agricultural direct use value. The simulation of the RHL optimization scenario shows the trend of the sustainability of ecosystem services. Findings relating to the natural characteristics and management of land as a source of ecosystem services and disservices could allow for better evaluation of watershed management.

Keywords: Ecosystem services, Ecosystem disservices, Systems thinking, System dynamics