



Abstract

Policymakers seeking to modify financial incentives to increase the flows of ecosystem services in and around tropical moist forests must consider where to focus their attention and what collection of incentives can effectively achieve policy objectives. In most cases, policymakers focus on extensively forested areas where the flows of ecosystem services between agriculture and the environment is generally characterized by massive flows of carbon and soil nutrients from forests to agriculture. In these forest margin areas the stock of primary forest is eventually exhausted and the cheap ingredients provided by nature to agriculture become increasingly scarce. At this point, policy interest generally wanes, and agriculture and the environment begin slow declines in ecosystem service exchange, often with negative consequences for rural poverty. How does one promote increased flows of ecosystem services from agricultural lands without increasing poverty when forests and soils have been depleted? Can the standard instruments, e.g., payments for ecosystem services, be effective in such situations, and if so, do the costs to society of securing these services increase? Here we focus on the flows of ecosystem services at the end of the cycle of converting primary forest to agriculture. Primary data from the Bragantina area in the southeastern Brazilian Amazon, an area cleared of primary forest decades ago, are used to characterize smallholder production systems, to describe the flows of ecosystem services into and from these systems, and to develop a bioeconomic model of smallholder agriculture capable of predicting the effects of several types of policy action on ecosystem services provided by and to agriculture, and on-farm household incomes and food self-reliance. Of particular interest is the *Proambiente* Pilot Program in Brazil, which uses smallholder payment schemes to induce farmers to manage land and forest resources in ways that generate more ecosystem services. Baseline results suggest that smallholder agriculture leads to a gradual loss of ecosystem services (mainly above-ground and root carbon) provided by secondary forest fallows, and that reduction in fallow age leads to reductions in plant diversity. Intensifying agricultural activities accelerates this process, but considerably increases smallholder incomes. Paying farmers for ecosystem services linked to the retention of secondary forests and the *Proambiente* program both increase area in forest fallow, but the latter substantially reduces farm income because of input use restrictions. In general, programs aiming to promote the production of ecosystem services should not limit farmers' choices of ways to provide them. Employment and food self-reliance issues associated with policy options for increasing on-farm stocks of carbon and plant biodiversity are also explored.

Keywords

Biodiversity; Agriculture; Carbon; Brazil; Deforestation; Payment for ecosystem services

Bibliographic information

Citing and related articles

This article belongs to a special issue

Special Section - Ecosystem Services and Agriculture — Ecosystem Services and Agriculture

Edited By Scott M. Swinton, Stephen K. Hamilton, Frank Lupi and G. Phillip Robertson

Other articles from this special issue

The dangers of extended, but incomplete, accounting for measurement errors

Mick Common

[Show more information](#)

Ecosystem services and agriculture: Cultivating agricultural ecosystem services

Scott M. Swinton, Frank Lupi, G. Phillip Robertson, Stephen K. Hamilton

[Show more information](#)

Ecosystem services and dis-services to agriculture

Wei Zhang, Taylor H. Ricketts, Claire Kremen, Karen Carney, Scott M. Swinton

[Show more information](#)

[View more articles »](#)

Related articles

Airborne P-band SAR applied to the aboveground biomass studies in the Amazon

2003, Remote Sensing of Environment

[Show more information](#)

Tropical forest management and silvicultural practices by smallholders in the Amazon

2004, Forest Ecology and Management

[Show more information](#)

Predicted soil organic carbon stocks and changes in the Brazilian Amazon

2007, Agriculture, Ecosystems & Environment

[Show more information](#)

Applications and tools

Workspace