Short Communication:
Survival and growth of mono and mixed species plantations on the Coromandel coast of India

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Abstract. Anbarashan M, Padmavathy A, Alexandar R. 2017. Short Communication: Survival and growth of mono and mixed species plantations on the Coromandel coast of India. Asian J For 1: 70-76. There exists very little information on the growth of autochthonous tree species autochthonous in the tropics and on the experiences in conducting mono and mixed species plantations. The aim of this study was to compare the variation in growth parameter between the mixed species plantation and mono species plantation. The growth, survival, and height of 82 autochthonous mixed species plantations were compared with Casuarina equisetifolia, an exotic species broadly planted in this region after over a decade (2006 to 2016). In the mixed species plantation, seven species showed 100 % survival rate and 19 species were not survived after 10-year intervals. In the mono species plantation, Casuarina equisetifolia had 92 % of the survival rate. When it is compared to the mono plantation, the growth rate of mixed species plantation showed highly significant differences (P < 0.05) values. Simple linear regression between annual girth increment and height produced very strong positive relations (R^{2} 0.759). Plantations of Casuarina equisetifolia seem to be well adapted to the coastal region. On the other hand, mixed plantation with autochthonous species would contribute more to sustainable management because they provide a greater range of ecological goods and ecosystem services than the single species plantations.

Keywords: Exotic species, growth, mortality, autochthonous tree species, plantation, survival

INTRODUCTION

In the tropical countries, there is an increasing interest in establishing mixed autochthonous species plantation for a wide range of economic, silvicultural and sustainability objectives (Nguyen et al. 2016). This is in contrast to the dominance of monoculture in ‘industrial' plantation practices in the tropics and temperate regions, largely because of the association with economic benefits. Mixed plantation system provide autochthonous broader range of option for the restoration of autochthonous species in degraded areas, protection and biodiversity conservation (Montagnini et al. 1995; Keenan et al. 1995; Guariguata et al. 1995; Parrota and Knowles 1999). Vietnam, China, and the Philippines encourage landholders to plant mixtures by their national reforestation programs (Lamb et al. 2005); in several countries, smallholder and community forestry (mostly of autochthonous species) (Herbohn et al. 2014) and there is often little comprehensive information. In certain situations, Mixed species plantations are found to be more successful in terms of biomass production and carbon sequestration (Lawson and Michler 2014; Puettmann and Tappeiner 2014), improved nutrient cycling (Forrester et al 2010; le Maire et al 2013), reduced damage from pest or disease (Nichols et al 2006; Hung et al 2011), than monocultures. Ecological disturbance and climate change impacts can be balanced and more resilient forests can be provided for localities, when mixtures of different species with different traits are established (Rodrigues et al. 2011). Lamb and Lawrence 1993 stated that the complete utilization of soil and water resources as well as different soil strata could be attained by roots of different species during plantation. Plantation of different species tends to observe more solar energy and the light requirements are broadly distributed in the vertical plane (Guariguata et al. 1995).

The primary goal of ecological research in tropical forests is about comprehending the patterns of highly dynamic plant growth. Forest growth function is important for determining the size and multitude of ecology management applications (Vivek et al. 2016). Providing practical and meaningful classification of tropical forest species is needed by foresters in modeling the growth and yield factors, whereas the ecologists explain the life history of tropical forest and their diversity (Vivek et al. 2016). In the prediction of forest dynamics understanding of tree, mortality is inevitable, and its center to any long-term dynamics of woody plants as their biomass is regulated by the difference between gains through individual growth and losses through mortality (Scherer-Lorenzen et al. 2005). The growth and mortality of saplings of trees are dependent on impacts of various factors such as species-specific, tree vigor and size, and environmental conditions on the interactions and processes in stands (Scherer-Lorenzen et al. 2005; Radosevich et al. 2006). Differences in mortality rates among species are the major determinants of ecological succession (Schneider et al. 2014) and forest stand structure (Semwal et al. 2013). Performance of a tree...
species was indicated by their vigor and size, as it partially reflects the competitive ability of a tree (Nakashizuka 2001). Growth-mortality trade-off can also be predicted by their relationship to plants functional traits (Baker et al. 2004; Nguyen et al. 2016).

However, the success of the establishment of mixed forest plantations depends on plantation design and an appropriate definition of the species to be used, taking into consideration ecological and silvicultural aspects (Wormald 1992). There is very little information on the growth of autochthonous tree species autochthonous in the tropics and on the experiences on comparing mono and mixed species plantations. However, in the present study, we tested if the mixed forest tree species can grow/survive in the coastal sand dunes. The main objective of the present study is to determine the growth and survival of 82 autochthonous species in the mixed plantations when they were compared with Casuarina equisetifolia mono plantation after over a decade (2006-2016). The hypotheses tested were: there is variation in growth and survival among species, and the growth and survival of autochthonous species are higher in mixed plantation than that in mono-species plantations.

MATERIALS AND METHODS

Study site
The study plots were developed in 2006 in Koonimedu Coastal village on the Coromandel Coast of southern India.

Table 1. List of species with families and ecological importance

<table>
<thead>
<tr>
<th>Species</th>
<th>Family</th>
<th>Ecological values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed species</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aegle marmelos (L.) Correa</td>
<td>Rutaceae</td>
<td>Medicinal, economic</td>
</tr>
<tr>
<td>Aglaia elaeagnoides (Juss.) Benth.</td>
<td>Meliaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Alangium salvifolium (L.f.) Wangerin</td>
<td>Angiaceae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Albizia amara (Roxb.) Bovin</td>
<td>Mimosaceae</td>
<td>Medicinal, commercial</td>
</tr>
<tr>
<td>Atalantia monophylla (L.) Correa</td>
<td>Rutaceae</td>
<td>Medicinal, ecological</td>
</tr>
<tr>
<td>Azadirachta indica A. Juss.</td>
<td>Meliaceae</td>
<td>Medicinal, cultural</td>
</tr>
<tr>
<td>Barringtonia acutangula (L.) Gaertner</td>
<td>Barringtoniaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Bauhinia purpurea Lam.</td>
<td>Leguminosae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Bauhinia racemosa Lam.</td>
<td>Leguminosae</td>
<td>Timber, ecological</td>
</tr>
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<td>Benkara malabarica (Lam.) Tirven.</td>
<td>Rubiaceae</td>
<td>Medicinal</td>
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<td>Calophyllum inophyllum L.</td>
<td>Rubiaceae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Calotropis gigantea L.</td>
<td>Calophyllaceae</td>
<td>Medicinal</td>
</tr>
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<td>Carmona retusa (Vahl) Masm</td>
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<tr>
<td>Canthium dicoccum (Gaertn.) Merr.</td>
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<td>Ecological</td>
</tr>
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<td>Cassia auriculata L.</td>
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<td>Fabaceae</td>
<td>Medicinal</td>
</tr>
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<td>Chloroxylon swietenia DC.</td>
<td>Fabaceae</td>
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<td>Coccoloba uvifer L.</td>
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<td>Ecological</td>
</tr>
<tr>
<td>Commissophora berryi (Arn.) Engl.</td>
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<td>Dalbergia latifolia Roxb.</td>
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<td>Timber</td>
</tr>
<tr>
<td>Delonix elata Gamble.</td>
<td>Burseraceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Diospyros ebenum J. Koenig ex Retz.</td>
<td>Fabaceae</td>
<td>Timber</td>
</tr>
<tr>
<td>Diospyros ferrea (Willd.) Bakh.</td>
<td>Ebenaceae</td>
<td>Medicinal, aesthetic</td>
</tr>
<tr>
<td></td>
<td>Ebenaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Plant Name</td>
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<td>Use</td>
</tr>
<tr>
<td>------------------------------------</td>
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</tr>
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<td>Diospyros montana Roxb.</td>
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</tr>
<tr>
<td>Dolichandrone falcata Seem.</td>
<td>Bignoniaceae</td>
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<tr>
<td>Drypetes sepialia (Wight and Arn.) Pax and Hoffm.</td>
<td>Euphorbiaceae</td>
<td>Ecological</td>
</tr>
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<td>Ehretia pubescens Benth.</td>
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<td>Erythrina indica L.</td>
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</tr>
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<td>Ecological</td>
</tr>
<tr>
<td>Ficus benghalensis L.</td>
<td>Moraceae</td>
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</tr>
<tr>
<td>Ficus hispida Lf.</td>
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<td>Ficus religiosa L.</td>
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</tr>
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<td>Garcinia spicata (Wight and Arn.) J.D. Hook.</td>
<td>Clusiaceae</td>
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<td>Glycosmis mauritiana (Lam.) Tanaka</td>
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<td>Gliricidia sepium (Jacq.) Kunth ex Walp.</td>
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<td>Gymelina asiatica L.</td>
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<td>Helicteres isora L.</td>
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<td>Holoptelea integrifolia Planch.</td>
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<td>Cultural</td>
</tr>
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<td>Isora pavetta T. Anderson</td>
<td>Lythraceae</td>
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<td>Lawsonia inermis L.</td>
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<td>Cultural</td>
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<td>Lepisanthes tetraphylla (Vahl.) Radlk.</td>
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<td>Limonia acidissima L.</td>
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<td>Aesthetic</td>
</tr>
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<td>Madhuca longifolia (L.) Macbr.</td>
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</tr>
<tr>
<td>Maerua oblongifolia Forsk.</td>
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<tr>
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<td>Fruit, ecological</td>
</tr>
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<td>Medicinal</td>
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<td>Melia azedarach L.</td>
<td>Melastomataceae</td>
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<td>Memecylon umbellatum Burm.f.</td>
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<td>Minusops elengi L.</td>
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</tr>
<tr>
<td>Mitragyna parviflora (Roxb.) Korth.</td>
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<td>Aesthetic</td>
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<td>Murraya paniculata (L) Jack</td>
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<td>Pamburus missionis (Wight) Swingle</td>
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<td>Ecological</td>
</tr>
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<td>Pandanus oddarattissimus Lf.</td>
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<td>Phyllanthus reticulatus Poir.</td>
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<td>Pleiospermum alatum (Wall. ex Wight. &amp; Arn.) Swingle</td>
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<td>Polyalthia suberosa (Dunal) Thw.</td>
<td>Fabaceae</td>
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<td>Pongamia pinnata (L.) Pierre</td>
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<td>Timber, medicinal</td>
</tr>
<tr>
<td>Pterocarpus marsupium Roxb.</td>
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<td>Ecological</td>
</tr>
<tr>
<td>Pterospermum canescens Roxb.</td>
<td>Sterculiaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Pterospermum xilocarpum (Gaertn.) Sant. &amp; Wagh.</td>
<td>Celastraceae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Salacia chinensis L.</td>
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<td>Medicinal, economic</td>
</tr>
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<td>Salvadora persica L.</td>
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</tr>
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<td>Sapindus emarginatus Vahl</td>
<td>Moraceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Sirehhus asper Lour.</td>
<td>Loganiaceae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Strychnos mac-vomica L.</td>
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<td>Ecological, medicinal</td>
</tr>
<tr>
<td>Strychnos potatorum Lf.</td>
<td>Meliaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Suregada angustifolia Bai. ex Muell.-Arg.</td>
<td>Myrtaceae</td>
<td>Medicinal, fruit</td>
</tr>
<tr>
<td>Syzygium cumini (L.) Skeels</td>
<td>Rubiaceae</td>
<td>Medicinal, cultural</td>
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<tr>
<td>Tarenna asiatica (L.) Kuntze</td>
<td>Combretaceae</td>
<td>Medicinal, timber</td>
</tr>
<tr>
<td>Terminalia arjuna (DC.) Wight &amp; Arn.</td>
<td>Combretaceae</td>
<td>Medicinal, timber</td>
</tr>
<tr>
<td>Terminalia bellirica (Gaertner) Roxb.</td>
<td>Combretaceae</td>
<td>Medicinal, timber</td>
</tr>
<tr>
<td>Terminalia catappa L.</td>
<td>Combretaceae</td>
<td>Ecological, fruit</td>
</tr>
<tr>
<td>Thespesia populnea (L.) Sol.</td>
<td>Malvaceae</td>
<td>Timber, cultural</td>
</tr>
<tr>
<td>Tricalysia sphaerocarpa (Dalz.) Gamble</td>
<td>Rubiaceae</td>
<td>Timber, cultural</td>
</tr>
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<td>Vitis leucocylon Lf.</td>
<td>Lamiaceae</td>
<td>Timber, ecological</td>
</tr>
<tr>
<td>Vitis negundo L.</td>
<td>Lamiaceae</td>
<td>Medicinal, cultural</td>
</tr>
<tr>
<td>Walusia trifolia (A.Juss.) Harms</td>
<td>Rubiaceae</td>
<td>Ecological</td>
</tr>
<tr>
<td>Wrightia tinctoria (Roxb.) R.Br.</td>
<td>Apocynaceae</td>
<td>Medicinal</td>
</tr>
<tr>
<td>Ziziphus mauritina Lam.</td>
<td>Rhamnaceae</td>
<td>Ecological</td>
</tr>
</tbody>
</table>

**Pure plantation**

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casuarina equisetifolia L.</td>
<td>Casuarinaceae</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION

Measurements in the mixed species plantation, at 10 years of age, showed that *Albizia amara*, *Leptanthes tetraphylla*, *Diospyros ferrae*, *Eugenia bracteata*, *Minusops elengi*, *Sapindus emarginata* and *Terminalia bellerica* exhibited the highest rate of survival (100%), followed by *Wrightia tinctoria*, *Mitragyna parviflora*, *Streblus asper*, *Pleiospermum xlocarpum*, *Strychnos potatorum*, *Terminalia catappa* and *Thespesia populnea* did not survive any single sapling in the two-hectare plots. *Barringtonia acutangula*, *Cassia fistula*, *Chloroxylon swietenia*, *Pamburus missionis* and *Pterocarpus marsupium* demonstrated less than 20% survival rates. Comparing mono to mixed species plantations, in general, species in the mono plantation demonstrated better survival rates. Notably, in the single species plot, *Casuarina equisetifolia* exhibited high survival and growth rates in the single species plantation. Introducing new species, however, is not without risks. Many reforestation projects fail due to inappropriate species choice, a consequence of inadequate knowledge about the potential of species and their growth and survival rates under different site and environmental conditions (Corlett 1999; Wuethrich 2007; Rodrigues et al. 2009).

The use of a wider variety of autochthonous species in reforestation may enhance the recovery of ecosystems, decrease sensitivity to pest and diseases, and increase functional diversity (Hooper et al. 2005; Benayas et al. 2009; Rodrigues et al. 2009). Creation of forests in the tropics takes place across a wide variety of non-climatic and climatic conditions. Different reforestation experiments have elucidated the strong effects that environmental conditions may have on species growth and survival (Butterfield 1996; Calvo-Alvarado et al. 2007; Park et al. 2010). On the other hand, the finding that 23% of the species may have high initial mortality and unsatisfactory early growth is critical information in avoiding early failure of reforestation projects. Several species showed poor performance and seemed to be unsuitable for large-scale planting in open plantation sites. Ashton et al. (2001) reported that some of these species might do better when they were planted after site restoration by earlier plants or extant nurse trees.

In the mixed species plantation, the measurements taken at 10 years interval showed that *Ficus benghalensis* and *Bauhinia racemosa* have the best growth in terms of height, followed by *A. amara* and *Azadirachta indica*, with no statistically significant differences (P < 0.05) between mono and mixed autochthonous species plantations. In the mono plantation, *C. equisetifolia* showed moderate growth of height (average 9.5) and girth. Simple linear regression between annual girth increment and height produced very strong positive relation (R² 0.759) (Figure 1).

<p>| Table 2 List of species with survival and growth rate after 10 year period of intervals |
|------------------------------------|----------------|----------------|----------------|</p>
<table>
<thead>
<tr>
<th>Species</th>
<th>Planted in 2006</th>
<th>Survival in 2016</th>
<th>Mean annual girth Increment (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mono plantation</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Casuarina equisetifolia</em> L.</td>
<td>1500</td>
<td>1380</td>
<td>14.564±0.478</td>
</tr>
<tr>
<td><strong>Mixed species</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Aegle marmelos</em> (L.) Correa</td>
<td>10</td>
<td>8</td>
<td>2.337±0.678</td>
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<td><em>Aglaia elaeagnoides</em> (Juss.) Benth.</td>
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<td>4</td>
<td>2.774±0.478</td>
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<td><em>Alangium salvifolium</em> (L.f.) Wangerin</td>
<td>26</td>
<td>22</td>
<td>2.945±1.317</td>
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<tr>
<td><em>Albizia amara</em> (Roxb.) Boivin</td>
<td>40</td>
<td>40</td>
<td>14.978±9.127</td>
</tr>
<tr>
<td><em>Atalantia monophylla</em> (L.) Correa</td>
<td>50</td>
<td>31</td>
<td>2.464±0.863</td>
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<td><em>Azadirachta indica</em> A. Juss.</td>
<td>20</td>
<td>18</td>
<td>12.65±4.608</td>
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<td><em>Bauhinia purpurea</em> Lam.</td>
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<td>0</td>
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<tr>
<td><em>Bauhinia racemosa</em> Lam.</td>
<td>150</td>
<td>145</td>
<td>12.458±5.055</td>
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<td><em>Benkara malabarica</em> (Lam.) Tirven.</td>
<td>20</td>
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<td>0</td>
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<td><em>Calophyllum inophyllum</em> L.</td>
<td>15</td>
<td>0</td>
<td>0</td>
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<td><em>Calotropis gigantea</em> L.</td>
<td>10</td>
<td>4</td>
<td>2.525±0.853</td>
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<tr>
<td><em>Carmona retusa</em> (Vahl) Masm</td>
<td>35</td>
<td>29</td>
<td>2.658±0.797</td>
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<tr>
<td>Species</td>
<td>10</td>
<td>10</td>
<td>3.95±2.204</td>
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<tr>
<td>------------------------------------------------</td>
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<td>Cassia auriculata L.</td>
<td>20</td>
<td>13</td>
<td>7.36±3.509</td>
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<td>Cassia fistula L.</td>
<td>10</td>
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<td>1.9±0.707</td>
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<td>Cassine glauca Rottb. Kunze.</td>
<td>30</td>
<td>28</td>
<td>6.275±3.750</td>
</tr>
<tr>
<td>Chloroxylon swietenia DC.</td>
<td>10</td>
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<td>4.4±1.414</td>
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<td>Cocolubu uvarif L.</td>
<td>30</td>
<td>29</td>
<td>5.786±4.142</td>
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<tr>
<td>Commiphora berriyi (Arn.) Engl.</td>
<td>100</td>
<td>81</td>
<td>7.907±3.142</td>
</tr>
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<td>Dalbergia latifolia Roxb.</td>
<td>5</td>
<td>4</td>
<td>5.4±1.914</td>
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<td>Delonix elata Gamble.</td>
<td>15</td>
<td>12</td>
<td>5.608±3.538</td>
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<td>Diospyros ebenum J. Koenig ex Retz.</td>
<td>70</td>
<td>69</td>
<td>4.066±2.681</td>
</tr>
<tr>
<td>Diospyros ferrea (Willd.) Bakh.</td>
<td>70</td>
<td>70</td>
<td>4.271±2.534</td>
</tr>
<tr>
<td>Diospyros montana Roxb.</td>
<td>20</td>
<td>18</td>
<td>2.927±1.143</td>
</tr>
<tr>
<td>Dolichandrace falcata Seem.</td>
<td>50</td>
<td>45</td>
<td>6.122±4.170</td>
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<tr>
<td>Drypetes septaria (Wight and Arn.) Pax and Hoffm.</td>
<td>28</td>
<td>26</td>
<td>3.419±1.808</td>
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<td>Ehretia pubescens Benth.</td>
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<td>Eugenia punctulata L.</td>
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<td>0</td>
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<tr>
<td>Eugenia bracteata (Wild.) Roxb. ex DC.</td>
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<td>20</td>
<td>2.425±2.009</td>
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<td>Ficus benghalensis L.</td>
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<td>24.066±9.928</td>
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<td>Ficus hispida Lf.</td>
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<td>Ficus religiosa L.</td>
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<td>1</td>
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<td>Garcinia spicata (Wight and Arn.) J.D. Hook.</td>
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<td>13</td>
<td>3.746±1.983</td>
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<tr>
<td>Glycosmis mauritiana (Lam.) Tanaka</td>
<td>20</td>
<td>16</td>
<td>1.931±0.618</td>
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<tr>
<td>Gliricidia sepium (Jacq.) Kunth ex Walp.</td>
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<td>Gmelina asiatica L.</td>
<td>25</td>
<td>24</td>
<td>6.796±3.175</td>
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<tr>
<td>Helicteres isora L.</td>
<td>30</td>
<td>28</td>
<td>3.978±2.404</td>
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<tr>
<td>Holoptelea integrifolia Planch.</td>
<td>90</td>
<td>82</td>
<td>7.332±4.175</td>
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<td>Isora pavetta T. Anderson</td>
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<td>19</td>
<td>3.924±1.219</td>
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<td>Lawsonia inermis L.</td>
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<td>3.9±1.732</td>
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<td>Lepisanthes tetraphylla (Vahl.) Radl.</td>
<td>101</td>
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<td>Limonia acidissima L.</td>
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<td>Madhuca longifolia (L.) Macbr.</td>
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<td>Maerua oblongifolia Forssk.</td>
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<tr>
<td>Mallotus rhamnifolius Muell.-Arg.</td>
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<tr>
<td>Manilkara hexandra (Roxb.) Dubard</td>
<td>85</td>
<td>83</td>
<td>6.719±3.075</td>
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<td>Melia azedarach L.</td>
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<td>6.566±3.107</td>
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<td>Memecylon umbellatum Burm.f.</td>
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<td>Minusos elengi L.</td>
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<td>35</td>
<td>5.82±3.083</td>
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<td>Mitragyna parviflora (Roxb.) Korth.</td>
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<td>15</td>
<td>4.233±2.135</td>
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<tr>
<td>Murraya paniculata (L) Jack.</td>
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<td>2.471±0.449</td>
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<td>Occhna obtusata DC.</td>
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<td>7.525±3.224</td>
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<td>Ornacarpum sennoideis (Wild.)DC.</td>
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<td>Pamburus missionis (Wight) Swingle</td>
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<td>Pandanus oddarattisimus L.f.</td>
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<td>9</td>
<td>3.177±0.440</td>
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<td>Phyllanthus reticulatus Poir.</td>
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<td>0</td>
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<tr>
<td>Pterospermum alatum (Wall. ex Wight. &amp; Arn.) Swingle</td>
<td>100</td>
<td>88</td>
<td>8.396±5.134</td>
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<tr>
<td>Polyalthia suberosa (Dunal) Thw.</td>
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<td>Pongamia pinnata (L.) Pierre</td>
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<td>Pterocarpus marsupium Roxb.</td>
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<td>8.769±4.281</td>
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<td>Pterospermum canescens Roxb.</td>
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<tr>
<td>Salacia chinensis L.</td>
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<td>4.7±3.383</td>
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<td>Salvadoria persica L.</td>
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<td>2.622±1.617</td>
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<tr>
<td>Sapindus emarginatus Vahl.</td>
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<td>40</td>
<td>6.5±4.071</td>
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<td>Streblus asper Lour.</td>
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<td>Strychnos max-vomica L.</td>
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<td>Syzygium cumini (L.) Skeels</td>
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<td>Tarenna asiatica (L.) Kuntze</td>
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<td>Terminalia arjuna (DC.) Wight &amp; Arn.</td>
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<td>10.955±4.126</td>
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<td>Terminalia bellirica (Gaertner) Roxb.</td>
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<td>5.95±4.126</td>
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<td>Terminalia catappa L.</td>
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<td>Thespesia populnea (L.) Sol.</td>
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<td>Tricalysia sphaerocarpa (Dalz.) Gamble</td>
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<td>2.4±0.866</td>
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<td>Vitea leucostylon Lf.</td>
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<td>13.864±5.607</td>
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<td>Vitea negundo L.</td>
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<td>9.025±2.100</td>
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<td>Waldbaia trifolia (A.Juss.) Harms</td>
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<td>48</td>
<td>4.289±4.16</td>
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<tr>
<td>Wrightia tinctoria (Roxb.) R.Br.</td>
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<td>69</td>
<td>9.146±3.860</td>
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<td>Ziziphus mauritina Lam.</td>
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<tr>
<td><strong>Total</strong></td>
<td>2055</td>
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ACKNOWLEDGMENTS

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