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Trade-Offs Between Smallholder Welfare and Environmental Services in the Eastern Brazilian Amazon: Technology and Policy Options

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Abstract

For more than a century, smallholders in the Zona Bragantina (Northeast of Pará, Brazil) have depended on fallows as a natural nutrient source for annual food and cash crop production in a slash-and-burn system. Productivity losses due to recent negative soil nutrient balances are a problem faced by many farmers in the region who have developed various strategies for dealing with it. One prominent example is the adoption of mechanical land preparation technologies combined with the use of chemical fertilisers. This paper examines two types of mechanical land preparation, i.e. ploughing and mulching, that are currently being tested in the study area.

The paper first presents and discusses the baseline results of the farm-level linear and non-linear bio-economic models developed to simulate smallholder land use, product mix and technology choice decisions under market and production risk. The models are then used to examine the effects of the introduction of ploughing and mulching. Results suggest that the use of mechanical ploughing is affordable and would likely improve farm-household income, while leading to large losses in below- and above-ground carbon and to an increase in temporarily unproductive fallow land. The introduction of mechanical mulching of above-ground biomass, on the other hand, will likely positively influence carbon sequestration and fallow conservation, but is unaffordable to smallholders at its current costs. Policy instruments, such as a tax on land that is slashed and burned or payments for environmental services such as carbon sequestered appear to be feasible options to maintain natural resource quality without halting technological change and the economic benefits it brings to smallholders. Estimates of the levels of taxation and payments for environmental services required to facilitate the adoption of these technologies by smallholders are provided.

The final discussion centres on how research results could guide existing policy dialog and implementation in the area.

Keywords: Alternatives to slash-and-burn, bio-economic model, carbon, fallow system, risk analysis, technology adoption