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Assessment of Land Use Impact on Water-Related Ecosystem Services Capturing the Integrated Terrestrial-Aquatic System

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Abstract

Although the importance of green (evaporative) water flows in delivering ecosystem services has been recognized, most operational impact assessment methods still focus only on blue water flows. In this paper, we present a new model to evaluate the effect of land use occupation and transformation on water quantity. Conceptually based on the supply of ecosystem services by terrestrial and aquatic ecosystems, the model is developed for, but not limited to, land use impact assessment in life cycle assessment (LCA) and requires a minimum amount of input data. Impact is minimal when evapotranspiration is equal to that of the potential natural vegetation, and maximal when evapotranspiration is zero or when it exceeds a threshold value derived from the concept of environmental water requirement. Three refinements to the model, requiring more input data, are proposed. The first refinement considers a minimal impact over a certain range based on the boundary evapotranspiration of the potential natural vegetation. In the second refinement the effects of evaporation and transpiration are accounted for separately, and in the third refinement a more correct estimate of evaporation from a fully sealed surface is incorporated. The simplicity and user friendliness of the proposed impact assessment method are illustrated with two examples.

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