Tree gardening and taungya on Java:
Examples of agroforestry techniques in the humid tropics*

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Abstract: Agroforestry is a general concept for a land management system combining trees and agricultural crops. For application, various specific techniques can be chosen. Each of these techniques is adjusted to a specific set of environmental as well as socio-economic factors. Agroforestry cultivators or managers belonging to varying social strata and institutional groupings may practice different forms of agroforestry, even within the same general region. This is demonstrated on the basis of two contrasting types of agroforestry which are found on the Indonesian island of Java. Tree gardening or the cultivation of a wide variety of crops in a multiple-storeyed agroforestry system is an indigenous practice on private lands, while taungya or the intercropping of young tree plantations with staple crops is practiced on state forest lands. Both systems are described as to their management characteristics, past development as well as possibilities and constraints for further development. These two practices are then compared as to various attributes, like producer group, production purpose, area of cultivation, land ownership situation, structural organization of crop combinations, possibilities for improved cultivation techniques, and suitability for application in rural development for specific target groups.

Introduction
Agroforestry as any form of land use is primarily determined by the local physical circumstances and the ecological characteristics of the plant and animal species. However, within the boundaries of the possibilities and restrictions as offered by nature, the choice of the actual land-use system is determined by the cultural, political, psychological, economic and social circumstances of the societies. Palte [18] has mentioned 11 socio-economic factors which might influence the existence of indigenous agroforestry systems, its management methods and/or the success of its introduction, to wit: demographic situation, farm size and land tenure, local power structure, village cohesion, presence or absence of certain social institutions, household income, labour force and utilization, productivity, commercialization and marketing, availability of capital and credit, extension.

In a specific area, various forms of land use can be present, each adjusted to different sets of physical and socio-economic factors. This also holds true for agroforestry, as will be demonstrated in this paper on the basis of

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two contrasting types of agroforestry which are present on the Indonesian island of Java. These agroforestry systems will be analyzed as to the environmental and socio-economic situation, which determine its presence, and to the possibilities and constraints for more extensive use and further development.

Tree gardening

Tree garden types

The term 'tree gardening' is used here to denote multiple-storeyed agroforestry systems where a mixture of several fruit and other trees are cultivated, sometimes with inclusion of annual crops. Originally, three different types could be distinguished on Java [25–27].

a) The home garden (pekarangan): fenced-in gardens, surrounding individual houses, planted with fruit and other trees, vegetable herbs and annual crops. Historically they are associated with wet rice fields and more recently also with dry fields. They occur in regions with individual land ownership, where the culture has a strong matriarchal background. Typically these home gardens occur in Central Java and are inhabited by Javanese people.

b) The tree garden (kebun or talun): mixed tree plantations on communal lands surrounding villages with dense clusters of houses, sometimes also at some distance from the villages. These plots are not inhabited and they are historically associated with shifting cultivation. They occur in regions with communally owned land and a strong patriarchal background. Mostly they are to be found in West Java and are inhabited by Sundanese people. These tree gardens are much less tended than home gardens and often much wilder.

c) Clumps of fruit or other trees planted on former fields used for shifting cultivation. These plantings could denote a right of priority of these lands for the people who planted the trees in an area of otherwise communal landownership.

Over the ages, gradual changes have taken place in these systems. The most important change was the extension of the Javanese culture and subsequent spread of home gardens. Also, gradually communal lands were divided among individual landowners, who by building houses in such individual tree gardens, converted them to home gardens. However, the effect of various cultures (Javanese or Sundanese) is often still reflected in the structure of home gardens, e.g. in Sundanese home gardens often more vegetables and ornamentals are found [1].

In other tree gardens, annual crops were introduced and management became more intensive. Also shifting cultivation virtually disappeared and in