Many services generated by forest ecosystems provide essential support for human well-being. However, the vulnerability of these services to environmental change such as forest fragmentation are still poorly understood. We present spatial modeling of the generation of ecosystem services in a human-dominated landscape where forest habitat patches, protected by local taboos, are located in a matrix of cultivated land in southern Madagascar. Two ecosystem services dependent on the forest habitats were addressed: (1) crop pollination services by wild and semidomesticated bees (Apoidea), essential for local crop production of, for example, beans, and (2) seed dispersal services based on the presence of ring-tailed lemurs (Lemur catta). We studied the vulnerability of these ecosystem services to a plausible scenario of successive destruction of the smallest habitat patches. Our results indicate that, in spite of the fragmented nature of the landscape, the fraction of the landscape presently covered by both crop pollination and seed dispersal services is surprisingly high. It seems that the taboo system, though indirectly and unintentionally, contributes to upholding the generation of these services by protecting the forest patches. Both services are, however, predicted to be very vulnerable to the successive removal of small patches. For crop pollination, the rate of decrease in cover was significant even when only the smallest habitat patches were removed. The capacity for seed dispersal across the landscape displayed several thresholds with habitat patch removal. Our results suggest that, in order to maintain capacity for seed dispersal across the landscape and crop pollination cover in southern Androy, the geographical location of the remaining forest patches is more crucial than their size. We argue that in heavily fragmented production landscapes, small forest patches should increasingly be viewed as essential for maintaining ecosystem services, such as agricultural production, and also should be considered in the ongoing process of tripling the area of protected habitats in Madagascar.

Keywords: forest fragmentation, graph, habitat loss, pollination, seed dispersal, small habitats, southern Madagascar

Received: March 3, 2005; Revised: June 24, 2005; Accepted: July 18, 2005

Cited by


The Value Of Small Size: Loss Of Forest Patches And Ecological Thresholds In Southern Madagascar


Margaret E. Andrew, Michael A. Wulder, Nicholas C. Coops. (2011) Patterns of protection and threats along productivity gradients in Canada. Biological Conservation 144:12, 2891-2901


Liang Hu, Zhen Li, Wen-bo Liao, Qiang Fan. (2011) Values of village fengshui forest patches in biodiversity conservation in the Pearl River Delta, China. Biological Conservation 144:5, 1553-1559

Robert D. Archibald, Michael D. Craig, Katarzyna Bialkowski, Chris Howe, Treena I. Burgess, Giles E.St.J. Hardy. (2011) Managing small remnants of native forest to increase biodiversity within plantation landscapes in the south west of Western Australia. Forest Ecology and Management 261:7, 1254-1264


José M. Herrera, Daniel García, Daniel Martínez, Alicia Valdés. (2010) Regional vs local effects of habitat loss and fragmentation on two plant-animal interactions. Ecography-no

Florian Altermatt, Dieter Ebert. (2010) Populations in small, ephemeral habitat patches may drive dynamics in a Daphnia magna metapopulation. Ecology 91:10, 2975-2982


http://www.esajournals.org/doi/abs/10.1890/1051-0761%282006%29016%5B0440%3ATVOSSL%5D2.0.CO%3B2
Abstract


Online publication date: 1-Mar-2010.

Abstract - Full Text - PDF (522 KB) - Supplemental Material


Online publication date: 1-Jan-2010.

CrossRef


Online publication date: 1-Dec-2009.

CrossRef


Online publication date: 10-Oct-2009.

CrossRef


Online publication date: 28-Sep-2009.

CrossRef


Online publication date: 1-Sep-2009.

CrossRef


Online publication date: 1-Jun-2009.

CrossRef


Online publication date: 1-Jun-2009.

CrossRef

Naiara Pinto, Timothy H. Keitt. (2009) Beyond the least-cost path: evaluating corridor redundancy using a graph-theoretic approach. Landscape Ecology 24,2, 253-266

Online publication date: 1-Feb-2009.

CrossRef


Online publication date: 1-Feb-2009.

CrossRef


Online publication date: 1-Jan-2009.

CrossRef

Ernesto Estrada, Örjan Bodin. (2008) USING NETWORK CENTRALITY MEASURES TO MANAGE LANDSCAPE CONNECTIVITY. Ecological Applications 18,7, 1810-1825

Online publication date: 1-Oct-2008.

Abstract - Full Text - PDF (1017 KB)


Online publication date: 1-Aug-2008.

Abstract - Full Text - PDF (341 KB)


Online publication date: 1-Aug-2008.

CrossRef


Online publication date: 1-Apr-2008.

CrossRef


Online publication date: 1-Aug-2008.

CrossRef


Online publication date: 1-Apr-2008.

CrossRef

http://www.esajournals.org/doi/abs/10.1890/1051-0761%282006%29016%5B440%3ATVOSSL%5D2.0.CO%3B2