**TOPIC 3**

<table>
<thead>
<tr>
<th>Project title:</th>
<th>Integrated crop-livestock-tree systems for smallholder farmers in the Amazon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Institution:</td>
<td>Wageningen University</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Institution:</td>
<td>Montpellier Supagro/CIRAD</td>
</tr>
<tr>
<td>Associate Institution:</td>
<td>Embrapa Amazonia Oriental</td>
</tr>
</tbody>
</table>

**Key words (4-6):** integrated farming systems, agroforestry, resource use efficiency, co-innovation, livelihoods, Amazon

**Project description (max. 500 words):**

The colonization of the Brazilian Amazon has resulted in a process of intense deforestation which has triggered a myriad of environmental and social problems, including biodiversity loss, degradation of soils, regional and global climate change, violence, social unrest and poverty. This deforestation is in part associated with the slash and burn practice adopted by smallholder farmers. Although current legislation aims to reduce the deforestation rate by requiring the preservation of forest on smallholder properties, rural populations are facing difficulties to adapt their traditional land-use practices. As a result, the adherence to this legislation is generally poor and on-farm forest preservation is not effective. A potential pathway out this crisis is to make agriculture activity more profitable and develop sustainable on-farm production systems for wood and non-wood products.

A better integration of the crop-livestock and forestry subsystems of smallholder farms has high potential to increase resource use efficiency, the sustainable use of ecological services and overall resilience of production systems. To identify promising sets of integrated farm practices, local experimentation and adaptation with and by farmers are needed that take into account the trade-offs that arise from the constrained settings within which smallholder farmers operate. Analytical modelling frameworks can support the analysis, (re)-design, and adaptive management of such innovative farming systems.

We propose the following activities:

1) Review of the literature on crop-livestock integration, agroforestry (crop–tree integration) and sylvo-pastoral (tree-livestock) systems to quantify the resource use efficiency and ecological services in these systems. These data will be synthesised by a meta-analysis. A quick search showed us that there is virtually no literature on the integration of all three components (agriculture-livestock-forest) in the Amazon context.

2) Analysis of existing data and conduct additional experiments on the biophysical functioning of integrated crop-animal-tree systems on existing experimental plots that span a gradient from cleared to largely forested landscapes in the Embrapa region in Amazonia (www.ilpf.com.br). This will provide important new insights in the resource use efficiency, productivity and profitability of integrated farming systems.
3) Collect data on farming systems and their trajectories in the region, apply the COMPASS modelling framework\textsuperscript{1} to explore synergies and trade-offs between agricultural production and the environment at the farm and landscape scale, and support learning with the innovative practices.

4) Develop, test and evaluate with local smallholder farmers a set of integrated crop-animal-tree practices on 15-20 family farms in the study area.

This project will contribute to the design of ecologically intensive production systems that reconcile agricultural production and biodiversity conservation, while minimizing GHG emissions. Potential innovative practices include direct seeding (to minimize soil erosion), use of legumes and animal manure (to maintain soil fertility) and intercropping/trap-cropping (to manage pests). There is ample experience with agro-ecology, pest management, agro-ecological modelling and stakeholder interaction in the team\textsuperscript{1,2,3,4}. We already have matching funding for 1.5 year of the PhD from the Agropolis Foundation and the project links with the CIRAD Ecoterra project, the CIAT Amazon Ecoregional Research Program and the Embrapa project “Integrated crop livestock forest systems in northern Brazil/Amazon”.


Key research questions (2-4):

1) Which are the system trajectories that result from current drivers of change in Amazonian agroecosystems?

2) Can diversified farming systems based on the integration of crop-animal-tree production result in improved resource efficiency, resilience and profitability as compared to current production systems based on a single subsystem?

3) What is the impact of integrated crop-livestock-tree systems on farm productivity and the environment?

4) Which incentives are needed for the adoption of integrated crop-livestock-tree systems by local farmers?

Required competences of applicant:

Background in agro-ecology, experience with field experiments and modelling, able to conduct research independently, excellent analytical, communication, writing and presentation skills, team player