

## Modelling the Sustainability of Frontier Farming at the Forest Fringe in Amazonia

Interventions are identified which will enable smallholders at the forest fringe in Amazonia to improve environmental sustainability and increase economic efficiency of their farming enterprises. Adoption of such interventions could decrease the rate of further encroachment into the forest and the conversion of smallholdings to extensive livestock ranching.

### Background

Stabilisation of frontier zones in the Amazon region is a key element in reducing deforestation rates and encroachment into new, forested areas. It is widely recognised that a cycle of declining fertility, pasture degradation and poor economic opportunities lead colonist farmers – the most populous group of Amazonian forest dwellers – to sell their land to cattle ranchers and then colonise new areas. These colonist farmers must, therefore, be central actors in any strategy for frontier stabilisation. Furthermore, these farmers are often particularly impoverished.

Extensive, pasture-based cattle production has usually been regarded as the main cause of environmental degradation in Amazonia. Consequently, little attention has been

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Project completed in 2000



*Cattle grazing seeded pasture in regenerating forest, Amazonia.*

paid to the more positive roles of livestock in mixed farming systems, where their effective integration can greatly benefit the sustainability of the system as a whole.

### Research highlights

Research conducted under this project modelled the sustainability of frontier family farming systems in the Marabá region of Pará State of Brazil and examined the contribution of livestock enterprises. Three localities at different stages of frontier settlement were selected in partnership with farmers' organisations. A key strategy for enhancing the sustainability of these frontier farming systems is to increase the integration of their components – crops, pasture and forests. Farmers' diagrammatic representations of their farming systems show that most farms have these components but the efficiency of nutrient cycling of the components is often poorly developed. As a result, farmers believe that they will not be able to sustain crop production.

For farmers, the key indicator of declining soil fertility is the presence of weeds. This reflects the lack of labour

as a critical limiting resource in farm management. Furthermore, many farmers believe that the area will become a *sertão* (savannah-type vegetation), demonstrating their understanding of the broader ecological consequences of different management practices.

Conventional thinking suggests that pasture degradation is due to a loss of soil nutrients coupled with overgrazing. However, detailed monitoring of pasture areas has indicated that overgrazing is not common on colonists' farms. On the contrary, as rotational grazing models show (see overleaf), pasture is often not used as intensively as it could be. In effect, under-utilisation leads to pasture degradation.

The research has demonstrated that farmers have a wide knowledge of forest species. They are able to list 17 forest and fallow species that are consumed by animals, some of which could have potential as cultivated fodder trees. Also, some of their current practices may be beneficial in the improvement of silvo-pastoral systems. When clearing forest, for example, farmers leave certain 'useful'

<p><b>House Paddock</b>  <i>Panicum maximum</i> &amp; <i>Brachiaria brizantha</i></p> <ul style="list-style-type: none"> <li>• 180 days' use in six periods from seven to 60 days</li> <li>• Stocking rates of between 0.8 and 1.8 animals/hectare</li> </ul>	<p><b>River Paddock</b>  <i>Panicum maximum</i> &amp; <i>Brachiaria mutica</i></p> <ul style="list-style-type: none"> <li>• 45 days' use in two periods from 15 to 30 days</li> <li>• Stocking rates of between 2.3 and 2.4 animals/hectare</li> </ul>
<p><b>Bottom Paddock</b>  <i>Brachiaria brizantha</i></p> <ul style="list-style-type: none"> <li>• 50 days' use in only one period</li> <li>• Stocking rate of 2.1 animals/hectare</li> </ul>	<p><b>Side Paddock</b>  <i>Brachiaria humidicola</i></p> <p>Not used at all</p>

Example grazing model of a colonist farm in Pará State, Brazil.

trees that will yield building materials at a later date.

### Uptake

By sampling case studies of farm households at different stages of frontier settlement, changing patterns of resource use can be assessed, and farmers' practices identified that will provide insights to assist in increasing sustainability. Project findings will contribute to policy-making in terms of identifying appropriate interventions that will enable smallholders to increase the environmental sustainability and economic efficiency of enterprises at the forest fringe. With this information, it is anticipated that policy formulation will be more effectively directed at slowing the rates of further encroachment into forest land and conversion of smallholdings to extensive livestock ranching.

### Linkages

Translating research outputs into developmental benefit was one of the themes of a workshop in Marabá,

included: (a) development of new strategies for pasture management and rotational grazing; (b) introduction of forage legumes, and development of locally available resources to provide supplementary minerals; and (c) adoption of common calendars for vaccination.

It is intended that collaborative follow-up work will be conducted by LASAT, local farmers' organisations and local development agents.

The outputs of this project complement those of Livestock Production Programme Project R6774: Alternative strategies for small livestock keepers in forest margins.

### Relevance to sustainable livelihoods

In most farming systems in the study area, the forest makes an important contribution to livelihoods, accounting for up to 51 per cent of income. Interestingly, on some of the more established farms, the forest component of the system has been

where farmers, researchers and development specialists were able to discuss the key findings. A number of proposals for further work were identified as participants assessed the key constraints relevant to their own experiences. Topics of general importance

minimised. However, it appears that this move has generally been driven by a market-oriented intensification into specialised dairying. It is, therefore, an option only where a marketing infrastructure for dairy products exists to ensure continued financial viability.

### Selected project publications

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- Muchagata, M.G. and Amaral, M. (1998) Tem barulho na mata. Perspectivas para manejo comunitário de florestas em uma região de fronteira. In: *Métodos e Experiências de Pesquisa-Formação-Desenvolvimento em Agricultura Familiar*. NEAF-CAP-UFPa (Núcleo de Estudos Integrados da Agricultura Familiar-Centro Agropecuario-Universidade Federal do Pará), Belém, Brazil.
- Muchagata, M.G. and Brown, K. (2000) Colonist farmers' perceptions of fertility and the frontier environment in eastern Amazonia. *Agricultural and Human Values*, 17 (4): 371–384.

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