UNIVERSITI PUTRA MALAYSIA

TREE GROWTH AND FINANCIAL EVALUATION OF AGROFORESTRY SYSTEM IN KAMPUNG TEBUK PULAI, SABAK BERNAM, SELANGOR

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TREE GROWTH AND FINANCIAL EVALUATION OF AGROFORESTRY SYSTEMS IN KAMPUNG TEBUK PULAI, SABAK BERNAM, SELANGOR

By

JULSUN @ JOSEPH SIKUI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

March 2005
Specially Dedicated To My Late Mother, Angela Jingkiep Lojimoh

You Gave Me Life  
Gave Me Your Heart  
And Your Shoulder  
When I Needed To Cry

You Gave Me Hope  
When All My Hope Is Gone  
Wings So My Dreams Can Fly

And I Haven't Told You Enough  
Haven't Been Good Enough  
Making You See.....

  My Love For You  
  Will Live In My Heart  
  Until Eternity's Through

  I See Your Smile  
  In The Eyes Of My Child  
  I Am Who I Am  
  Mama Thanks To You

You Gave Me Your Word  
Gave Me Your Voice  
You Gave Me Everything

  Each Breath Of My Life  
  You Believe, When I Can't Remember How  
  You Teach My Faith To Survive

  And I Never Can Do Enough  
  Never Thank You Enough  
  For All That You Are

  I Know The Treasure  
  I'm Filled With Grace  
  Whenever I See Your Face
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

TREE GROWTH AND FINANCIAL EVALUATION OF AGROFORESTRY SYSTEMS IN KAMPUNG TEBUG PULAI, SABAK BERNAM, SELANGOR

By

JULSUN @ JOSEPH SIKUI

March 2005

Chairman: Professor Dato’ Nik Muhamad Nik Abd. Majid, PhD
Faculty: Forestry

A study was conducted at Kg. Tebug Pulai, Sabak Bernam, Selangor to assess the growth performance and financial aspects, evaluate the financial component and also to determine the optimum combination of agroforestry system practised by the farmers. There are three farms involved in the study with the holding size of two hectares each. The farms were planted with teak trees as the major component and practised different types of agroforestry system. This study involved collection of data on growth of teak and Tongkat Ali and other information obtained through informal interviews with the farmers. The results of this study are explained in terms of assessment on growth performance and financial aspects of three different agroforestry systems, evaluation of financial component and also determination of the optimum combination of agroforestry system. In terms of growth performance, the diameter and height growth of teak trees in the three farms are significantly different ($P \leq 0.05$). Trees in Farm C performed the best followed by trees in Farms A and B. Farms A and B had a total of 1122 and 2173 teak trees, respectively and most of the trees are in the diameter class ranging from 12-14cm for both farms. For Farm C, a total of 1651 teak trees were
recorded and most of them occurred in the diameter class range of 14-16cm. The total volume projected in Farms A, B and C is 111.9m³/ha, 92.2m³/ha, 120.6m³/ha with the mean growth of 17.4m, 16.4m and 20.0m, respectively. Similarly, the basal diameter and height of Tongkat Ali seedlings in Farm C were significantly higher (P ≤ 0.05) than those in Farm B. Farms B and C had 1522 and 1976 Tongkat Ali seedlings, respectively. Most of the seedlings in Farm B are in the basal diameter class range of 1.1-2.0cm with a total of 276.80kg of root weight and in Farm C most of the seedlings are in the basal diameter class range of 3.1-4.0cm with a root weight of 783.20kg. The project financial appraisal as “Type B With Project Approach” of Farm C was projected as the most economically viable project among the three farms giving the highest return to the farmer. The agroforestry system introduced under agrosilvopastoral in this farm (Scenario III) shows the IRR, NPV and B/C Ratio of 34.5%, RM150,100.91 and 1.12, respectively. If the project implemented as “Without Project Approach” and “Type A With Project Approach”, Farm C is still the most economically viable project. Although, the project implemented in Farms A and B offers another option, they are still considered economically viable to be implemented as the results are acceptable for project analysis requirement. Under Scenario I, Farm A shows the IRR, NPV and B/C Ratio of 19.9%, RM27,648.05 and 3.08, while Farm B has 23.6%, RM32,469.12 and 4.05, respectively. The farmers of Farms A and B will maximize the return at a 15-year rotation and the value are decreasing with the increases in the number of years.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PERTUMBUHAN POKOK DAN PENAKSIRAN KEWANGAN SISTEM PERHUTANANTANI DI KAMPUNG TEBUK PULAI SABAK BERAM, SELANGOR

Oleh

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Mac 2005

Pengerusi: Prof. Dato' Nik Muhamad Nik Abd. Majid, PhD

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kelas diameter 12-14cm. Bagi Ladang C, sebanyak 1651 bilangan pokok direkodkan dan kebanyakkan berada dalam kelas diameter 14-16cm. Jumlah isipadu unjuran bagi Ladang A, B dan C adalah 111.9m³/ha, 92.2m³/ha, 120.6m³/ha dengan min pertumbuhan 17.4m, 16.4m dan 20.0m. Perbezaan diameter pangkal dan ketinggian anak pokok Tongkat Ali di Ladang C adalah sangat ketara (P ≤ 0.05) berbanding dengan ladang B. Sebanyak 1522 dan 1976 anak pokok Tongkat Ali direkodkan di Ladang B dan C. Kebanyakkan anak pokok di Ladang B adalah berada dalam kelas diameter pangkal 1.1-2.0cm dengan jumlah berat akar sebanyak 276.80kg dan di Ladang C, kebanyakkan anak pokok berada dalam kelas diameter pangkal 3.1-4.0 dengan jumlah berat akar sebanyak 783.20kg. Taksiran kewangan dengan "Pendekatan Jenis B dengan Projek" menunjukkan Ladang C adalah yang paling menguntungkan petani. Sistem perhutanantani-ternakan yang diperkenalkan di ladang ini (Gambaran III) menunjukkan IRR, NPV dan Nisbah B/C sebanyak 34.5%, RM150,100.91 dan 1.12. Sekiranya projek ini dijalankan dengan "Pendekatan Tanpa Projek" dan "Pendekatan Jenis A dengan Projek", Ladang C masih merupakan projek yang ekonomik. Sungguhpun projek yang diusahakan di Ladang A dan B adalah sebagai alternatif, ianya masih dianggap ekonomik untuk diusahakan kerana memenuhi syarat analisis kewangan projek. Bagi Gambaran I, Ladang A menunjukkan IRR, NPV dan Nisbah B/C sebanyak 19.9%, RM27,648.05 dan 3.08, manakala Ladang B mempunyai 23.6%, RM32,469.12 dan 4.05, masing-masing. Projek perhutanantani yang diusahakan petani diladang A dan B akan dapat memaksimumkan pulangan pada 15 tahun kitaran dan nilai pulangan ini akan susut dengan peningkatan bilangan tahun perlaksanaan.
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I certify that an Examination Committee met on 16th March 2005 to conduct the final examination of Julsun @ Joseph bin Sikui on his Master of Science thesis entitled "Tree Growth and Financial Evaluation of Agroforestry Systems in Kampung Tebuk Pulai, Sabak Bernam, Selangor" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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Date: 11 AUG 2005
DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

JULSUN @ JOSEPH SIKUI

Date: 16 JULY 2005
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<td>--------------</td>
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<td></td>
</tr>
<tr>
<td>B/C Ratio</td>
<td>Benefit-Cost Ratio</td>
<td></td>
</tr>
<tr>
<td>CATIE</td>
<td>Tropical Agricultural Research and Higher Education Center</td>
<td></td>
</tr>
<tr>
<td>DBH</td>
<td>Diameter at Breast Height</td>
<td></td>
</tr>
<tr>
<td>FDSM</td>
<td>Forestry Department of Sabah</td>
<td></td>
</tr>
<tr>
<td>FELCRA</td>
<td>Federal Land Consolidation and Rehabilitation Authority</td>
<td></td>
</tr>
<tr>
<td>FELDA</td>
<td>Federal Land Development Authority</td>
<td></td>
</tr>
<tr>
<td>FRI</td>
<td>Forest Research Institute</td>
<td></td>
</tr>
<tr>
<td>FRIM</td>
<td>Forest Research Institute Malaysia</td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
<td></td>
</tr>
<tr>
<td>ICRAF</td>
<td>The International Center for Research in Agroforestry</td>
<td></td>
</tr>
<tr>
<td>INB</td>
<td>Incremental Net Benefit</td>
<td></td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
<td></td>
</tr>
<tr>
<td>JPS</td>
<td>Drainage and Irrigation Department</td>
<td></td>
</tr>
<tr>
<td>MARDI</td>
<td>Malaysian Agricultural Research and Development Institute</td>
<td></td>
</tr>
<tr>
<td>MIRA</td>
<td>Manejo de Información sobre Recursos Arbóreas</td>
<td></td>
</tr>
<tr>
<td>MPOB</td>
<td>Malaysia Palm Oil Board</td>
<td></td>
</tr>
<tr>
<td>MPTS</td>
<td>Multipurpose Tree Species</td>
<td></td>
</tr>
<tr>
<td>NAP3</td>
<td>The Third National Agricultural Policy</td>
<td></td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
<td></td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
<td></td>
</tr>
<tr>
<td>PBP</td>
<td>Pay Back Period</td>
<td></td>
</tr>
<tr>
<td>RISDA</td>
<td>Rubber Industry Smallholder Development Authority</td>
<td></td>
</tr>
<tr>
<td>RRIM</td>
<td>Rubber Research Institute Malaysia</td>
<td></td>
</tr>
<tr>
<td>SALT</td>
<td>Slopping Agricultural Land Technology</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 General Background

Malaysia is one of the most successful developing countries in the world. One of the major contributors to economic development of the country is the agriculture and forestry sectors. These sectors have been the driving force behind the economic growth of the country over the last four decades. It was used to finance the development of the country, which progressively led to the transformation of the economy towards industrialization. In terms of gross domestic product (GDP) in purchaser’s values at 1987 prices, for a year 1990, 1998 to 2000, agricultural sector component still one of the major contributor to the country’s economic revenues with trend increasing consistently (Table 1.1).

This country is blessed with relatively large tracts of natural forest which is a highly complex ecosystem and is considered as having a very rich biodiversity. This has made the forestry sector one of the top foreign exchange earners for Malaysia, and there is a growing awareness of the vital role forestry is playing in the socio-economic development and environmental protection of the country.
Table 1.1: Gross Domestic Product (RM Million) of Agriculture and Forestry Activity in Purchaser's Values, At 1987 Prices, Malaysia, 1990–2000

<table>
<thead>
<tr>
<th>Item</th>
<th>1990</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Livestock Production</td>
<td>10,579</td>
<td>11,531</td>
<td>12,422</td>
<td>12,226</td>
</tr>
<tr>
<td>Forestry and Logging</td>
<td>5,194</td>
<td>3,648</td>
<td>3,237</td>
<td>3,092</td>
</tr>
<tr>
<td>Fishing</td>
<td>1,534</td>
<td>2,236</td>
<td>2,335</td>
<td>2,369</td>
</tr>
<tr>
<td>GDP in Purchasers' Values</td>
<td>105,977</td>
<td>182,219</td>
<td>192,712</td>
<td>209,365</td>
</tr>
<tr>
<td>Agricultural Sector Component</td>
<td>17,307</td>
<td>17,415</td>
<td>17,994</td>
<td>17,887</td>
</tr>
<tr>
<td>Agricultural Sector Component in Percentage</td>
<td>16.3</td>
<td>9.6</td>
<td>9.3</td>
<td>8.4</td>
</tr>
</tbody>
</table>


Rapid population growth in the country has undoubtedly posed many socio-economic and environmental problems causing unabated need for food, fodder, energy and wood. Thus, there exists an increasing pressure on the two main renewable resources that is forestry and agriculture which are related in many aspects but apparently, incapable of meeting the increasing demand even though there is functional allocation of land for both purposes. Such problems, coupled with urbanization, industrialization and other aspects of socio-economic development, resulted in rapid deforestation leading to serious degradation of the ecosystem and diminution of arable land areas. Moreover, there also exists land use conflict between agriculture and forestry, amidst the need for rural development and growing environmental issues.

Agriculture and forestry sectors are also facing major rural land use challenges, including increasing scarcity of timber products and
environmental degradation on fragile lands. In 2000, the total export value of wood and wood-based products was RM17.6 billion or 4.7 percent of the country's total export value (Anonymous, 2001). Further exploitation of forest land area also contributed to environmental issues such as decreasing in the total number of natural forest lands. Tables 1.2 and 1.3 shows the remaining

Table 1.2: Distribution and Extent of Major Forest Types in Malaysia 2003 (Million ha.)

<table>
<thead>
<tr>
<th>Region</th>
<th>Land Area</th>
<th>Dipterocarp Forest</th>
<th>Swamp Forest</th>
<th>Mangrove Forest</th>
<th>Plantation Forest</th>
<th>Total Forest Land</th>
<th>Percentage Total of Forest Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peninsular Malaysia</td>
<td>13.16</td>
<td>5.40</td>
<td>0.30</td>
<td>0.10</td>
<td>0.08</td>
<td>5.88</td>
<td>44.70</td>
</tr>
<tr>
<td>Sabah</td>
<td>7.37</td>
<td>3.83</td>
<td>0.12</td>
<td>0.34</td>
<td>0.11</td>
<td>4.40</td>
<td>59.70</td>
</tr>
<tr>
<td>Sarawak</td>
<td>12.30</td>
<td>7.92</td>
<td>1.12</td>
<td>0.14</td>
<td>0.06</td>
<td>9.24</td>
<td>75.10</td>
</tr>
<tr>
<td>Malaysia</td>
<td>32.83</td>
<td>17.15</td>
<td>1.54</td>
<td>0.58</td>
<td>0.25</td>
<td>19.52</td>
<td>59.50</td>
</tr>
</tbody>
</table>


Table 1.3: Permanent Reserved Forest (PRFs) in Malaysia 2003 (Million ha.)

<table>
<thead>
<tr>
<th>Region</th>
<th>Protection Forest</th>
<th>Production Forest</th>
<th>Total Land Area Under PFE</th>
<th>Percentage of Total Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peninsular Malaysia</td>
<td>1.52</td>
<td>3.18</td>
<td>4.70</td>
<td>35.70</td>
</tr>
<tr>
<td>Sabah</td>
<td>0.59</td>
<td>3.00</td>
<td>3.59</td>
<td>48.70</td>
</tr>
<tr>
<td>Sarawak</td>
<td>1.10</td>
<td>5.00</td>
<td>6.10</td>
<td>49.60</td>
</tr>
<tr>
<td>Malaysia</td>
<td>3.21</td>
<td>11.18</td>
<td>14.39</td>
<td>43.80</td>
</tr>
</tbody>
</table>

distribution and extent of major forest types and permanent reserved forest in
Malaysia. In order to protect and avoid further exploitation of the remaining
forest land, action plan have to be considered to develop better solution for
land development strategies.

One of the responses to these problems is the development and promotion of
agroforestry practise to be implemented in the country. Agroforestry, which
integrates forest management, food crop production and environmental
conservation appears to be a promising alternative system of land use. The
objective of agroforestry is to maximize land usage and economic return
especially to the rural communities (Wan Razali and Abd. Razak, 1987), and
reducing shifting cultivation in Permanent Forest Estate (Morningstar and
Knight, 1990).

In general, agroforestry as it is being researched and practised today is not
new but it is a modification of systems that have been used by farmers for
hundreds of years. In Malaysia it has been practised on a trial basis since
1930 and it was only being encouraged since the Fourth Malaysian Plan
(1981-1985), due to the realization of the importance of both agriculture and
forestry sectors (Nor Aini and Jalil, 1989).