*Extended Abstract**

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Ecosystem services in conservation planning: Less costly as costs and side-benefits

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Abstract

Because of their potential to explicitly link conservation and human well-being, there is growing support to include ecosystem services in conservation planning. In this study, we explored three questions: (1) what is the most effective and efficient method of including ecosystem services in Marxan—the most widely used software tool for conservation reserve network design; (2) what reduction in estimated reserve costs is enabled by the explicit inclusion of ecosystem-service opportunity costs; and (3) what are the relationships between services across space. In conjunction with the Nature Conservancy of Canada, we answered these questions by examining the potential impact of conservation on the supply of these three ecosystem services and biodiversity in the Central Interior of British Columbia, relative to a business-as-usual scenario. Our findings suggest that including ecosystem services within a conservation-planning program may be most cost-effective when these services are represented as substitutable costs or benefits (within the cost surface), rather than as targeted features.

KEYWORDS: *Central Interior Ecoregional Assessment; conservation planning; ecosystem services; Marxan; opportunity costs.*

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*** Editor's Note**

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Background

Support is growing for the inclusion of ecosystem services in conservation (Goldman et al. 2008) because of their potential to explicitly link conservation and human well-being; however, few studies have explicitly included ecosystem services within systematic conservation planning analyses (Chan et al. 2006; Egoh et al. 2007). We explore three questions in our current study (Chan et al., in review).

First, what is the most effective and efficient method of including ecosystem services in Marxan—the most widely used software tool for conservation reserve network design (Ball and Possingham 2000)? Inclusion of terrestrial ecosystem services alongside biodiversity in conservation plans has generally been through the use of explicit targets for services as features. In the marine realm, fishing has been considered in systematic conservation planning within the cost surface. We compare these two approaches (features vs. benefits/costs).

Second, what reduction in estimated reserve costs is enabled by the explicit inclusion of opportunity costs (Naidoo et al. 2006)? Increasing attention is paid to the importance of accounting for a broad suite of costs of conservation in planning, and here we characterize timber harvest (the prevailing land use) values as an opportunity cost of conservation to investigate the extent to which inclusion of such costs increases the efficiency of conservation.

Third, what are the relationships between services across space? Previous studies have demonstrated mostly weak correlations between ecosystem services and biodiversity priorities across space (Chan et al. 2006; Naidoo et al. 2008; Egoh et al. 2009; Luck et al. 2009). In this study, we examined correlations between priorities for timber harvest and two conservation-compatible services (carbon storage and recreational angling).

In conjunction with the Nature Conservancy of Canada's Central Interior Ecoregional Assessment, we answered these questions by examining the potential impact of conservation on the supply of these three ecosystem services and biodiversity in the Central Interior of British Columbia, relative to a business-as-usual scenario.

Methodology/principal findings

We calculated and mapped marginal economic values for carbon storage, timber production, and recreational angling from biophysical data sets using a geographical information system. Service values were derived, using methodologies and reasoning established in previous work (Kurz et al. 1997; Chan et al. 2006; Naidoo and Ricketts 2006). We found that including services as substitutable benefits/costs, as opposed to intrinsically valuable features in Marxan, resulted in a reserve network that captured all biodiversity and ecosystem service targets at a lower total cost (1.6% reduced). By including timber production as an opportunity cost in the cost surface, we greatly reduced the total cost of our reserve (15%). Nevertheless, there was counter-intuitive good news in our ecoregions: timber harvest (the only conservation-incompatible service) was negatively correlated in space with carbon storage, biodiversity, and angling, whereas biodiversity and these conservation-compatible services were all positively correlated.

Our findings suggest that including ecosystem services within a conservation-planning program may be most cost-effective when these services are represented as substitutable costs or benefits, rather than as targeted features.

Conclusions/significance

Our findings suggest that including ecosystem services within a conservation-planning program may be most cost-effective when these services are represented as substitutable costs or benefits (within the cost surface), rather than as targeted features. By explicitly valuing the costs and benefits associated with ecosystem services, we may be able to achieve meaningful biodiversity conservation at lower cost and with greater side-benefits. In the central interior of British Columbia, conservation may be less at odds with timber harvest than might be expected, and more congruent in space with recreational angling and carbon storage.

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