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Integrating Multiple Types of Value in Natural Capital Accounting Systems: Environmental Value Functions

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Abstract : Societies and economies worldwide fundamentally depend on natural capital. Alarmingly, natural capital assets are quickly depreciating, posing an existential challenge for humanity. The development of robust natural capital accounting systems is essential for transitioning towards sustainable economic systems and ensuring sound management of capital assets. However, the accurate, equitable and comprehensive estimation of natural capital asset stocks and their accounting values still faces multiple challenges. In particular, the representation of socio-cultural values held by groups or communities has arguably been limited, as to date, the valuation of natural capital assets has primarily been based on monetary valuation methods and assumptions of individual rationality. People relate to and value the natural environment in multiple ways, and no single valuation method can provide a sufficiently comprehensive image of the range of values associated with the environment. Indeed, calls have been made to improve the representation of multiple types of value (instrumental, intrinsic, and relational) and diverse ontological and epistemological perspectives in environmental valuation. This study addresses this need by establishing a novel valuation framework, Environmental Value Functions (EVF), that allows for the integration of multiple types of value in natural capital accounting systems. The EVF framework is based on the estimation and application of value functions, each of which describes the relationship between the value and quantity (or quality) of an ecosystem component of interest. In this framework, values are estimated in terms of change relative to the current level instead of calculating absolute values. Furthermore, EVF was developed to also support non-marginalist conceptualizations of value: it is likely that some environmental values cannot be conceptualized in terms of marginal changes. For example, ecological resilience value may, in some cases, be best understood as a binary: it either exists (1) or is lost (0). In such cases, a logistic value function may be used as the discriminator. Uncertainty in the value function parameterization can be considered through, for example, Monte Carlo sampling analysis. The use of EVF is illustrated with two conceptual examples. For the first time, EVF offers a clear framework and concrete methodology for the representation of multiple types of value in natural capital accounting systems, simultaneously enabling 1) the complementary use and integration of multiple valuation methods (monetary and non-monetary); 2) the synthesis of information from diverse knowledge systems; 3) the recognition of value incommensurability; 4) marginalist and non-marginalist value analysis. Furthermore, with this advancement, the coupling of EVF and ecosystem modeling can offer novel insights to the study of spatial-temporal dynamics in natural capital asset values. For example, value time series can be produced, allowing for the prediction and analysis of volatility, long-term trends, and temporal trade-offs. This approach can provide essential information to help guide the transition to a sustainable economy.

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