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Environmental compensation for coastal biodiversity and ecosystem services: A flexible framework that addresses human well-being

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Abstract

Continued loss of biodiversity and ecosystem services creates an urgent need to halt environmental degradation, not least in coastal areas. Environmental compensation has been suggested as a potential tool to reduce or neutralize this development. When applied as a last step in a mitigation hierarchy, the suggested benefit of environmental compensation is that it focuses on the resource itself, so that compensation is “paid” to the public in terms of environmental resources rather than in financial terms. However, estimating the compensation need is inextricably linked to the “value” of what is lost; which losses in values should be compensated and how? Failure to recognize the full damage of environmental degradation is known to lead to poor decision-making both publicly and privately, as the limited subset of values taken into account by markets still tend to be decisive for when and how environmental assets and flows are consumed.

We present a framework for estimating residual losses in connection to a human impact, identifying compensation needs and exploring compensation options. The framework is based on the cascade model, identifying structures, functions, ecosystem services, and benefits damaged. The theoretical principle is to compensate for *all* impacts by matching resource loss with subsequent resource gain, however balancing this with flexibility in selecting appropriate compensation options. Rather than a step-by-step guide, this offers resource managers a structure for analyzing how a coherent resource-based compensation can be formulated in relation to agreed-upon compensation objectives, such as no net loss. The framework is applicable in a variety of environmental settings and contexts (e.g., expected damage *ex ante* or actual damage *ex post*), but here, we demonstrate it by an illustrative case study involving eelgrass habitat loss in a coastal setting.

Keywords

biodiversity offset, cascade model, ecosystem services, habitat loss