

Expanding megacities and its effect on regional capacity to provide ecosystem services: The case of Jakarta-Bandung conurbation

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The development of megacities, particularly in Indonesia, has led to new challenges as the expanding of Jakarta and Bandung megacities have formed mega-urban conurbation where population growth and physical expansion are going to reach unprecedented magnitude. It is predicted that this region will become the biggest megacity worldwide surpassing the Tokyo Metropolitan Area. Consequently, the expanded urban areas will convert vast agricultural land, forest, and other natural areas, thus regional capacity to provide ecosystem services will be severely declining. Ecosystem services play important roles in supporting life through 4 functions consisting provisioning (e.g. food, freshwater, clean air, etc); regulating (e.g. climate regulation, flood regulation, disease regulation, etc.), cultural (e.g. aesthetic, spiritual, educational, recreational, etc.), and supporting (e.g. nutrient cycling, soil formation, biodiversity habitat, etc.). Certainly, lessening ecosystem services in expanding megacities will escalate urban vulnerability as growing numbers of inhabitants will be exposed to increasingly socio-ecological urban issues such as flood, freshwater scarcity, food insecurity, etc. In this case, land use planning becomes crucial as every land use type has various capacity to deliver different ecosystem services and/or disservices. Therefore, this research aims (1) analyzing land use changes in Jakarta-Bandung Mega Urban Region (JBMUR); (2) developing urban growth model for predicting land use changes; (3) building scenarios of urban growth and analyzing its impact on land use composition; (4) Assessing the capacity of future land use in JBMUR to provide ecosystem services. Generating temporal land use maps would be done based on satellite imagery data interpretation to analyze land use changes in JBMUR, then urban growth model would be developed based on spatial logistic regression coupled with CA-Markov for predicting future land use. Some scenarios of urban expansion were built consisting of (a) urban growth follows spatial planning policy and (b) urban growth follows the trend of previous land use changes which often violate spatial planning policy. Afterwards, by using map of ecosystem services obtained from Ministry of Forestry and Environment which is developed based on map of ecoregion and land use map 2014, we can calculate the impact of land use changes on regional capacity to provide 7 types of ecosystem services consisting of: water regulation, genetic resources, freshwater supply, energy supply, food production, climate regulation, and mitigation of natural disaster. Each type of ecosystem services has specific scores which is different in every area. As an area could have multiple ecosystem services and its services were also influenced by services capacity in its surrounding areas, a spatial multivariate data analysis (i.e. spatial Principal Component Analysis (PCA) combined with spatial clustering technique) is employed to calculate the capacity of JBMUR in providing ecosystem services. Since this research still on progress, the preliminary results show that recent urban expansion has converted vast agricultural land, particularly paddy fields which is important to produce rice as the main staple food in Indonesia. Furthermore, there is an increasing trend of flooding and landslides which occurred in wider areas in correlation with land use changes. This indicates declining capacity of the region to deliver ecosystem services during urban expansion. Therefore, modelling approach is required in the next step to predict urban growth as well as to calculate total ecosystem services that can be delivered after the growth. Strategies to maintain the provision of ecosystem services can be formulated based on the model. These strategies should be specific for each type of ecosystem services and for a particular area, therefore

spatial clustering technique is employed.

Keywords: Megacities, Conurbation, Land Use Changes, Ecosystem Services, Jakarta-Bandung
Mega-Urban Region