Do agroforestry systems make financial sense? Lessons from Vietnam and Indonesia

Public and private bodies are often constrained from investing in sustainable land use (SLU) practices by a lack of data. Several agroforestry-based SLU practices have been developed to increase the range of sustainable management options available to farmers, but little information is available on their profitability. This policy brief compares prospective profitability of agroforestry systems (AF) and that of conventional practices by using a financial model that helps interested investors to assess the value for their investments.

Key messages

1. Profitability of Agroforestry Systems (AF) is context-dependent and location-specific.
   » In Ba Be District, Vietnam, AF was found to be unprofitable but still financially more attractive than conventional practices such as maize mono cropping.
   » In Tanjabar province, Indonesia, AF showed a profitable return but below the conventional system such as oil palm.

2. Appropriate costing of inputs and outputs is crucial to understand the profitability of AF.

3. A discounted cash-flow model at the farm-level based on the cost and revenue inputs for the different crops grown is suggested.

4. Better data, robust financial models and tools that sufficiently capture local realities are still needed to provide accurate cost benefit analysis of AF.

Implications

Conducive policy environment and portfolio of appropriate incentives are needed to narrow the profitability gap between AF and conventional practices.

Tree cultivation takes a long period to yield a positive cash flow. For AF to be attractive to smallholders and suitable for private investment, it requires public financial support in the initial stages.

Estimating the direct and indirect economic values of the tree based AF could encourage smallholders to adopt AF and help policy makers determine who should pay for, and who gains from the benefits of such practices implemented on private lands.

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Agroforestry-based land management practices that combine crop production and environmental conservation are practiced in different forms. Economic considerations are often the most important factors leading to landowner adoption of agroforestry systems (AF), therefore real data are needed on the expected costs and returns from production-driven agroforestry practices.

However data on the financial profitability of these systems remains scarce; the lack of robust cost-benefit analysis procedures to improve understanding of their financing requirements and viability are particularly pronounced. Within the framework of the ICRAF-led SECURED Landscape (Securing Ecosystems and Carbon benefits by Unlocking Reversal of Emissions Drivers in Landscapes) project, we tried to develop an accessible and scalable financial model to compare the profitability of AF with conventional practices.

Developing a Financial Model

The proposed financial model is a discounted cash-flow model based on the cost and revenue inputs for the different crops grown in a given landscape (see figure 1) and encompass cash flow projections for the entire farm over the holding period (usually 10 years).

Cost items are broken down into Capex (Capital expenditure, i.e. non-recurring, usually fixed and important cost items) and Opex (Operating expenditure, i.e. recurring costs, usually variable). The revenue items comprise the yields and market prices of the different crops. For each crop, total costs and revenue are calculated based on the specifics of the way it is produced (use of pesticide, etc.) and processed (need for dryers, etc.), the yields obtained and the market prices.

In this analysis the profitability computation only focused on the sold components of the products from the land uses i.e. excluding the consumed portion.

The model contains micro and macro data relevant to the locations in question. The micro data are specific to each location and practice, and include, for instance, items such as the total population, the number of farms, the farm area and the labor force. Macro data include factors such as the inflation rate and the exchange rate of the local currency versus a hard currency, usually the US dollar.

Taking into account the costs and revenues in the system, the projected cash flows of each activity through time are then discounted by the expected risk-free rate (in this case we use the government-lending rate adjusted for inflation as a proxy).

Given the lack of data that would usually be required to develop a comprehensive financial model, we had to complement our primary data with a series of assumptions. For instance, most of the products identified are both consumed and sold by the smallholders. This overlap between subsistence and commerce creates some difficulty in acquiring accurate data on revenue generation. So where data wasn’t provided, we assume a 50:50 split, a ratio based on group discussions with farmers who said that they consume about 50% of their agricultural produce. We made exceptions in products that were apparently wholly commercial i.e. palm oil in Indonesia.

We concluded from the homogeneity of the landscapes and consistency of responses in the focus groups we led, that the market and business conditions are essentially uniform for all villages represented within each landscape in the study. We therefore assumed the same input costs, processing costs and revenues received for all the farm households. We made an exception for transportation, which varies according to distance from market. In this model, we also ensured that all labor is financially compensated therefore labor was applied to family farmers as well as hired workers.

Figure 1: Elements of the cash-flow (CF) model
Main Findings

Two case-studies from the SECURED Landscape project

i) Financial model results in Ba Be district, Vietnam

In Ba Be district, Vietnam, the option of intercropping maize on productive sloping lands with high value trees, namely Acacia mangium and Melia azedarach has been explored with the hope that it could increase economic return while enhancing the ecological health of the landscape. Based on our analysis, this does not show a profitable return (-392USD/household for inter-cropping Acacia and -367USD/household for inter-cropping for Melia), but it does significantly economically improve on the business-as-usual scenario (maize, rice and cassava monocropping) by +47USD/household and +72USD/household respectively.

The base case scenario shows the worst average loss because maize, rice, and cassava are not purely commercial products, a large percentage being consumed by the household as part of their daily dietary requirement, and in some cases maize is also used as animal feed. One key reason why the proposed options of intercropping maize with either Acacia or Melia are not profitable is that they both incur large expenses and produce consistent net losses in the years leading up to maturity. The main income is derived from the final sale of timber products in the harvest years, which isn’t sufficient to fully compensate for the expenses incurred in the previous years.

Table 1: Financial model results in Ba Be district (with approximately 10,981 households and a total of 7867 hectares) in Vietnam (TMP, 2014)

<table>
<thead>
<tr>
<th>Average annual figures</th>
<th>Base case scenario (maize, rice, cassava monocropping)</th>
<th>Inter-cropping Acacia</th>
<th>Inter-cropping Melia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Capex (USD)</td>
<td>2,789,575</td>
<td>2,901,444</td>
<td>2,821,533</td>
</tr>
<tr>
<td>Total Opex (USD)</td>
<td>11,437,798</td>
<td>10,258,883</td>
<td>9,505,783</td>
</tr>
<tr>
<td>Total Expense (USD)</td>
<td>14,227,373</td>
<td>13,160,326</td>
<td>12,327,316</td>
</tr>
<tr>
<td>Total Revenue (USD)</td>
<td>9,410,304</td>
<td>8,855,632</td>
<td>8,294,812</td>
</tr>
<tr>
<td>Total Profit (USD)</td>
<td>-4,817,069</td>
<td>-4,304,694</td>
<td>-4,032,403</td>
</tr>
<tr>
<td>Total Profit/Household (USD)</td>
<td>-439</td>
<td>-392</td>
<td>-367</td>
</tr>
</tbody>
</table>

NB: The specific model was run over different periods based on the product/harvesting cycle: Maize mono-cropping: 10 years, Intercropping Acacia: 7 years, after Acacia maturity, Intercropping Melia: 10 years, after Melia maturity. 1USD=20933.42VND (WorldBank 2013 exchange Rate).

ii) Financial model results in Tanjabar province, Indonesia

Jelutong (Dyera lowrii) is a commercially viable tree species which produces latex, used by industries for chewing gum, cable coating and cellophane. Jelutong timber is also sold for plywood, as material for pencils and other wood products. It previously grew as a natural tree species in the area of Tanjabar. In order to further support peat forestry protection in Tanjabar, Indonesia, Jelutong was tested as a more sustainable alternative to the oil palm plantations and gardens resulting in less CO\textsubscript{2} emissions while also presenting a potential alternative for generating an economic livelihood. Jelutong is intercropped with maize in the initial years to provide immediate income because the tree can only be tapped for latex from year 9 on.

Based on our analysis, Jelutong intercropped with maize shows a profitable return (866USD/household) despite the long lead-time. Yet the profits for this option remain below the conventional system, i.e. oil palm by -150USD/household. Profitable farm practices that yield positive short-term cash flows are needed to increase the income from Jelutong in the first 9 years of cultivation until the tree is ready for tapping latex.

Table 2: Financial model results in protected peat land (with approximately 100 households and a total of 200 hectares) in Tanjabar Province, Indonesia (TMP, 2014)

<table>
<thead>
<tr>
<th>Average annual figures</th>
<th>Oil Palm System</th>
<th>Jelutong intercropped with maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Capex (USD)</td>
<td>6,330</td>
<td>5,591</td>
</tr>
<tr>
<td>Total Opex (USD)</td>
<td>49,566</td>
<td>56,691</td>
</tr>
<tr>
<td>Total Expense (USD)</td>
<td>55,895</td>
<td>62,282</td>
</tr>
<tr>
<td>Total Revenue (USD)</td>
<td>157,530</td>
<td>148,854</td>
</tr>
<tr>
<td>Total Profit (USD)</td>
<td>101,635</td>
<td>86,572</td>
</tr>
<tr>
<td>Total Profit/Household (USD)</td>
<td>1,016</td>
<td>866</td>
</tr>
</tbody>
</table>

NB: The specific model for oil palm system and Jelutong intercropped with maize was run over 25 years. 1USD=10461.24IDR (WorldBank 2013 exchange Rate).
Do Agroforestry systems make financial sense?

The financial model is highly sensitive to the data provided. More accurate and reliable ground level data is needed to provide accurate cost benefit analysis of AF practices.

At the same time the reporting must be standardized and location specific. While the need for robust, reliable and comparable data is crucial, the cost of sending people out to collect data is high, and even more so for projects like ICRAF’s at smallholder level.

To address this challenge, TMP Systems is developing a Field Monitoring System that can combine self-reporting and a high level of automation. This system aims to significantly improve on current methods in terms of cost, efficiency, data granularity and reliability, and adaptability to different local contexts and investor requirements.

Recommendations

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The ASB Partnership for the Tropical Forest Margins is working to raise productivity and income of rural households in the humid and sub-humid tropics without increasing deforestation or undermining essential environmental services.

ASB is a consortium of over 90 international and national-level partners with an ecoregional focus on the forest-agriculture margins in the humid and sub-humid tropics. The partners have established 12 benchmark sites in the tropical forest biome of Brazil, Cameroon, Indonesia, Peru, Philippines and Vietnam.

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A conducive policy environment and appropriate incentives are needed to narrow the profitability gap between AF practices and conventional practices.

In order to motivate shade tree planting and retention, there is a need for a wider portfolio of interventions that enhance the profitability of the agroforestry-based practices at the individual farm level.

Such interventions may include:

- Payments for ecosystem services (PES) and certification schemes. REDD+ could also be an alternative intervention depending on the forest definition
- Creation of platforms for cooperatives which lower transaction costs for smallholders and can also allow smallholders to better negotiate prices, quantities and the “terms and conditions of sale”
- Exploration and development of domestic and export markets for agroforestry products and facilitation of farmer-market linkages
- Affordable credit mechanisms and loans for smallholders from banks and other potential public and/or private investments which are needed while long lead-time crops such as trees mature
- Issuance of land user right certificates that give farmers a sense of land security
- Advisory support for increasing profitability from the tree component of the AF

Additionally, estimating the direct and indirect economic values of the tree-based AF including the ecosystem services it delivers could further close the gap between AF and conventional practices.

This would allow smallholders to evaluate the trade-offs between on farm practices and off-farm effects and could also help policy makers determine who should pay for, and who gains from, the benefits of SLU practices implemented on private lands.

Correct citation


Reference


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