Assessing the values of water and its allocation under climate change scenarios using a biophysical approach

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Water is a fundamental resource, necessary for most processes of the geobiosphere, where its chemical and physical properties are used to dilute, cool, carry, react with or physically drive processes. It is also required as a sink for many processes, carrying away wastes that would otherwise buildup to lethal quantities in local environments. In essence, it is valued for its quality and quantity. Increasingly, as quality and quantity of water resources and adequacy of supplies in light of population growth and economic development are questioned, there is a pressing need to decide the most appropriate use and allocation of water resources for the welfare of both humans and the environment.

In this paper we examine water from a biophysical perspective using emergy evaluation to establish values of water from different sources (natural capital value), the value as a sink for pollutants (one of its environmental services) and its value to environmental systems. Further, we develop a regional production function to test allocation of water between urban, agricultural and environmental uses. Using Florida as a case study, the model suggests that maximum total production occurs when the fresh water remaining after evapotranspiration is allocated at the rate of 25% to urban uses, 30% to agricultural, and 45% to the environmental.