
Using biodiversity offsets to mitigate environmental damage

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Abstract

The use of biodiversity offsets to mitigate environmental damage is rapidly proliferating, with biodiversity offsets set to play a key role in nature conservation globally. While these policies are designed to compensate for development impacts on biodiversity, in many circumstances the environmental gains can take decades to accrue, or fall short of the "no-net-loss" (NNL) objective that underpins biodiversity offsetting. Previous work identifying the potential biodiversity outcomes under various offset schemes has focused on evaluating a particular development and associated offset implementation, rather than a systematic evaluation of how biodiversity offset policies perform in a spatial system with many development/offset exchanges taking place over time. Here we present a spatial model that can evaluate likely long-term biodiversity outcomes of biodiversity-offset policies at a range of scales.

We propose a spatial model that can be used to quantitatively estimate the performance of environmental policies including biodiversity offset policies at local through to landscape scales over decadal periods prior to their implementation. In the context of biodiversity offsets the model allows the estimated biodiversity gains and losses associated with development to be evaluated against a range of counterfactuals. The model can be used to forecast the outcomes of a specific policy and evaluate the potential for policy loopholes and systemic policy failure. In addition, the model can be used to determine the overall policy structures that are likely to meet desirable future targets with some degree of certainty, where specific future targets can be used as parameter constraints in the model. Together these approaches are complementary, with the ability to explore multiple policies and offset actions and assess the robustness of these options.

We explore the potential biodiversity outcomes resulting from a range of biodiversity offset policies in the context of a landscape with declining ecological value on three evaluation scales, namely the *local scale*, where the loss of biodiversity value from a particular development parcel is offset by an associated gain from one or more offset parcels, the *program scale*, composed of all cumulative set of land parcels involved all development and offsets in the scheme, and the *landscape scale*, comprising all parcels in the simulated landscape. We show that even under an idealized situation where the development-offset parcel-sets achieve NNL, the time lags involved in accruing offsets gains can lead to the policy failing it's NNL objective at the program and landscape scale when the offsets are implemented at the same time as or when lagging behind development. Conversely, we show that if the offsets are performed prior to development using an "offset banking" scheme, NNL is achievable using a number of the policies that fail when the offsets are implemented post development.

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Keywords: offsets, conservation, modelling, No Net Loss