Emic Perception and Valuation of Useful Plants Cultivated in Tropical Rural Homegardens, Central Sulawesi, Indonesia

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"Happiness is when what you think, what you say, and what you do are in harmony."

Mahatma Gandhi

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Cover Picture: *Mama Esra* from Wanga, Napu valley in Central Sulawesi, Indonesia.

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Abstract

Tropical homegardens are an ancient form of agro-ecosystems, and especially in the tropics, they tend to harbor high species diversity. In addition to providing food and income generation, homegardens fulfill important ecological and socio-cultural functions. In this study, I first documented in collaboration with Dr. Kehlenbeck the species diversity of rural homegardens in Napu Valley, Central Sulawesi, Indonesia. Secondly, I explored the emic perception and valuation of useful plants cultivated in the homegardens. To that end I undertook seven months of fieldwork in 2011 and 2012, during which I recorded the floristic inventories in 45 homegardens in five villages and also conducted semi-structured interviews with the homegarden owners to document their socio-economic background. In addition, I used pile sort and ranking exercises to investigate the local perception and classification of useful plants. In total 29 men and 16 women with an average age of 53 (SD±12) were identified as “main gardeners” and interviewed. Results from the ranking exercise were analysed using the sum of the rank and pile sorting was analysed using cluster analysis.

Plant species diversity of the homegardens was found to be high with a total of 210 useful plan species (70 families) and an average of 41 (SD±14) spp. per garden, with a significant correlation between plant richness and garden size. A total of 23 categories was used by the respondents to classify the useful plants. Although the consistency of the categories among the respondents was relatively weak, a general overlap between the emic categories and etic categories from earlier studies was found. But emic categories tend to be more differentiated and permeable. The emic categories referred to the use of the plant (e.g. spices, drink, animal fodder) or its morphology (e.g. small sized plants). Hindu respondents also created a category of ritual plants. The respondents' agreement on classification was strongest for vegetables, fruits and the two spices *Zingiber officinale* and *Capsicum annuum*. Multi purposes plants like *Cocos nucifera* or *Aleurites moluccana* were classified in various different categories. Favorite plants for a new homegarden are *Capsicum annuum* (100% agreement), *Musa x paradisiaca* (65%) and *Manihot esculenta* (65%), fast growing staple foods. Plants which are perceived as most important additionally include cocoa and maize, important cash crops. *Solanum aethiopicum* is among the plants which are exclusively appreciated by local ethnic groups but not by the immigrated Hindus.

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1 Introduction

1.1 Homegardens

From the hunter-gatherers to the practice of intensive agriculture, people around the world have developed numerous strategies to produce edible goods. Diamond (2002:700) states that "the transition from hunting and gathering to farming resulted in more work, lower adult stature, worse nutritional condition and heavier disease burdens." People probably started to adopt the farming lifestyle at the end of the Pleistocene, when increasingly unpredictable climate had negative impact on big-game species hunting (Diamond, 2002). Plant cultivation is more laborious than hunting and gathering, but once domestication started, the phenotype of domesticated plants and animal changed and provided a fundamental advantage to farmers. The consequences of domestication for human societies was the settlement of the people near permanent gardens and fields, instead of moving around to follow the seasonality of wild plants and animals (Diamond, 2002).

Kumar and Nair (2004) describe homegardening as one of the oldest land use practices which has evolved over centuries of cultural and biological transformations. A homegarden is usually defined as a garden located around a homestead, in close association with family activities. Due to the high variation in appearance, no single definition of homegardens has been established in the literature. A particularly helpful definition by Kehlenbeck (2007) states that homegardens are “a piece of land with a definite boundary surrounding a homestead, being cultivated with a diverse mixture of perennial and annual plant species, arranged in a multilayered vertical structure, often in combination with raising livestock, and managed mainly by household members for subsistence production” (Christanty, 1990; Fernandes & Nair, 1986; Hoogerbrugge & Fresco, 1993; Kumar & Nair, 2004; Soemarwoto & Conway, 1992 as cited in Kehlenbeck, 2007)

In addition to providing food, homegardens fulfill important ecological, and socio-cultural functions (Christanty, 1990; Soemarwoto & Conway, 1992). For example, they offer a habitat for wild flora and fauna, contribute to pest and disease control and help to conserve soil fertility thanks to efficient nutrient cycling (Gajaseni, 1999). In terms of socio-cultural services, homegardens are a place for social encounters, mutual exchange of plant varieties, performing rites (e.g. sacrifices) and enjoying the outdoors (e.g. playground for children). In many societies, homegardens also serve as a status symbol, in which case the aesthetic aspect can largely outweigh the productive function (Arifin 1998). Kumar (2004:145) notes that "planting and maintaining of homegardens also reflect the culture and status of the household, especially the women". By participating in the design and management (i.e. growing, harvesting and eventually selling the products), women may gain a certain independence.

Homegardening has been and still is a key element for subsistence in many countries. Indeed, homegardens provide easy access to products which can either be consumed at home or be sold on the market (e.g. fruits, vegetables, spices, medicinal plants, staples, stimulants, wood, fodder, animals). Homegardens, therefore, contribute to the food security of small farmers and their families (Torquebiau, 1992; Kumar & Nair, 2004), but are also important sources for medicinal plants (Zumsteg & Weckerle, 2007). Homegardens are frequently

considered a model for sustainable agricultural production (Soemarwoto & Conway, 1992). Continuously cultivated over many decades, they contribute to in situ conservation of plant genetic resources (Smith et al., 1992; Watson & Eyzaguirre, 2002).

In tropical climate, most of the products of homegardens are available year-round. The plant diversity in tropical homegardens has been particularly widely studied, partially because of the high diversity level found in these agro-ecosystems (Christanty, 1990; Fernandes, 1986). In Indonesia, homegardens became a focus of rural development projects since the 1970s (Abdoellah, 2006; Wiersum, 2004). Detailed studies were, for example, carried out in Napu Valley in Central Sulawesi, by Kehlenbeck and collaborators (Kehlenbeck, Arifin, & Maass, 2007; Kehlenbeck & Maass, 2004, 2006; Kehlenbeck, 2007). The main objective of these studies was to assess the sustainability of selected rural homegardens located close to the Lore Lindu National Park. Factors responsible for spatial differences of useful plant diversity among homegardens were examined. These studies are based on detailed biodiversity and socio-economic data, but so far widely lack ethnobotanical information on the inhabitants' perceptions and values related to homegardens.

1.2 Aim of the Study and Research Questions

The aim of my thesis is to explore the emic perceptions and valuations of native and non-native useful plants cultivated in homegardens. To that end I engaged in extensive field research for which I visited the previously studied homegardens by Kehlenbeck (2007). At each of the 45 sites, I recorded the useful plant diversity in collaboration with Dr. Kehlenbeck. In a second step, I performed my own interviews with the main gardeners. First, I collected socioeconomic data of the households by using semi-structured interviews. Secondly, to investigate the emic perception and valuations, I employed two ethnobotanical approaches. In a first step, I performed a pile sort exercise to understand how the indigenous communities classify and group cultivated plants. In a second step, I explored the farmers' preferences (i.e. priority plant species), by using ranking exercises with 53 selected plants from the previously recorded floristic list. With the collected data I tried to answer the following questions:

Which plants are cultivated in the homegardens of Napu Valley in Central Sulawesi? (Method: floristic inventory)

What are the socio-economic characteristics of the gardeners and their households? (Method: semi-structured interview)

How do people categorise the useful plant species in the homegardens? (Method: pile sort exercise)

How do people value the useful plant species in the homegardens? (Method: ranking exercises)

These research questions I investigated based on the general hypothesis that the cultural background is a central factor that influences people's perception of useful plant species and thus the diversity of cultivated plants in their homegardens. Based on the socio-economic survey, I use the religion of the respondents as a proxy for their cultural background.

1.3 Description of the Research Site

1.3.1 Geographical Aspects and Administrative Divisions

The research for this thesis was carried out in Napu Valley[1], located in a remote highland region of the district of Poso, Central Sulawesi, Indonesia (Figure 1). The K-shaped island of Sulawesi is part of the Malay Archipelago and was formerly called Celebes by the Dutch. Sulawesi is the fourth largest island of Indonesia (after New Guinea, Borneo and Sumatra) and is situated in a tectonically active region (Whitten et al., 1987).

Napu Valley is a mountainous region situated in the humid tropics, approximately one degree south of the equator at an elevation of approximately 1'100 m asl. (latitude 1°23'–37' South, longitude 120°18'–20' East). Napu Valley belongs to the Lore Lindu region. This region includes the Lore Lindu National Park and the five surrounding sub-districts and covers an area of about 700 thousand ha in the south of Palu, the provincial capital of Central Sulawesi (Maertens et al., 2006). The five sub-districts are: *Lore Utara*, *Lore Timur*, *Lore Peore*, *Lore Tengah* and *Lore Selatan* (*Lore Timur* and *Lore Peore* have been recently created). All of these sub-districts belong to the district of Poso (*Kabupaten Poso*). Napu Valley includes the four first cited sub-districts[2] and is currently in the process of claiming its autonomy to become an independent district.

Wuasa is the main village of Napu Valley and has a population of approximately 2600 inhabitants (720 households). This village covers a territory of approximately 3000 hectares, according to the *Laporan Pembangunan Desa Wuasa, Tahun 2011*. Small asphalt roads link Napu to the cities of Palu and Poso.

Figure 1 Napu Valley (research site), in Central Sulawesi, Indonesia. Source: (Mehring et al., 2011)

[1] For the purpose of this study, I have included the village of Rompo in the broad definition of Napu Valley, although the inhabitants belong to the Besoa ethnic group (or Behoa).

[2] *Lore Tengah* includes the three villages of Napu valley (Rompo, Torire and Katu), as well as five other villages of the Besoa valley located in the South.

1.3.2 Biodiversity and the Lore Lindu National Park (LLNP)

Sulawesi, the largest island in the Indonesian biodiversity hotspot region Wallacea, is characterized by a high species richness and many endemic and/or endanged species (Myers et al., 2000) (Figure 2). The complex geological history of this area is one of the reasons for the high species-diversity and high levels of endemism (Michaux, 2010; Whitten et al., 1987). Hence, several endemic animals can be found in Sulawesi: different species of macaque monkeys and tarsiers, two species of anoa (family of Bovideae), several species of babirusa (family of Suideas), the maleo bird (*Macrocephalon maleo*), the Sulawesi bear cuscus (*Ailurops ursinus*) and the brightly colourful red-knobbed hornbill (*Aceros cassidix*).

Napu Valley is located at the eastern margins of the Lore Lindu National Park (LLNP), a rich natural area with multiple ecosystem types, ranging from lowland tropical rain forest to sub-alpine forest at altitudes of over 2'000 meters. Similarly to the island of Sulawesi at large, the patchwork of ecosystems of the LLNP offers habitat to highly diverse flora and fauna, including many endemic and endangered species (Kehlenbeck, 2007). Before becoming a National Park in 1993, the area was since 1977 already labelled as a "Man and Biosphere Reserve" by the UNESCO. With its wealth of natural treasures, massive illegal logging, hunting and poaching pose a significant threat to the park and its continued existence (UNESCO, n.d.). In addition, the forest margins of the LLNP are threatened by the expansion of cocoa plantations (Maertens et al., 2006).

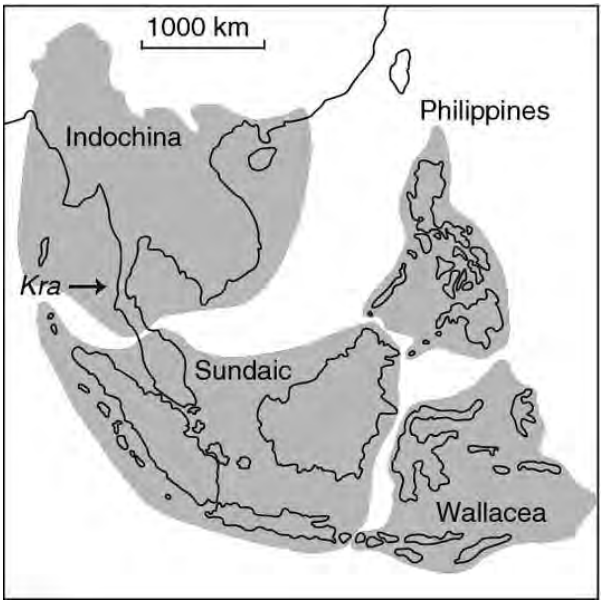

Figure 2 Wallacea hotspot among the others biogeographic regions of Southeast Asia Source: http://www.springerimages.com/Images/LifeSciences/1-10.1007_s10531-010-9783-3-0

1.3.3 Vegetation and Agriculture

As in many other parts of tropical Asia, Sulawesi has already lost most of its lowland forests due to the expansion of human population and activities such as cultivation of rice, cacao and palm oil. Nevertheless, the geography of the island, which is largely mountainous, has limited the expansion of agriculture in some of the regions. In his study, Cannon (2007) shows that when it comes to the different forest types in Sulawesi there is a strong positive correlation between forest condition and elevation. Approximately 70% of Sulawesi's mountain forests (i.e. upland forests above 1500m elevation) are considered intact, which means they have so far experienced no or minimum human disturbance (Cannon, Summers, Harting, & Kessler, 2007). There are, however, certain parts of the highland regions which are well suited for rice cultivation thanks to a remarkable adaptation of farming practices. An example of an indigenous ethnic group that has successfully developed such practices are the Toraja[3], who live in the mountainous region of South Sulawesi.

The natural vegetation of Napu Valley is classified as lower *montane* rain forest (Whitten et al., 1987), but the forest at the bottom of the valley has largely been removed and replaced by paddy rice fields (*sawah*) by the inhabitants (Figure 3, Figure 4C,D). In addition, the forest on the East slopes of the valley, which does not belong to the LLNP, has been used for agro-forestry and in part has been heavily exploited for logging. The West side of Napu Valley on the other hand is still covered by dense forest since it is under protection by the LLNP. Nonetheless, the forests are under threat by the expansion of cocoa plantations (Maertens et al., 2006). A large part of the Napu Valley is still covered by non-agricultural area, mainly grasslands (*padang rumput*) (Figure 3A), but also small patches of fallow (sometimes called *ladang tidur*), secondary forest (*hutan bekas ladang*) or former orchard (*kebun bekas*).

Traditionally, most of Napu Valley was used for slash-and-burn cultivation of food crops such as upland rice, corn, and cassava (Feintrenie, Schwarze, & Levang, 2010). Nowadays, the subsistence of communities is primarily based on irrigated rice cultivation and income is mostly generated from the two perennial cash crops cocoa and coffee (Maertens et al., 2006). Nevertheless, farmers also sell the surplus from their rice production in the market. Vanilla (*Vanilla planifolia*), pepper (*Piper spp.*), Indonesian cinnamon (*Cinnamomum burmanii*) – important cash crops among others in other parts of Sulawesi – are rarely cultivated in Napu. Cloves (*Syzygium aromaticum*), another monetarily relevant endemic tree spice from the North Moluccas (Indonesia) which is used to fabric the Indonesian aromatized cigarette *kretek*, does not grow in highland forests.

Similarly, coconut (*Cocos nucifera*) and durian (*Durio zibethinus*), two other plants of significance and value in Indonesia, seem to be hard to grow in Napu Valley as well. The biophysical limits for growing cloves is at a maximum altitude of 1'000 m, whereas for coconut and Durian, the maximum altitudes are 900 m and 800 m respectively (ICRAF, n.d.). To a small extent, farmers are cultivating several maize, upland rice, peanuts, cassava, soybeans and vegetables (e.g. cabbage, tomatoes, eggplant, carrots, spring onion, shallot, pumpkin, Indian mustard). These dry-land seasonal crops are mainly grown in smaller areas

[3]The Toraja ethnic group is famous for the architecture of their huge boat-shaped rice barns and houses, as well as for their elaborated funeral traditions.

of land (Maertens et al., 2006) (Figure 4 A,B). Furthermore, fruit trees (e.g. banana, mango, avocado, water apple, lime, sweet orange) and spices (e.g. chilli, ginger, turmeric) are cultivated for home consumption or for sale on the local market, or to be sold in the markets of Palu or Poso. Since very recently (less than ten years), Japanese immigrants have heavily expanded the production of the root crop manioc by taking over previously infertile lands in Napu Valley and using tractors to create and service manioc fields.

Coffee was first introduced in Napu valley by the Dutch during the colonial period (17th century). Besides this new cash crop, the Dutch missionaries also introduced money and established taxes (Weber, 2005). Cocoa was first introduced in Sulawesi in the period 1820-1880, stimulated by market demand, but it then disappeared from Sulawesi until the mid-1970s (Li, 2002; Ruf, Ehret, & Yoddang, 1996). In Napu Valley, cocoa was introduced by Bugis migrants resulting in an important change of land use (Feintrenie et al., 2010). Bugis migrants, the most numerous ethnic group of South Sulawesi, introduced also methods to improve cacao cultivation (Kreisel, Weber, & Faust, n.d.).

To summarize, rice, maize and cacao are among the agricultural products that presently generate the highest income for most of the farmers of Napu Valley. It should be noted that most inhabitants of Napu Valley are self-employed small-scale farmers and mainly practice subsistence agriculture, since non-farm employment opportunities are scarce. However, many farmers of non-local decent (i.e. particularly migrants or people with an ethnic origin that is not Napu) developed their own businesses such as small shops, garages, small restaurants, guesthouses (Figure 4 E,H).

Figure 3 Napu Valley, Central Sulawesi, Indonesia (**A**) Grasslands (*padang rumput*) (**B**) Paddy rice fields (*sawah*) (**C**) Rice seeddlings (**D**) Ripe rice.

Figure 4 Napu Valley (**A**) (**B**) Vegetables growing on the slopes of the valley (**C**) (**D**) Paddy rice fields at different time periods (**E**) Itinerant sellers (**F**) Improvement of the road in the village of Siliwanga (**G**) Bridge connecting the two parts of the village of Rompo (**H**) Vegetables sold at the market in Wuasa.

1.3.4 Population

Ethnic Groups

Napu Valley has long been considered a remote and inaccessible area encircled by high mountains. In the past, the inhabitants of the valley were known and feared as skilled head hunters. They invaded villages in the neighbouring valleys and in the Poso plain, where they were named Napu, i.e. manslaughterer in the Poso language (Kehlenbeck, 2007). They, however, called themselves Pekurehua derived from the similar sounding call of a common bird in this valley (Weber, 2005). The language of the Napu ethnic group is, therefore, called bahasa Pekurehua or bahasa Napu (Hanna, 2001).

The adjoining valleys to Napu are Sedoa in the North and Besoa (or Behoa) in the South. The Bada valley in the South of the Besoa valleys has no direct connection with the Napu or Besoa valleys, but is historically and culturally connected to them. Each one of these valleys has its own local language which can be used to define the different ethnic groups. Despite their different languages, the ethnic groups of Sedoa (or Tawailia), Napu (or Pekurehua), Besoa (or Behoa) and Bada are considered to be closely connected by their culture and are called *suku Lore*[4] (Tokare, 1990). The neighbouring ethnic groups are mainly *suku Kulawi* (from the Kulawi Valley on the Western border of the LLNP) and *suku Kaili* (from Palu).

The present study was carried out in five villages of the Napu Valley. As indicated earlier in a footnote (1), it should be noted that one of the studied villages, Rompo, is located at the southern tip of Napu Valley (Figure 5). Due to the geographic proximity of Rompo with the Besoa Valley, the inhabitants of this remote village speak the Besoa rather than the Napu language. Moreover, Rompo belongs to the same sub-district (*kecamatan*) as the Besoa Valley (i.e. *Lore Tengah*). When I refer to Napu as an ethnic group in the following pages, this does not include the inhabitants of Rompo since the locals of Rompo define themselves as members of the Besoa or Behoa ethnic group.

Figure 5 Village of Rompo (**A**) Hilly scenery around the remote village of Rompo (**B**) The inhabitants of Rompo going home after visiting the church.

[4]*Suku* means tribe or ethnic group in the Indonesian language. According to information gathered in conversations with locals from Rompo, there is even a fifth local language (bahasa Tawailia), which is used in the village of Betue, between Napu Valley and Rompo.

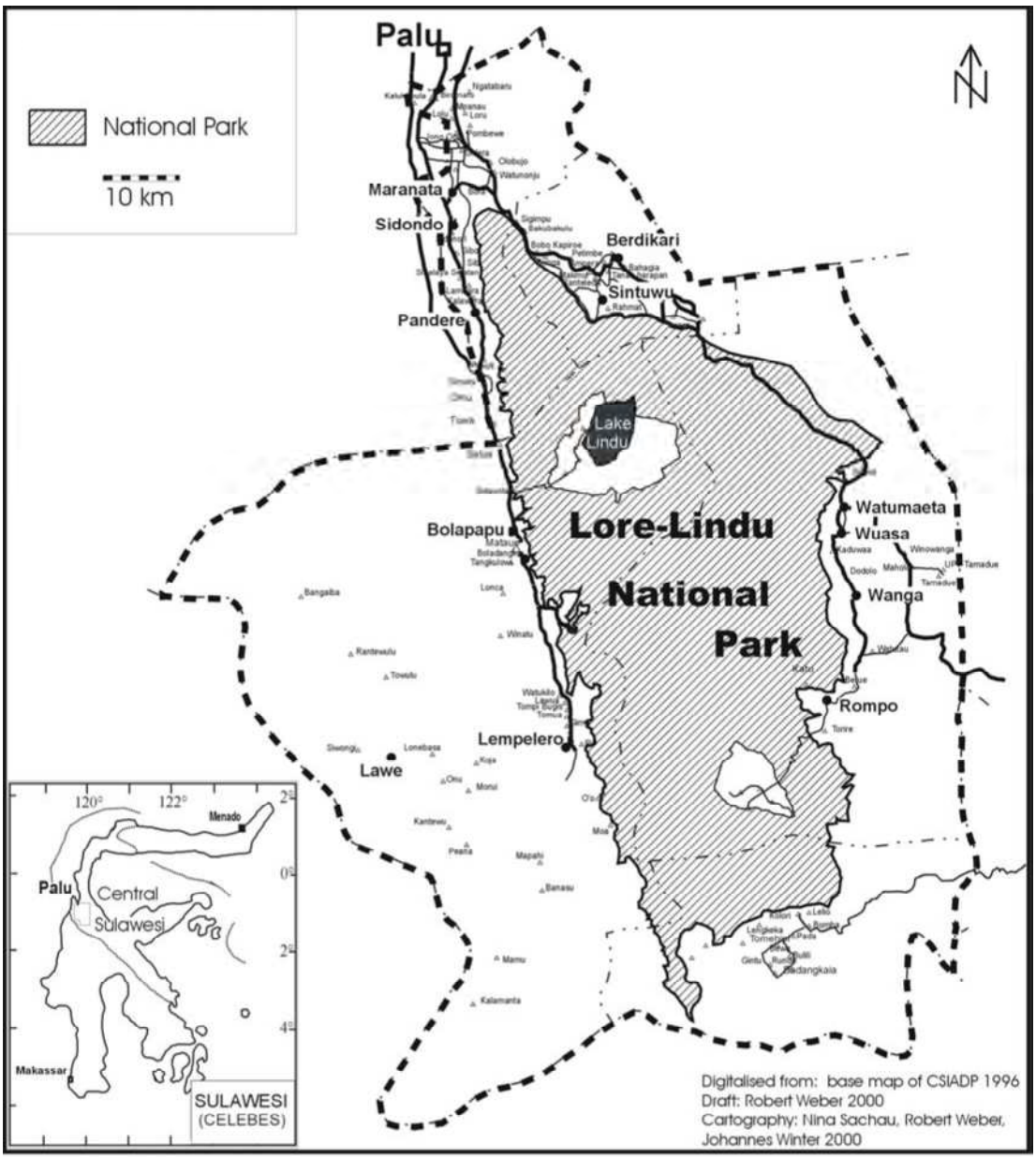

Figure 6 Map of the Lore Lindu region. The main village of the Napu valley, Wuasa, is located at the eastern margin of the Lore Lindu National Park. Source: Schwartz (2004)

Religions and Migration

Since the 17th century the Dutch were a colonial presence on Sulawesi. In their conquest, they ignored the inaccessible and agriculturally less productive mountain areas. The first European missionary reached Napu Valley in the beginning of the 20th century and converted the animist inhabitants to Christianity (Weber, 2005). Today, the cities of Palu and Poso are both predominantly Muslim, while most of the Napu Valley inhabitants are Christian. Between 2000 and 2008, religious struggles between Christians and Muslims occurred around Poso. The influx of Christian refugees from the district capital Poso led to an increase in the population size of Napu Valley (Faust et al., 2003). Prior to this influx, the population size of Napu Valley had been on the rise due to spontaneous migration from other regions of Sulawesi as well as due to several planned migration programs (local resettlements and inter-island transmigration programs) (Hoppe & Faust, 2004) (FIGURE). The governmental objectives of the aforementioned migration programs were to divide the population more evenly in the archipelago, to provide land for the poor and landless people, to further develop agriculture for income generation (in particular by supporting export crops), and to control the borders more tightly (Levang, 1997). Currently, the main driving factor for the population increase in Napu as well as in the Lore Lindu region is the abundance of easily accessible forest, which can be cleared for cocoa production (Faust et al., 2003).

When the new asphalt road connection to Palu was established in 1982, Napu Valley became more attractive for spontaneous migrants, often from the ethnic group of Bugis, who introduced cocoa plantations at a larger scale (Feintrenie et al., 2010). During the 1990's, the government also resettled 600 transmigrant households and 271 local households in the district of Lore Utara (Faust et al., 2003) (Figure 7). The migrants who joined transmigration programs were mainly poor Hindu people from the over-populated islands of Java or Bali. An important detail to note is that some of these Balinese families were originally assigned a different location in Sulawesi (e.g. Parigi Moutong, Morowali in Central Sulawesi). In a second step, they spontaneously migrated to Napu Valley due to better future perspectives. Hence, numerous members of these Hindu families in Napu Valley are born in Sulawesi (second generation immigrants) since their parents (first generation) had migrated to Sulawesi. Balinese Hindu people tend to strongly preserve their rituals and traditions. For example, all Hindu families have a special area in front of their house for various religious rituals (Figure 8A,B). In addition, the two transmigrant villages of Napu Valley with Hindu families (Siliwanga and Mekarsari) have undertook a large effort to construct a Hindu temple for their village center. The renovation and expansion of the Hindu temple (called *Pura* in the Indonesian language) in Mekarsari was recently completed in 2012 (Figure 9A,B). Many of the migrants have been successful in agricultural production and trading or in other entrepreneurial ventures. This success has caused feelings of envy among the local inhabitants (Kehlenbeck, 2007). The social integration of the migrants is still limited and many stereotypes about them exist. For example, migrants tend to think that locals are lazy. Meanwhile, locals feel that migrants want to dominate them economically (Hoppe & Faust, 2004).

Figure 7 Example of new settlement in Napu Valley (**A**) Cassava (*Manihot esculenta*) is often planted to set up a new homegarden (**B**) Absence of three (no vertical structure) (**C**) Set of small houses constructed by the government for migrants (already occupied by families) (**D**) New road leading to a new settlement establish mainly on unfertile land (**E**) Set of small houses not yet inhabited (**F**) New road and houses of a settlement village that is not yet inhabited.

Figure 8 Socio-cultural functions of homegardens for the Hindus (**A**) Small temple in front of the house of a poor Hindu family in Siliwanga (**B**) New house built by a Hindu respondent in Mekarsari (**C**) (**D**) (**E**) (**F**) (**G**) (**H**) Teeth cutting ceremony (*potong gigi*) taking place in the homegarden of a Hindu family.

Figure 9 The Hindus in Napu Valley (**A**) (**B**) New temple in Mekarsari (**C**) Temple in the center of Siliwanga (**D**) Sacred offerings (*sajen*) (**E**) Hindu respondents near their coffee plantation.

2 Methods

2.1 Data Collection

For the first time I visited the study area in August 2011 to get to know the indigenous communities, meet the participants of my survey as well as to acquire basic linguistic skills in the Indonesian language (*bahasa Indonesia*). In February 2012, I returned to the study area to perform floristic inventories of homegardens in collaboration with Dr. Katja Kehlenbeck. Our aim was to estimate the plant species diversity in the pre-selected homegardens. Then, from March to August 2012, I revisited each of the 45 study participants twice; the first time to collect socio-economic data of the household and the second time to do the pile sort and ranking exercise.

During the early stages of my fieldwork, I was assisted by a member of the Napu indigenous ethnic group (*suku Pekurehua*) to translate and perform the first set of interviews with the participants as well as to conduct the first ethnobotanical exercises. This assistant was a 28-years-old unmarried woman, who spoke the indigenous ethnic language (*bahasa* Napu or *bahasa Pekurehua*) and lived in the same village as I did (Wuasa). She had graduated from the University of Palu (agronomy science) and lived at her family's home. It should be noted that she was the daughter of the former deceased mayor of the village of Wuasa who was highly esteemed by the inhabitants. It was therefore very easy for her to speak with the members of the indigenous communities and conduct the interviews on my behalf. It should further be noted that she had previously acted as a field assistant or translator for scientific projects led by the multidisciplinary Indonesian-German research program "Stability of Rainforest Margins in Indonesia" (STORMA) and the “Centre for Tropical Forest Margins” (CTFM).

2.1.1 CBD, Prior Informed Consent and Legal Authorisations

This research conforms to the Convention of Biological Diversity (CBD) and is based on Prior Informed Consent (PIC). All participants confirmed that they were willing to participate in this research project. All participants except two new families, were used to give interviews as they had already participated in previous surveys conducted in the area by Dr. Kehlenbeck and other researchers, within the framework of the multidisciplinary Indonesian-German research program STORMA.

The different research permits and other legal authorisations were obtained with the support of my Indonesian counterpart, Prof. Dr. Purwanto, Laboratory of Ethnobotany, Research Center for Biology - Indonsian Insitute of Sciences (LIPI), Bogor, Indonesia.

2.1.2 Selection of Study Sites

The sample of my study consisted of a set of 45 rural homegardens from five villages located in the Napu Valley, Central Sulawesi, Indonesia (Figure 15, Figure 16). Since my research is a continuation of the work of Dr. Kehlenbeck, the homegardens were the same as the ones she surveyed from 2001 to 2007 (Kehlenbeck, 2007). To have a representative sample of homegardens and respondents, she chose five out of fifteen villages within the Napu Valley, which differed in terms of their market access, origin of inhabitants and soil quality, among other characteristics (Kehlenbeck, 2007; Zeller, Schwarze, & Van Rheenen, 2002). Some features of the five studied villages are presented in Table 1 (information marked with * are from Kehlenbeck, 2007). Three of the villages, Wuasa, Wanga and Rompo, were originally populated by indigenous people and still mainly consist of inhabitants from the Napu ethnic group (for Wuasa and Wanga) or the Besoa ethnic group (for Rompo). The two other villages (Siliwanga and Mekarsari[5]) are both largely populated by migrant families, mainly Hindu in Siliwanga, while there is a mix of Hindus and Muslims in Mekarsari.

Table 1 Characteristics of the five researched villages in Napu Valley, Central Sulawesi, Indonesia

	Wuasa	**Rompo**	**Wanga**	**Siliwanga**	**Mekarsari**
Year of foundation	1892*	1915*	1923*	1992*	1991*
Previous sub-district	Lore Utara	Lore Tengah	Lore Utara	Lore Utara	Lore Utara
Actual district	Lore Utara	Lore Tengah	Lore Peore	Lore Peore	Lore Timur
Inhabitants	2'609	456	300	506	*No data*
Households	719	124	120	119	*No data*
"Local ethnicity"	90% *	90% *	75% *	5% *	1% *
Main religion	80% Christian 20% Muslim	Christian	Christian	50% Hindu 25% Muslim 25% Christian	Hindu, Muslim
Ethnic language	Napu	Behoa	Napu	-	-
Market access	Good*	Poor*	Medium*	Medium*	Medium
Respondents and inventoried homegardens in 2012	10	8	10	8	9

Note: *Data from Kehlenbeck (2007). For the total numbers of inhabitants (*penduduk*) and households (*kepala keluarga*), as well as for the main religions, I used different reports obtained from the secretary of the villages (*sekdes* or *sekretaris desa*). For Wuasa: "*Laporan Pembangunan Desa Wuasa, Tahun 2011*"; for Rompo: "*Format Laporan Profil Desa Dan Keluarahan, Tahun 2007*"; for Wanga: data from *sekdes*; for Siliwanga: "*Rencana Pembangunan Jangka Menengah Desa (RPJM-DES), Tahun 2011*"; for Wanga: *sekretaris desa*.

[5] In accordance with the inhabitants' preferences, the name Mekarsari is used here rather than Tamadue-Trans, the official name of the village.

2.1.3 Respondents

Interviews were conducted with the "main gardeners" (for details on the inteviews see 2.1.5). To determine who the main gardener was, I asked the family who spent the largest amount of time managing the homegarden (e.g. planting, harvesting, hoeing/spraying). The head of the household as well as his wife often responded that they both worked equally as much in the homegarden. Whenever this was the case, I interviewed the same person as Dr. Kehlenbeck previously did. An overview of the age, ethnicity, profession and main income sources of the respondents are provided in the Figures 10-14.

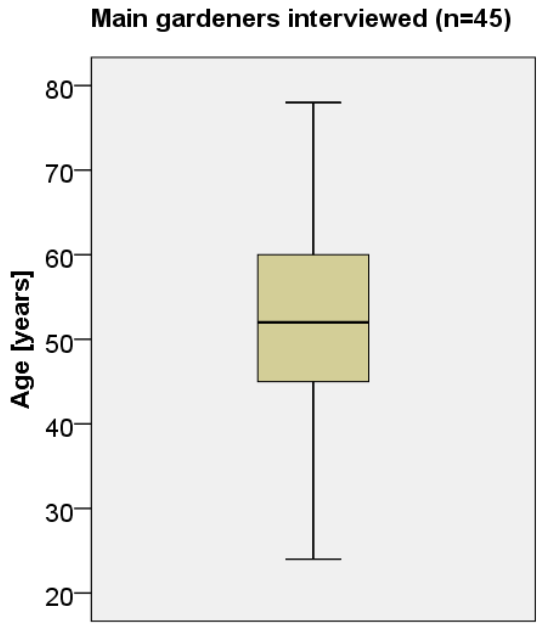

Figure 10 Age distribution among the 45 respondents (median=52 years).

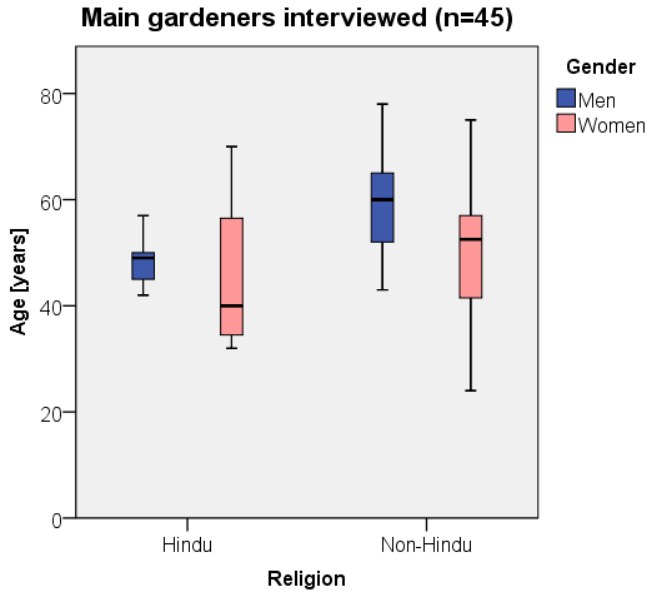

Figure 11 Age distribution within Hindus and non-Hindus.

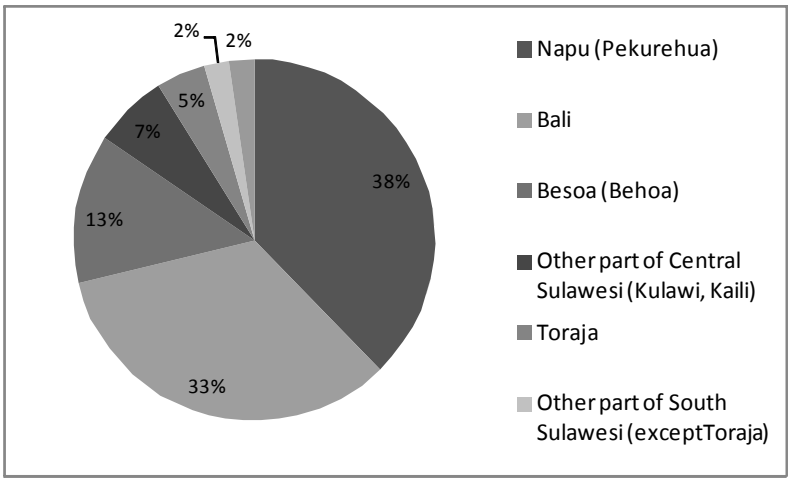

Figure 12 Ethnicity of the 45 respondents.

Figure 13 Main occupation of the Hindu (left) and the non-Hindu respondents (right).

Figure 14 Non-agricultural cash income of the Hindu (left) and non-Hindu respondents (right).

Figure 15 Some of the studied homegardens (**A**) Multi-layer of trees (**B**) Spring onions (*Allium fistulosum*) and other vegetables (**C**) (**D**) (**E**) (**F**) Homegardens and homestead (**G**) (**H**) Frontyard of the homegarden used to dry cocoa (*Theobroma cacao*).

Figure 16 Socio-cultural functions of homegardens (**A**) The front part of a homegarden in Wuasa which was used for a commemoration ceremony of a deceased person (**B**) The back part of a homegarden used to cook food for a wedding party (**C**) A homegarden, July 2011 (not from my sample) (**D**) The same homegarden during a wedding party in Mai 2012 (**E**) The same homegarden the day after the wedding party (**F**) The same homegarden three months after the wedding party in August 2012 (**G**) (**H**) Homegarden as a place to meet for kids, teenagers, but also for adults and the elderly.

2.1.4 Floristic Inventory of Homegardens

For the floristic inventory, the abundance of all the useful plants in the sampled homegardens was recorded. In this thesis, the terms of crop, crop plant, cultivated plant and useful plant cultivated in homegardens are used as synonyms. We did not include ornamental plants in the floristic list. However, when respondents mentioned a medicinal use for a plant widely considered as ornamental, we recorded this plant in our list (e.g. *Pedilanthus tithymaloides*, Euphorbiaceae). Since we decided to focus on cultivated plants (i.e. planted or promoted), weeds were not included in the floristic list, even though some of them have medicinal use. A detailed list of useful weeds is available in the thesis of Dr. Kehlenbeck (Kehlenbeck, 2007). I would like to point out the permeable borderline between weeds (i.e. undesired plants) and useful plants. For example, forest strawberries (*Rubus rosifolius*), which we included in our inventory list, were probably not planted by gardeners. Rather, they exist in the natural ecosystem and survived in the homegardens whenever its gardener did not pull it out manually or sprayed herbicide on it. We further recorded all the trees in our floristic list, even if the gardeners did not know the tree or its use.

In general, plants were identified in the field, except in a few cases in which specimens were pressed or stored in alcohol for later identification[6] at the Herbarium of Bogor (BZ), Indonesia. These samples remain in the storage facilities of this Herbarium. During the fieldwork conducted in 2012 in Napu Valley, I tried to complete the list of useful plant species published by Kehlenbeck (2007) with local names in two local ethnic languages (*Bahasa Napu* and *Bahasa Behoa*). To do so, I gathered information from respondents or from other locals whom I questioned in an informal way. For the spelling of the species names in *Bahasa Behoa*, my main linguistic aide was Ibu Hania Pande, from Torire village, located between Rompo and Besoa valley. At the time she was participating in other projects related to English-Bahasa Behoa translation (Rantung, 2004).

2.1.5 Semi-Structured Interviews

Semi-structured interviews were used to collect (1) specific data of the homegarden (Appendix I) and (2) quantitative socio-economic data of the household (see Kehlenbeck, 2007). I used and adapted the questionnaires previously designed by Kehlenbeck and researchers of the STORMA project (Kehlenbeck, 2007; Schwarze, 2004). I translated the two questionnaires into the Indonesian language with the help of Sisi Boka, the local assistant, with whom I worked during my fieldwork. During the first interviews, Sisi Boka accompanied me as an interpreter. At a later point, I interviewed the respondents in the Indonesian language myself. The duration of each of these semi-structured interviews varied between one and two hours, depending on the respondent's time availability. When it was possible, I made an appointment with respondents ahead of time. This was particularly important because many of the interviewees were busy during the day. In addition, strong tropical rain showers as well as the occasional absence of electricity during the evenings posed challenges to the execution of the fieldwork. I mostly met the respondents at their home, but in exceptional cases interviewed gardeners at their rice fields or plantations. To

[6] Specimen numbers are given in the floristic list in the Appendix II.

ensure the accuracy of the study, I interviewed every time the main gardener of the homegarden.

Raw data from the socio-economic interviews are presented in the Appedices III and IV but are not further analysed in this thesis.

2.1.6 Pile Sort and Ranking Exercises

Franz Boas, one of the pioneers of modern anthropology, carried out extensive ethnographic fieldwork in which he examined the specific cultural traits of a community (behaviours, beliefs, and symbols) within its local context (Boas, 1937). To study a cultural system of a society, he put forward the idea that researchers should take the point of view of an insider (emic approach). In his fieldwork, Boas pursued this approach to analyse the diffusion of cultural traits between individuals and cultures. The emic approach has been primarily used in studies in the linguistic sciences (Pike, 1993). Later on, analyses and methods for other cross-cultural domains such as ethnobiological classifications were developed as well (Berlin et al., 1966; Berlin, 1992). As argued by Stepp (2005), ethnobiologists might not always find a pattern of classification for a given cultural domain. This is due to the variation in significance of the domain in different cultural contexts, as well as because of the cognitive variation among the respondents. In this thesis, I will explore the classification and the cultural importance of the useful plants cultivated in homegardens in Napu Valley, Central Sulawesi.

In order to investigate the respondents' agreement on plants classification and valuation, I used two structured interview methods. First, I performed a pile sort exercise and secondly a ranking exercise (Bernard, 2000; Borgatti & Halgin, 1998). For these, I used 53 out of the 210 plants recorded in the floristic inventory of homegardens. The plants were chosen according to the summed dominance ratio (SDR), which is an index calculated from the densities and relative frequencies of plants. Since the plants with the highest SDR value were the most often cultivated in the homegardens, I expected that nearly all the gardeners would know these plants. For practical reasons and due to the high number of species, I performed the pile and sort exercise with pictures of the plants rather than with fresh samples. To do so, I took pictures[7] of each one of the 53 plants and printed them on small cards of the size of 8x8 cm (Appendix V). I added the name of each plant under the pictures in the Indonesian language and sometimes also in the local ethnic language. The Latin name, as well as the plant's family name were printed on the back of the card, as information for myself.

For the pile and sort exercise, I asked the respondents to sort the plants and to explain the criteria they used to form groups or categories (Figure 17). I introduced the exercise with a simple sentence: "Please, make groups of similar plants." Whenever a respondent asked: "What do you mean by similar or belonging together?", I generally gave them a simple example: "For example, you could group together Arabica coffee with Robusta coffee." To facilitate the statistical evaluation, people were not allowed to place a plant in more than one pile, even when a plant had multiple uses (e.g. *Curcuma longa* is often considered as a medicinal plant but was also frequently grouped with spices). I did, however, take note of these cases in order to allow for further interpretation of the results. After all the plants had

[7] All pictures are from Isaline Mercerat (2011 and 2012).

been sorted, I asked respondents to name each group and to explain the differences between two separated groups. Unknown plants were sorted in a single separate group.

After this first part, I asked respondents to rank the plants within the piles, according to their importance in the specific context of homegardens. People were subsequently asked to justify these rankings by explaining why a certain plant was more important than another one for them. I further asked the respondents whether there were other important plants, which were not among these 53 that I had selected.

Following the pile and sort exercise, I performed three ranking exercises. In the first exercise, I wanted respondents to imagine that they would have to set up a completely new home garden, as if they would move to a new village (Figure 7). Then, I asked them to choose and rank from the 53 pre-selected plants which ten crops they would plant ("new homegarden setup - top ten crops"). For the second exercise, I had them imagine that they owned a homegarden with all of the 53 plants. Then I asked them which plants they would remove first, if they had to eliminate ten ("unimportant plants in a homegarden - removal of ten useless crops"). For the last exercise, I asked respondents to choose and rank among the 53 plants the five most important crops for their livelihood ("favourite useful plants - general top five crops").

Figure 17 Pile sort and ranking exercises with respondents and the local assistant.

2.2 Data Analysis

Raw data resulting from floristic inventories (species abundance data), semi-structured interviews (socio-economic data) and pile sort and ranking exercise (ethnobotanical data) were stocked in Microsoft Office Excel 2007 and analyzed statistically with the programs SPSS (IBM SPSS Statistics 20).

2.2.1 Homegardens' Floristic Diversity

In a first step, I have described the overall plant species richness of the 45 studied homegardens (e.g. number of floristic families, number of plants per use category). It has to be noted that the use categories to describe the floristic composition were the ones recorded by Kehlenbeck (2007). In a second step, I compared the total plant richness per homegardens between the villages as well as between the Hindu (n=15) and non-Hindu (n=30) respondents.

2.2.2 Consensus Analysis of Pile Sorts

To investigate the respondents' assessment on plants classification, I first described in detail the categories which were used by the respondents to classify the 53 selected plants. To have an overview on how strong was the respondents' agreement, I summed for each plant the categories in which at least one respondent mention the plant.

In a second step, I generated cladograms from the pile and sort exercise, using cluster analysis on SPSS in order to show the respondents' assessment of the different plant categories (e.g. vegetables, fruits, medicinal plants). I used "hierarchical cluster" and the 53 plants as cluster variables. The purpose of using the cluster analysis method was to estimate the consistency of the piles among the respondents. First I performed the analysis for all the respondents. Then, I divided the 45 respondents into different groups, whereby each group had at least 15 respondents (except for one group with 6 respondents). I compared visually the resulting cladograms to see if there were marked differences between the different groups or not. I choose groups according to the criteria that I suspected would determine or be of importance when it comes to the perception of plants. My first idea was to separate the respondents into two groups, according to their origin (i.e. locals and migrants). I realised, however, that it was not possible to clearly define these groups because of the time scale issue of the migration. At what point is somebody who has immigrated considered a local? Can we consider the children of the migrants as locals? What happens when a migrant marries a local? To deal with this problem, I used the ethnicity and split the 45 respondents into three groups: Napu/Pekurehua (n=17), Besoa/Behoa (n=6) and other ethnicity/Non-Napu or Besoa (n=22). I always refer to the ethnicity of the main gardener who I interviewed and not to the household's ethnicity (e.g. in case a respondent married with someone from a local ethnic group, I still considered the original ethnic group of the respondent). I also used the religion to divide the respondents into two groups: Hindu (n=15) and non-Hindu (n=30). In my sample, the Non-Hindus include respondents from the ethnic groups Napu/Pekurehua (n=17), Besoa/Behoa (n=6) and other ethnic groups from Sulawesi, as well as one from Sumatra (n=7). Gender was used also to split the respondents and to investigate whether this factor influences the respondents' assessment of different plant categories. Finally, I decided to use

a biodiversity measurement of homegardens (plant species richness), to divide the respondents into two and three similar sized groups: respondents owning a homegarden with a plant species richness < 40 spp. (n=22) and ≥40 spp. (n=23); and respondents owning a homegarden with a plant species richness < 36 spp. (n=15), 36-50 spp. (n=15) and ≥ 51 spp. (n=15). My hypothesis was that the respondents who own a homegarden with a low plant richness might have a different perception of plants (reflected in the cluster analyses of the pile sort exercise) than those with a homegarden with high plant richness.

2.2.3 Ranking Data

As for the consensus analyse of the pile-sort exercise, I explored the differences of the results of the three ranking exercises between the two groups Hindus and non-Hindus.

New homegarden setup - top ten crops

For the first exercise ("choose and rank the ten first plants you would cultivate in a new homegarden"), I gave the score ten for the plant ranked first, then nine for the rank two, eight for the rank tree, etc. Since I asked respondents to select and rank only ten plants among the 53 plants available for the exercise, the plants which were not selected were attributed the score zero. Then I summed up the scores of the ranks and recorded the frequency of selected plants from all the 45 respondents to find out which plants gardeners would cultivate first in a new homegarden.

Unimportant plants in a homegarden - removal of ten useless plants

For the second exercise ("which plants would you remove first if you had to eliminate ten"), I gave the score ten for the first plant that respondents would like to remove and so one. I processed the data in the same way as for the first ranking exercise.

Favourite useful plants - general top five crops

For the third exercise, I processed the data in the same way, but gardeners had to choose only five plants among the 53 ("the five most important plants"), thus I atributed the score five to the plant ranked first, four to the second rank, etc.

In addition, I tried to analyse whether the results of the pile sort and ranking exercise correlate with the diversity of the homegardens. This analysis is presented in Appendix VI.

3 Results and Discussion

3.1 Homegardens' Floristic Diversity

Plant species richness[8] and diversity were very high in the homegardens that we inventoried in the Napu Valley of Sulawesi. In the 45 surveyed homegardens, we identified a total of 210 different useful plant species, belonging to 70 plant families (Appendix II). Divided into use categories, following Kehlenbeck (2007), 46 were mainly used for medicine, 36 each for vegetable and fuel wood/timber, 31 for fruit, 26 for spice, 10 each for staple and stimulant/cash crop and the remaining 15 for other uses (e.g. handicraft, wrapping).

If we compare plant species richness of homegardens studied to other agro-ecosystems (e.g. forest gardens) in the same region, homegardens we inventoried clearly harboured higher crop diversity. For comparison, Brodbeck (2004) documented 183 crop and wild species on three plots of 1 ha size each in traditional forest gardens in the lower *montane* rainforest region (800-1140 m) in Central Sulawesi. A similar total of tree species in forest gardens (maximum no. about 140 spp.), was estimated in the Napu valley by Kessler et al. (2005).

On average, 41 (SD ± 14) useful plant species were cultivated in the inventoried homegardens. We recorded a maximum of 76 useful plants in a homegarden of the remote village of Rompo and a minimum of 8 species in the administrative-centre village of Wuasa. There was no significant difference of the plant richness between Hindu (mean 39; SD ± 12) and non-Hindu respondents (mean 42; SD ± 15) (T-test; p=0.474). There was, however, a significant influence of homegarden size on plant richness of homegarden (i.e. crop species number) using non-parametric[9] Spearman rank correlation (R^2 = 0.348; p=0.019) (Figure 18).

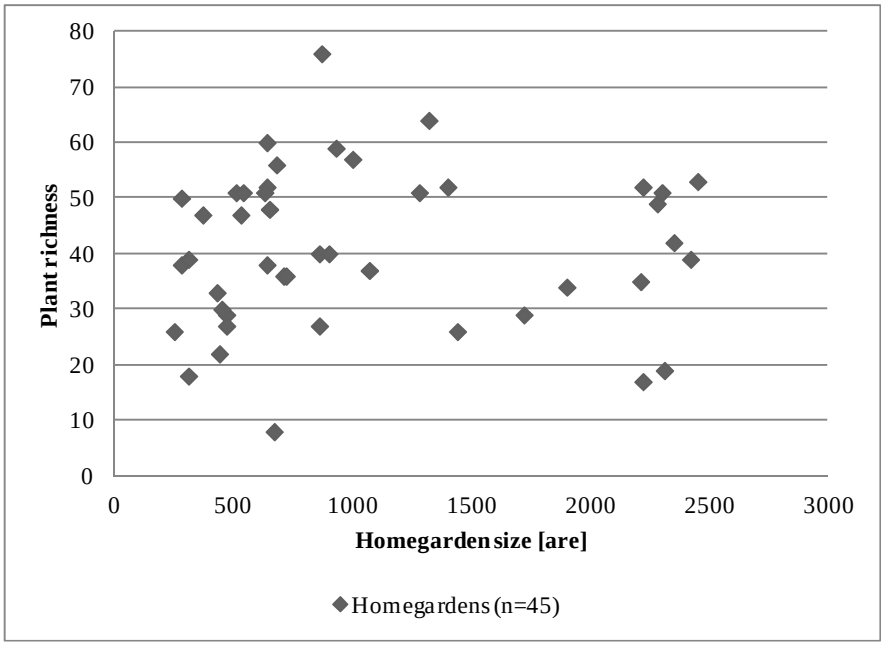

Figure 18 Relation of homegarden size with the species richness of useful cultivated plants.

[8] Useful plant (without ornamental plants).
[9] The plant richness was normally distributed, but not the homegarden size.

Plant richness of homegardens might also be influenced by development activities such as, for example, the aesthetic competition between villages. In summer 2012, the mayor of Rompo forced gardeners to install fences and shelfs for ornamental plants painted in white and blue colour. In addition, he adviced the gardeners to plant specific medicinal plants in their homegardens, as recommended by the village development programme, PKK (*Pemberdayaan Kesejahteraan Keluarga* or "Family Welfare Movement") (Figure 19).

Figure 19 Village development program in Rompo - "village competition" in July 2012 (**A**) Houses and fences had to be painted in white and blue (**B**) Shelf for ornamental plants (**C**) (**D**) (**E**) Medicinal plants (*toga*) (**F**) Hole in the back of homegarden to burn the trash.

3.2 Emic Perception and Valuation of Useful Plants Cultivated in Homegardens

3.2.1 Consensus Analysis of Pile Sorts

Emic Plant Categories

In total, I recorded 23 categories to which respondents referred when they classified the 53 selected plants during the pile and sort exercise (Table 2). The respondents did not use the same number of categories and number of species assigned to the categories was highly variable. For these reasons, it was difficult to evaluate the consistency of the piles among the respondents by looking at the cladograms (Appendix VIII). Prior to discussing the cladograms, however, I will discuss in detail the categories used by the respondents to classify the plants.

The categories created by the respondents mainly referred to criteria such as the use of the plants (e.g. fruits, vegetables, spices, drink, animal fodder) or the morphology of the plants (e.g. shrub with leaves like small palm, small sized plants). Some gardeners used very specific categories to classify the plants. For example, one gardener distinguished the fruits which are falling by themselves when they are ripe (*buah yang jatuh sendiri waktu jadi masak di pohon*; e.g. mango, guava, avocado, lime, jackfruit, coconut, durian and Pummelo) and the fruits which do not fall from the tree when ripe (*buah yang tidak jatuh sendiri waktu masak*; banana, papaya, pineapple, rambutan coffee and cocoa). Another woman distinguished the vegetables which can be mixed with meat when cooking (*sayur yang bisa campur dengan daging*; cassava, sweet potato, banana, jackfruit and pumpkin) from the normal vegetables. Some respondents created categories based on morphology when they did not know in which group to include some plants. For example, some respondents grouped some plants in "shrubs with leaves looking-like small palm" (*tumbuhan*[10] *dengan daun bertulang sejajar*; e.g. maize, pineapple, pandan, papaya, banana, Napier grass).

People gave numerous names to the categories that I call "cash crop". They used the following expressions among others: *tanaman*[11] *yang bisa di jual* ("plants that can be sold"), *nilai ekonomis* ("economic value"), *pohon hasil tahunan* ("tree with annual results"), *buah ekonomis* ("economic fruits"), *tanaman kusus dijual* ("special plant to sale"), *tumbuhan yang bisa menghasilkan* (plants which can produce/be productive), *tanaman ekonomis yang perlu process* (economic plant which needs process), *perkebunan* (plantation), *budidaya petani* (farmers' cultivation), *tanaman horticultural* (horticultural plants), *tanaman produksi* (plant production).

It should be taken into consideration that among the 45 respondents, some of them did not know some of the plants among the 53 plants which were used for this exercise. Whenever this case occurred, I categorized these plants in the group of "unknown plant". These plants (with number of respondents who did not know the plant) were: chives or *bawang piara* (*Allium schoenoprasum;* 8 resp.), Purging nut or *jarak pagar* or *belacair*

[10] tumbuhan means plant, usually in its natural environment.

[11] tanaman refers to a cultivated plant (crop). Tanaman keras refers to perennial plant (literally "plant strong"). It should be noted that tanaman tahunan (literally "plant year") refers also to perennial plants, and not to annual plant

(*Jatropha curcas*; 4 resp.), Painted nettle or *miyana* or *bunga mayana* (*Solenostemon scutellarioides*; 8 resp.), false bird-of-paradise or *pisang hias* or *daun bungkus* (*Heliconia indica*; 9 resp.), bitter tomato or *terong palolakao* (*Solanum aethiopicum*; 13 resp.). One of the respondents created a category "ornamental, decoration" with two of the plants he did not know.

Table 2 Categories used by the 45 respondents to classify the 53 selected plants for the pile sort exercise

Nr. Cat.	Category (English)	Category (Bahasa Indonesia)
1	fruits	*buah*
2	fruits ripe on the tree	*buah yang tidak jatuh sendiri waktu masak; jadi busuk di pohon kalau tidak dipetik!*
3	fruits that falling by themself when ripe	*buah yang jatuh sendiri waktu jadi masak di pohon*
4	vegetables	*sayur*
5	vegetables used to mix with meat	*sayur yang bisa campur dengan daging*
6	vegetables edible fresh	*sayur lalap/yang bisa makan mentah*
7	spices	*rempah/bumbu*
8	medicines	*obat/jamu*
9	medicinal plants for animals	*penyakit hewan*
10	drink	*minuman*
11	animal fooder	*makanan ternak*
12	substitute for rice	*makanan penganti beras/pokok/tambahan*
13	root crops	*ubi*
14	cash crop (incl. economic plants which needs to be processed)	*nilai ekonomis/pendapatan (incl. tumbuhan ekonomis yang perlu process)*
15	plantation ecosystem (not only cash crops)	*horticultural/perkebunan*
16	protection trees/fences	*pelindung/pagar*
17	wrapping	*daun pembungkus nasi*
18	decorative, ornamental	*tanaman hias*
19	ritual, sacred offering	*sajen*
20	small sized plants	*tumbuhan yang pendek*
21	shrub with leaves like small palm	*tumbuhan dengan daun bertulang sejajar...*
22	"alone"	*kategori sendiri*
23	unknown plant	*tidak tahu tumbuhannya*

To have an overview on how strong the respondents' agreement on classification of plants among the categories was, I summed for each plant the categories in which at least one respondent mentioned the plant (Appendix VII). It has to be noted that I used the 23 categories (Table 2) for this analysis, whereas it would have been possible to group some similar categories together as well. For example, it would have been possible to include the "root crops" in the group of "substitute of rice/staple". The two categories "vegetables which can be mixed with meat when cooking" and "vegetables edible fresh" could be seen as sub-groups of the group "vegetables". Similarly, the two very specific categories "fruits that fall by themselves when ripe" and "fruits ripe on the tree" could be grouped in the single category of "fruits".

The number of categories, in which at least one respondent mentions the plant, as well as the percent of the respondents, who classified the plant in the category with the highest agreement, are presented in Figure 20. The respondents' agreement on classification was strong for vegetables, fruits and the two spices, ginger (*Zingiber officinale*) and chilli (*Capsicum annuum*). Some multi-purpose plants such as coconut palm (*Cocos nucifera*) and candle nut tree (*Aleurites moluccana*) were classified in different categories by the respondents. The coconut palm was grouped either together with the cash crops or with the fruits category by approximately half of the respondents for each of these classes. The banana (*Musa x paradisiaca*) was classified by 80% of the respondents as a fruit. Nevertheless, this plant was also classified in other categories (e.g. "vegetables", "replacement of rice", "cash crops", "wrapping"). The variety of groups into which banana was classified reflects the multiple uses and varying perception of this plant.

Probably because many of the species are used as both, medicine and/or spice, it was difficult for the respondents to sort these plants (Figure 21). There was rather a continuum for many plants sorted as food, spice or medicine by the respondents. Nevertheless, to be able to analyse the data, I asked the respondents to decide to classify the plants either as a medicine or a spice. Some plants (e.g. tomato, spring onion) were also often categorised into the two groups "vegetables" or "spice" (Figure 21).

In addition to the main use, in which they pile the plant, the respondents also mentioned secondary uses[12] for some of the 53 selected plants. For example, respondents mention medicinal use for the coral tree or *dadap* (*Erythrina subumbrans*), which was classified by more than more three-quarters of the respondents in the group "protection trees/fences" (*pelindung/pagar*).

For one respondent it was important to separate the medicinal plants used for the animals (*tanaman*[13] *obat penyakit hewan*) and humans. This respondent mentioned the tobacco (*Nicotiana tabacum*) plant with a main medicinal use for animal's wormy injuries (*obat untuk luka hewan yang berulat*). Approximately half of the respondents classified the tobacco in the category of medicinal plants. Additionally, respondents often mentioned its use for reducing the ticks often found in the chickens' feather coats (*mengurangi kutu ayam*). A few said the tobacco plant can also be used to prevent snakes from entering the house (*untuk mencegah ular masuk dalam rumah*). The second half of the respondents classified tobacco in the category "alone" (*category sendiri*) because they did not use it as a medicine nor for any other purpose. Respondents often included the sugarcane (*Saccharum officinarum*) in the category "alone" as well, because they said they do not use this plant.

[12] Respondents said bisa juga dipakai sebagai obat for some plants, which means "can also be used as a medicine".
[13] Tanaman means plant in the Indonesian language.

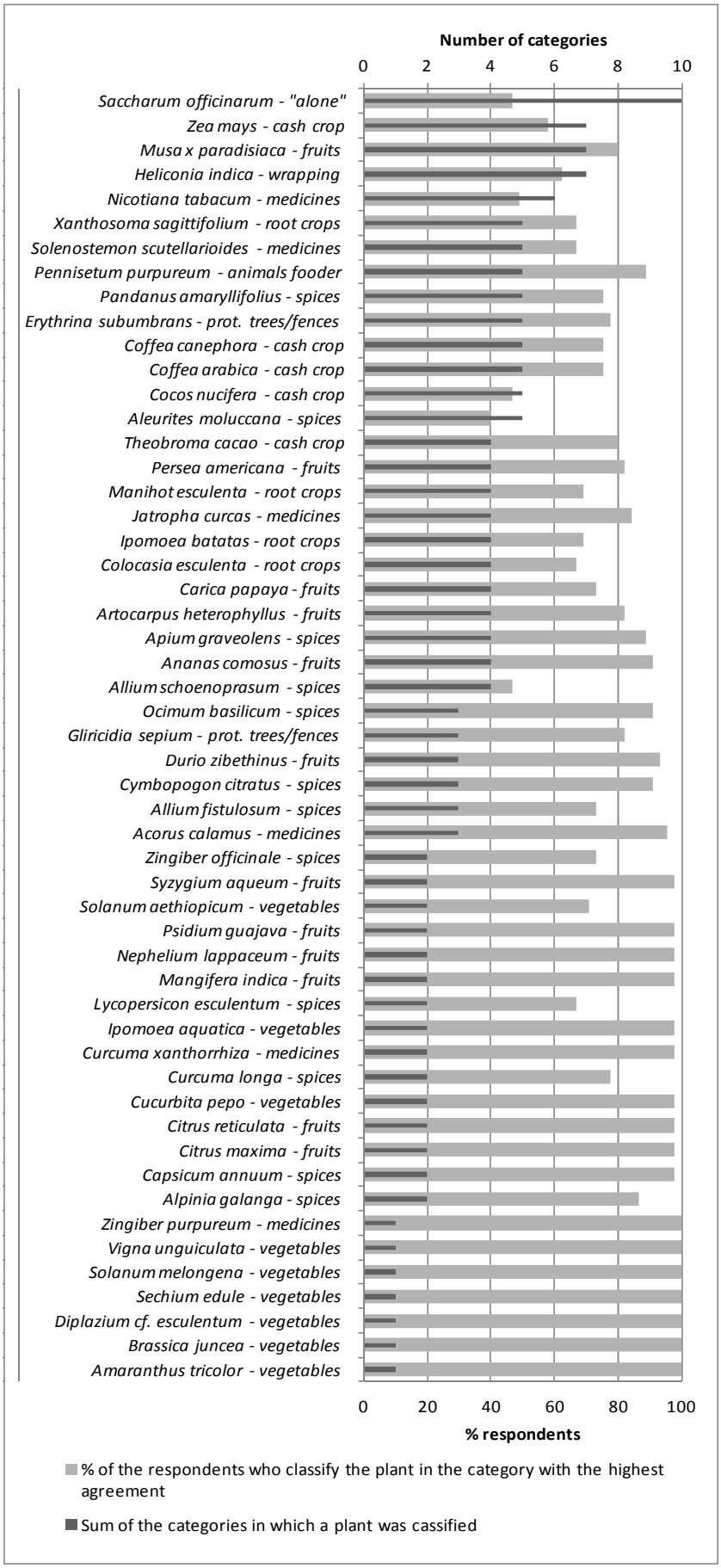

Figure 20 Respondent's agreement on plant classification: general overview.

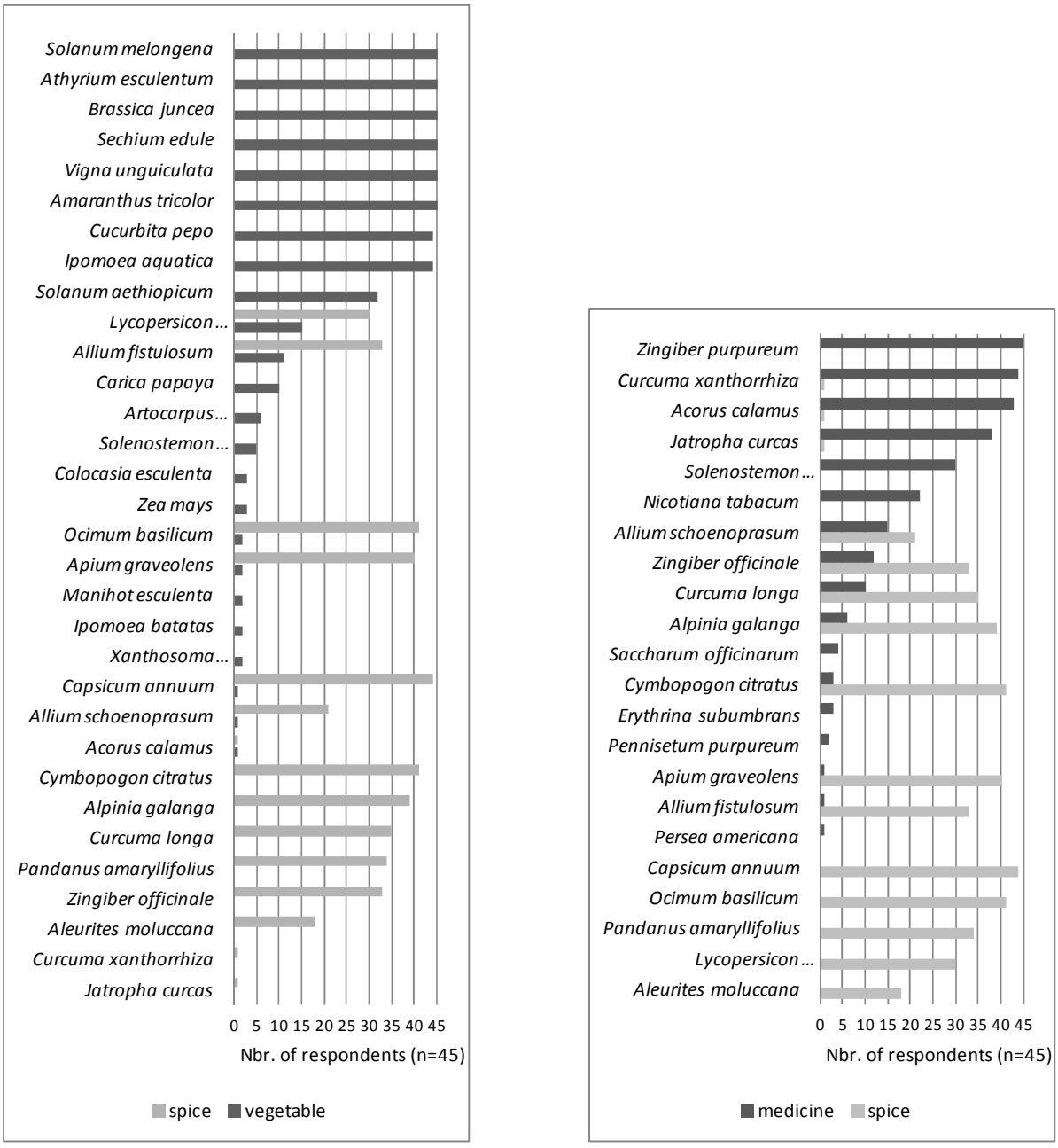

Figure 21 Respondent's agreement on the classification of plant species as vegetable and/or spice (left) and as medicine and/or spice (right).

Comparison Between Emic and Etic Plant Categories

Although the consistency of the categories among the respondents was relatively weak, a general overlap between the emic categories and etic categories from earlier studies of Kehlenbeck (2007) was found. The emic categories tend to be more differentiated and permeable. Agreement between main use categories, resulting from the pile and sort exercise and the ones established by Kehlenbeck, are given in Appendix VII.

The difference between these main use categories mainly occurred where the consensus of the respondent was weak (i.e. high number of different categories in which the plant was mentioned). For example, *Zea mays* was classified by the respondents among seven different use categories, with a maximum of respondents (more than half) classifying it among the cash crop group. However, Kehlenbeck (2007) assigned the maize in the category of staple because some inhabitants in Napu Valley cultivated a local variety of maize (called *jagung pulut*) used for making a special soup called *binte*. People also often included fruit trees in the cash crops category (e.g. candle nut tree, avocado, banana) whereas Kehlenbeck mentioned the market value of different plants as a secondary attribute.

During the pile and sort exercise, two third of the respondents classified tomato (*Lycopersicon esculentum*) among the spices, whereas Kehlenbeck classified it as vegetable. People explained that tomato belongs to the same group as chilli because they usually mix tomato with chilli to prepare a daily used sauce (*sambal chili*).

Ritual Plants Among the Hindus

The Hindu respondents also created a category for the plants that they use for rituals and offerings (*sajen*). From the 53 selected plants, the Hindus use the following for religious purposes: coconut or *kelapa* (*Cocos nucifera*), coral tree or *dadap* (*Erythrina subumbrans*), tobacco or *tembakau* (*Nicotiana tabacum*), pandan (*Pandanus amaryllifolius*), sugarcane or *tebu* (*Saccharum officinarum*) and painted nettle or *bunga mayana* (*Solenostemon scutellarioides*).

It should be taken into consideration that Hindus use many other plants during their rituals and ceremonies. In addition to the aforementioned plants, several useful plants that I recorded during the homegarden inventory were used as well by the Hindus for religious purposes (Figure 8, Figure 9), namely pineapple or *nanas* (*Ananas comosus*), soursop or *sirsak* (*Annona muricata*), ilang-ilang or *kenanga* or *kayu sandat* (Bali) or *andolia* (*Cananga odorata*), chilli or *cabe* (*Capsicum annuum*), pummelo or *jeruk besar* (*Citrus maxima*), sweet orange or *Jeruk cina* (*Citrus sinensis*), job´s tears or *jagung jali* or *kalide* (*Coix lacryma-jobi*), cotton or *kapas* (*Gossypium barbadense*), carricature plant or *daun wungu* or *daun teman* (*Graptophyllum pictum*), mango or *mangga* (*Mangifera indica*), banana or *pisang* (*Musa x paradisiaca*), passionfruit, *markisa* (*Passiflora edulis*), salak palm or *salak* (*Salacca zalacca*), Canadian elder (*Sambucus canadensis*), water apple or *jambu air* (*Syzygium aqueum*), malay apple or *jambu bol* (*Syzygium malaccense*), betel pepper or *sirih* (*Piper betle*).

Indonesians, like many other peoples in Asian countries, are particularly fond of chewing Areca nuts (*Areca catechou*), called *pinang*, mixed with Tobacco (*Nicotiana tabacum*), betel (*Piper betle*), called *sirih* and a white powder (calcium oxide) called *kapur*. During the fieldwork, I observed that the Hindus in Napu Valley were chewing this mixture

during religious ceremonies, and also to honor their guests. In addition to the useful plants cited above, many ornamental plants (e.g. *Bougainvillea* spp., *Rosa* spp.) are used as well by the Hindus for various ceremonies.

Additional Important Plants

When I asked the respondents whether important plants are missing among the 53 that I had selected, most of them said that the important plants were all there (*sudah ada semua*; "already all"). The majority of the respondents, however, were surprised that I did not select rice, which is the main subsistence crop in the area. In these cases, I would explain to them that because rice does not grow in homegardens (with few exceptions), this particular plant, even though it is very useful and popular in Indonesia, was not included in the exercises. The respondents occasionally mentioned some other important plants. The additional plants cited by some of the Hindu respondents were shallot or *bawang merah* (*Allium cepa*), *salak* (*Salacca zalacca*), mangosteen or *manggis* (*Garcinia mangostana*), sapodilla or *sawo* (*Manilkara zapota*). The non-Hindu respondents cited Malabar spinach or *binahong* (*Basella alba* var. *rubra*), chinese chives or *bawang kucai* or *lehune mpipi* (*Allium ramosum*) and Peppermint or *Tangkada* or *daun*[14] *solasi* (*Mentha x piperita*). Cat´s whizkers or *kumis kucing* (*Orthosiphon aristatus*) as well as *langsat* (*Lansium domesticum*) and *bratawali* or *tali pahit* (*Tinospora crispa*), were mentioned by both groups.

Cluster Analysis

The visual observation of the different cladograms resulting from the cluster analysis provides a general idea about the way respondents classified the 53 selected plants (Appendix VIII). No strong consensus was found across all respondents, mainly due to the fact that the respondents did not use the same categories. In other words, the consistency of the piles among the respondents was quite weak. When comparing the cladograms resulting from the cluster analysis of the different groups, based on gender, religion, ethnicity and plant species richness in the homegardens, the highest difference in the pattern of classification seemed to occur between the Hindus and the non-Hindus. For example, five plants (*Allium schoenoprasum, Solenostemon scutellarioides, Heliconia indica, Nicotiana tabacum* and *Solanum aethiopicum*) clearly appeared separate from the rest of the plants on the cladogram of the Hindu respondents, whereas these plants were integrated among the other categories of plants on the cladogram of the non-Hindu respondents (Appendix VIII). The most likely explanation is that most of the Hindu respondents did not know the aforementioned plants. As a result, the Hindus did not classify these plants into other categories, unlike the non-Hindus who classified for example *Allium schoenoprasum* and *Solenostemon scutellarioides* as spices and *Solanum aethiopicum* as vegetables. Similarly, sugarcane (*Saccharum officinarum*) appeared separate from the first junction of the cladogram when classified by non-Hindus, whereas Hindus located this plant close to the coconut (*Cocos nucifera*) and the pandan (*Pandanus amaryllifolius*). This is due to the fact that Hindus use these three different types of plants for sacred offerings or as decorations (Figure 8, Figure 9).

[14] *Daun* means "leaf" in the Indonesian language

3.2.2 Ranking and Priority Species

To Set Up a New Homegarden - The Ten Most Important Crops

To set up a new homegarden, 100% of the respondents selected chili (*Capsicum annuum*) among the top ten crops out of the 53 plants used for this exercise (Figure 20). Chilli is clearly an important spice for the Indonesian cuisine and people use it on a daily basis to prepare and serve various local dishes. By growing chilli in homegardens, this ingredient becomes freshly available at any time for cooking. One of the respondents used the expression *tumbuhan pasar dapur; tumbuhan yang pakai sehari hari* (plant-market-kitchen; plant which is used every day). Almost all the respondents explained that they like to have fresh chilli available at all times, to avoid having to buy some at the market or from the Javanese women who cycle every morning through the villages to sell some vegetables, spices and other fresh products.

The next crops, chosen among the 53, were banana (*Musa x paradisiaca*) and cassava (*Manihot esculenta*). Both were selected by more than 65% of the respondents These two crops grow very fast and can be used as staple (*makanan pokok, makanan tembahan*), which is why the farmers like to plant banana and cassava when they set up a new homegarden. Moreover, respondents mentioned that they often use banana to mark the limitation of their fields. The sweet potato (*Ipomoea batatas*) was also perceived as an important plant for setting up a new homegarden (47% of the Hindus and 33% of the non-Hindus). The high likelihood of sweet potato being cultivated in a new homegarden is probably due to the double importance of this crop (leaves and tuber) as staple food and pigs' feed. In addition, respondents explained that planting of sweet potato when moving in an empty land also reduces the amount of weeds growing there.

The following plants were chosen by more than half of the respondents when prompted to create a new homegarden: tomato (*Lycopersicon esculentum*), ginger (*Zingiber officinale*) and eggplant (*Solanum melongena*). When comparing the two groups, Hindus and non-Hindus, for the crops chosen by more than 50% of the respondents, it appears that Hindus prefer to cultivate ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*), both important spices and medicinal plants. Several Hindu respondents explained that they do not only use the root for cooking, but also prepare traditional herbal medicine (*jamu*) of these rhizomes and other plants. On the other hand, at least half of the non-Hindu respondents selected tomato (*Lycopersicon esculentum*) onion (*Allium fistulosum*), maize (*Zea mays*), ginger (*Zingiber officinale*) and eggplant (*Solanum melongena*). There is a stronger preference to plant maize in a new homegarden among the non-Hindus (60% of respondents), compared to the Hindus (20% of the respondents). According to the opinion of non-Hindu respondents, planting annual crops (e.g. tomato, spring onion, maize) when setting up a new homegarden is a strategy to get quicker harvests of crops for home consumption, as well as for selling. Maize is an example of a crop with high productivity, low labor needs, and short immature period, resulting in high profitability. Another plant which grows very fast and offers considerable profits is papaya (*Carica papaya*). The latter was chosen by 30% of non-Hindu respondents versus 7% of the Hindus. In addition to its fast growing characteristic, numerous seeds are contained in a single fruit, making them easily available to poor farmers. The respondents

mentioned that they like to cook the young leaves which can be eaten as a vegetable, as well as the male flowers (*Carica papaya* is usually dioecious).

The other crops which were chosen by 20%-50% of the non-Hindu respondents are lemon grass (*Cymbopogon citratus*), cocoa (*Theobroma cacao*), sweet potato (*Ipomoea batatas*), basil (*Ocimum basilicum*), yard-long bean (*Vigna unguiculata* ssp. *sesquipedalis*), celery (*Apium graveolens*) and Robusta coffee (*Coffea canephora*).

For the Hindu respondents, the plants following the top five crops (chili, banana, manioc, ginger and turmeric and sweet potato) chosen by more than 20 %, were eggplant, lemon grass, cocoa, tomato, rambutan (*Nephelium lappaceum*), onion, yard-long bean, jackfruit (*Artocarpus heterophyllus*), durian (*Durio zibethinus*) and Amaranth (*Amaranthus tricolor*).

When comparing the results of this exercise using the percent of respondents (Figure 22, A-B) or the percent of the maximal score (**Erreur ! Source du renvoi introuvable.**, C-D), we observe more or less the same pattern. For example, a slightly higher value was given to cocoa by Hindu respondents in comparison with non-Hindu respondents (27% and 18% of the maximal score for the respective groups). Unfortunately, the sample size was too small to test if the difference was statistically significant or not. It has to be noted that Hindu respondents own a significantly larger homegarden than the non-Hindus. In fact, during the transmigrant program, the Hindu families were provided with a homegarden of 25 ares where they mainly planted coffee and cocoa. As a result, when the Hindus imagine that they would have to set up a new homegarden, they project their own experience. This experience was by and large the same for every Hindu, namely that they arrived in Napu Valley and planted numerous coffee and cocoa trees to obtain income for survival. The Hindus explained they would plant cocoa in an early stage when setting up a new homegarden, to ensure future yields and thus income generation for the household. It has to be noted that cocoa trees need approximately five years of growing before the first fruit yield. On the other hand, many non-Hindu respondents (i.e. mainly respondents from the two local ethnic groups Napu and Besoa) said that cocoa is a tree which is more suitable to grow in plantations rather than in homegardens. Nevertheless, all of them grew cocoa in their present homegarden as well (see floristic inventory). Besides cocoa, some other fruit trees (rambutan, jackfruit, durian) were mentioned by more than 25% of the Hindu respondents in their top-ten selection. Because of the altitude and the climatic conditions of Napu Valley, rambutan and durian are not really suitable and are rarely cultivated at a large scale. Gardeners affirmed that they like growing rambutan and durian in their homegarden because they appreciate the taste of these two fleshy fruits. In addition, Hindus mentioned they sometimes use rambutan as sacred offerings during religious ceremonies. Jackfruit is often used by Hindus for cooking *lawar*. This special Balinese dish, often served during religious ceremonies, is made from a mixture of vegetables, grated coconut and minced meat mixed with rich herbs and spices. *Lawar* which is made from cooked flesh of young jackfruits is locally referred to as *lawar nangka*. On the other hand, non-Hindu respondents did not often mention fruit trees among the plants that they would plant first when setting up a new homegarden. Rather, they seemed to value annual crops. Thus, one might suppose that Hindu respondents tend to manage their homegarden more with a long-term-yield view.

Finally, I would like to mention some plants only chosen by non-Hindu respondents during this ranking exercise, because these plants are specifically used by the people from the local ethnic groups of Napu and Besoa. For example, a local variety of bitter tomato (*Solanum aethiopicum*) is appreciated by the local ethnic groups, whereas the Hindus affirm, either they do not know the plant, or they do not like its bitter taste and consequently do not grow this plant in their homegardens. Two other examples of medicinal plants mainly used by members of the Napu and Besoa ethnic groups are the chives (*Allium schoenoprasum*) and the great galanga (*Alpinia galanga*). Chives are called *bawang piara* (bawang means onion) or *lehune nkundu* (bahasa Napu) or *Pia' tiu* (bahasa Behoa). Another medicinal plant often used by the local ethnic groups, but not included in the list of 53 selected plants, are the Chinese chives (*Allium ramosum*), also called *bawang kucai* (bahasa Indonesian) or *lehune mpipi* (bahasa Napu) or *Pia' pipi'* (bahasa Behoa). The great galanga, called *lengkuas* (bahasa Indonesia) is especially used by the two local ethnic groups to cook dog. Cooking and eating dogs is very common in the Christian area of Sulawesi (e.g. Manado).

To conlude, it should be noted that some plants were only mentioned by Hindu respondents during the first ranking exercise. For example, pandan (*Pandanus amaryllifolius*, 20% of the Hindu respondents) is an important multipurpose plant which is mostly used as a spice for cooking (to add an aroma to rice, curry dishes or desserts such as pandan cake) or for weaving decorations and other handicrafts. Hindu respondents said they use this plant as *sajen* (offering) during their religious ceremonies.

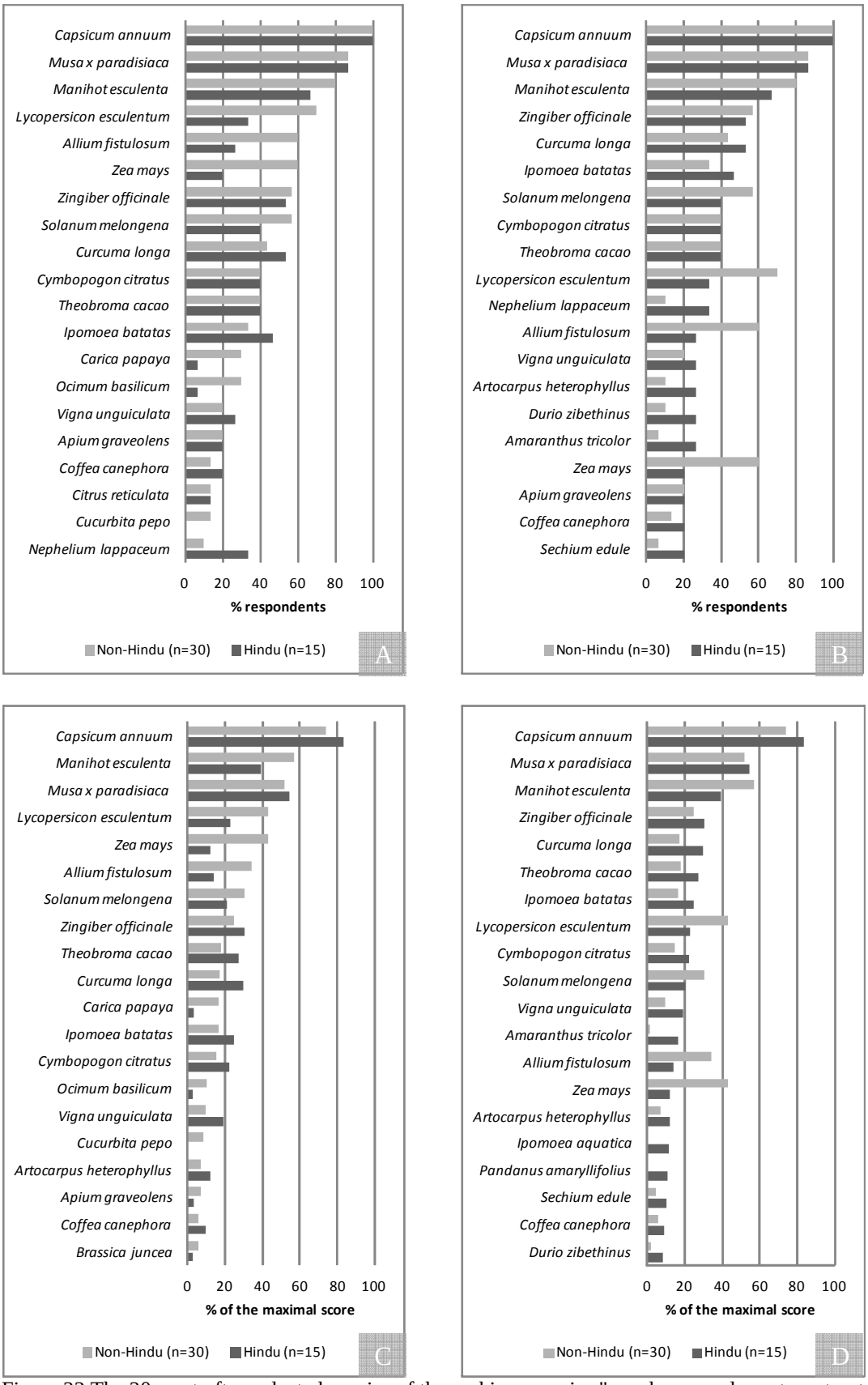

Figure 22 The 20 most often selected species of the ranking exercise "new homegarden setup - top ten crops", ordered by non-Hindu (A and C) and Hindu (B and D) according to the % respondents and the % of the maximal score, respectively.

Removal of Unimportant Homegarden Crops

The first few crops, which were chosen by more than 50% of the non-Hindu respondents, to be eliminated from a homegarden were the edible fern (*Diplazium cf. esculentum*, 93%), Napier grass (*Pennisetum purpureum*, 90%), coconut (*Cocos nucifera*, 80%), mother of cocoa (*Gliricidia sepium*, 77%), coral tree (*Erythrina subumbrans*, 73%) and tobacco (*Nicotiana tabacum*, 67%) (Figure 23). On the other hand, 50% or more of the Hindu respondents chose to remove the following plants: false bird-of-paradise (*Heliconia indica*, 100%), tobacco (*Nicotiana tabacum*, 93%), painted nettle (*Solenostemon scutellarioides*, 73%), bitter tomato (*Solanum aethiopicum*, 73%), Napier grass (*Pennisetum purpureum*, 67%), chives (*Allium schoenoprasum*, 67%) and the edible fern (*Diplazium cf. esculentum*, 60%). As explained in the method section, in addition to the pictures of the crops, names were indicate in the Indonesian language (and in local language for some local varieties) on the cards. Some Hindu respondents, however, said they did not know some of the plants used for the ranking exercise (e.g. *Allium schoenoprasum*, *Heliconia indica*) and therefore, selected these plants among the unimportant plants to be removed from the homegarden. Maybe the lack of Balinese names might have also hindered the Hindus from recognizing the plants. For the false bird-of-paradise (*Heliconia indica*), Hindu respondents reported that they would remove it because the majority of them do not knew this plant or do not use it. In the contrary, local ethnic groups (Napu and Besoa) said they often use the leaves of the false bird-of-paradise in the same way as the banana leaves, i.e. to wrap the rice (*bungkus*) or other food for transportation (e.g. to their fields). In addition, members of the Napu and Besoa ethnic group use *Solenostemon scutellarioides* and *Allium schoenoprasum* as medicine, which is the reason why they would not remove these plants form their homegarden. Similarly, their preference for the bitter tomato (*Solanum aethiopicum*) used as a vegetable is a reason why the members of the Napu and Besoa ethnic group Napu and Besoa rarely selected it in the list of unimportant plants in homegardens.

In general, for both Hindus and non-Hindus, removal of large trees is given a high priority. Thus, candle nut tree (*Aleurites moluccana*, 33% of both groups), pummelo (Citrus maxima, 27% of the Hindus and 40% of the non-Hindus), guava (*Psidium guajava*, 27% and 37%), durian (*Durio zibethinus*, 7% and 23%) and Water apple (*Syzygium aqueum* 13% and 33%) were chosen to be eliminated. An explanation which was given by respondents during interviews is the space that the large trees take. Thus, farmers reported they prefer to grow high trees in their plantation fields. In addition, they added that the risk of the trees collapsing on the house during disasters is a liability. One of the respondents explained that the other crop plants grow with difficulty under the big trees (*tanaman lain susah berbuah dibawah pohon besar, karena pohonnya termasuk rakus*). It need to be noted, that despite the medicinal use of guava as a medicinal plant (anti-malaria), a third of all the respondents mentioned this tree among the ten plants they would remove first from their homegarden. If children seems to like very much unripe guava fruits, some respondent warned that children eaten a lot of these fruits, might have constipation problems.

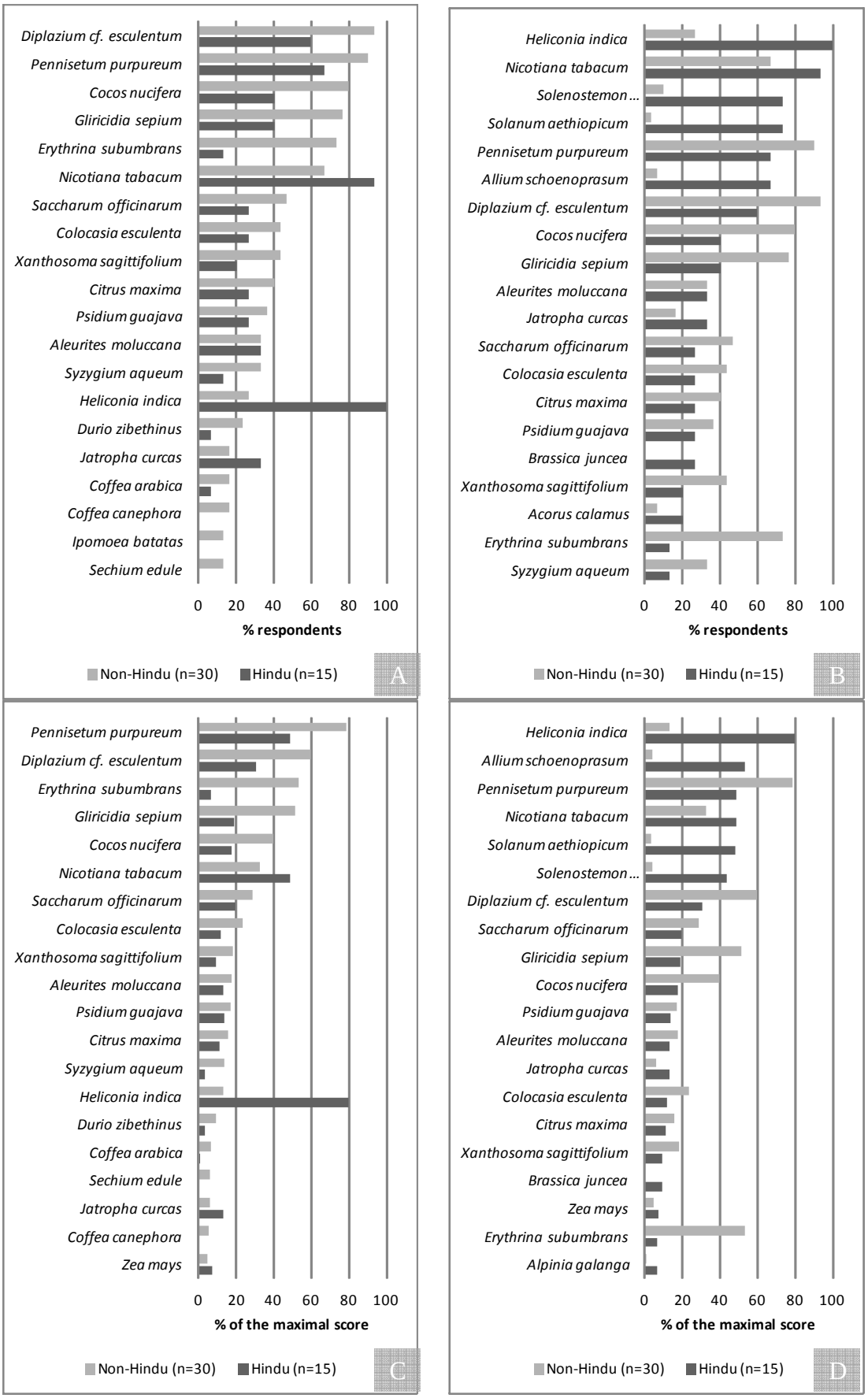

Figure 23 The 20 most often selected species of the ranking exercise "removal of unimportant crops in a homegarden", ordered by non-Hindu (A and C) and Hindu (B and D) according to the % respondents and the % of the maximal score, respectively.

General Top Five Crops

Among the 53 selected plants, cocoa and chilli were the favourite useful plants selected by >90% of the respondents (Figure 24). Following these, the non-Hindus preferred maize (70% of the respondents) and cassava (57%), whereas the Hindus preferred Robusta coffee and banana (both 53%). Maize and Robusta coffee are important cash crops for the inhabitants of Napu Valley. 20% of the Hindus selected coconut and jackfruit among their top five crops, whereas no one from the non-Hindus respondents mentioned jackfruit and only one chose coconut. A reason for Hindus' preference for coconut might be that they migrated from lowland regions where this plant is growing abundantly (on the coast of Sulawesi or in Bali). Among the staples, cassava was more popular than sweet potato for both Hindus and non-Hindus. Tomato was the first vegetable listed, following by spring onion and eggplant. In general, the results of this last ranking exercise are consistent with the first ranking exercise (new homegarden setup - top ten crops), but some differences can be observed. For example ginger, which was, according to the respondents, an important spice when setting up a new homegarden, was only cited by 3 respondent (7%) among the general top five crops. To conclude, cocoa was not among the first plants chosen by respondents to be planted in a new homegarden, but was very often mentioned as one of the five most important plants. Cocoa is certainly the most profitable cash crop in Napu valley and provides a regular source of cash incomes for many families of Napu Valley.

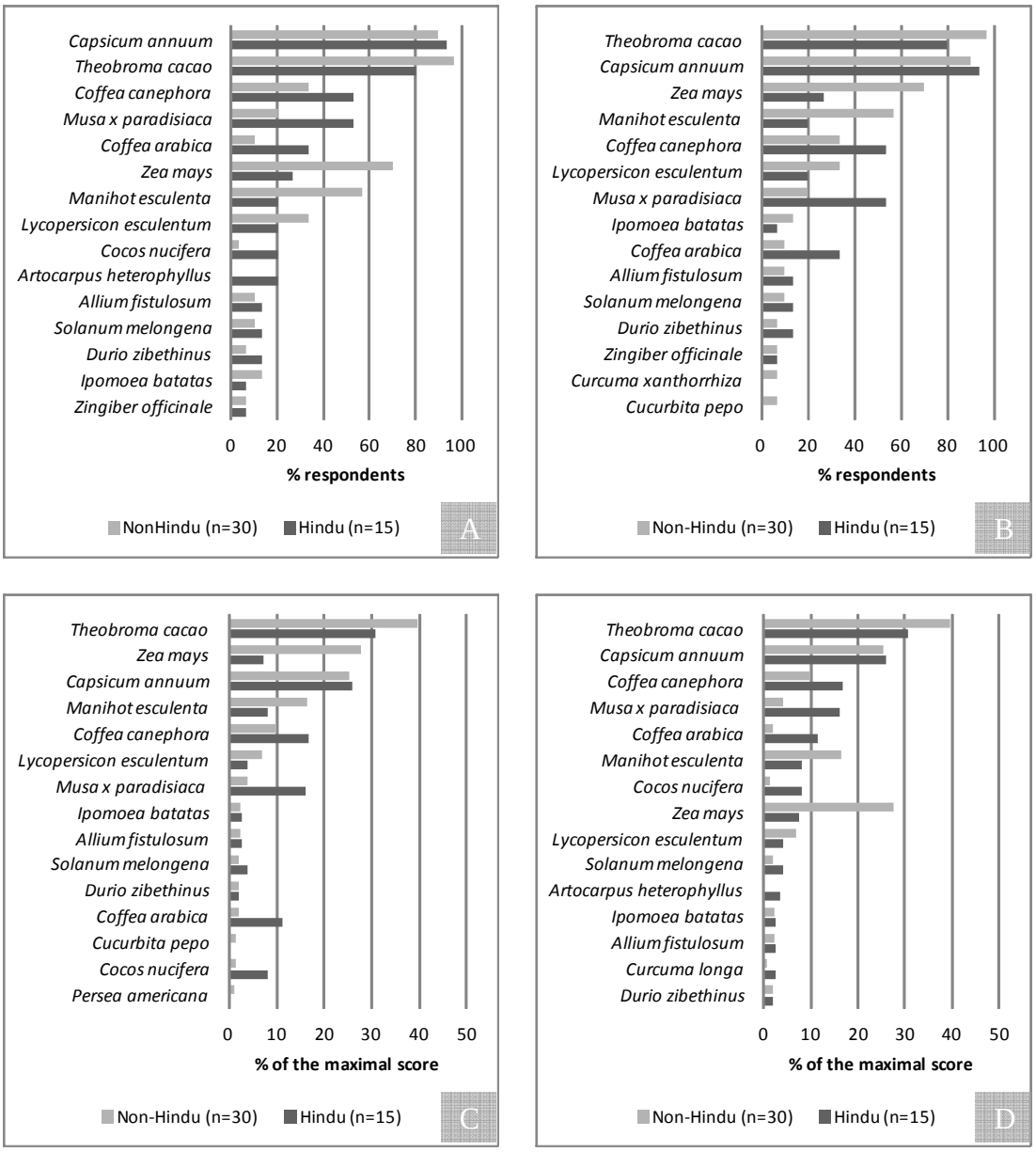

Figure 24 The 15 most often selected species of the ranking exercise "general top five crops", ordered by non-Hindu (A and C) and Hindu (B and D) according to the % respondents and the % of the maximal score, respectively.

3.3 Limitations of the Study and Outlook

I tested if the respondents who own a homegarden with a poor plant richness have different perceptions of plants and plant classification (reflected by the cluster analyse of the pile sort exercise) compared to the respondents with a homegarden with high plant richness. Plant richness is, however, a relatively simple biodiversity indicator which does not truly reflect the complex structure and diversity of a homegarden. It would be interesting to calculate other diversity indices, which take into account the species composition and not only the species richness. In a next step new groups among the respondents could be built and tested, whether their agreement on plant classification is linked to the current plant diversity and composition of their homegardens.

Moreover, the ethnobotanical research methods could be adjusted with the now available knowledge. Other options to improve the results would be to increase the sample size of respondents, as well as the number of the selective plants.

4 Conclusions

Plant The plant species richness and diversity were very high in the homegardens that we recorded in our inventory in Napu Valley in Sulawesi. However, a general consensus among all respondents on how to classify these useful plants was not found. When comparing the emic classification of the 53 selected plants with the classification that was put forward by Dr. Kehlenbeck, I found a high congruence between the general categories. Nevertheless, local categories tend to be more precise. They may refer to special uses or the morphology of a plant, whereas the main use categories established by Kehlenbeck are broader in nature. For example, I would like to highlight the fact that the category of cash crops (cocoa, coffee and maize among others) seemed to be the most important category for the people living in Napu Valley. Several names were given to this category such as "economic value" (*nilai ekonomis*), "tree with annual results" (*pohon hasil tahunan*), "economic fruit" (*buah ekonomis*), "special plant to sale" (*tanaman kusus dijual*), "plant which can produce" (*tumbuhan yang bisa menghasilkan*) or "economic plant which needs process" (*tanaman ekonomis yang perlu process*). People often included other fruit trees in the cash crops category (e.g. candle nut tree, avocado, banana) whereas Kehlenbeck mentioned the market value of different plants as a secondary attribute. It therefore seems that the “commercial perception” i.e. the perception of the potential commercial value of plants, plays an important role for the homegarden plant diversity. This homegarden plant diversity is a mirror of the gardener's perception and valuation of plants.

The respondents' agreement among plant categories was not as strong as expected. The respondents did not use the same number of categories and the number of species assigned to each category varied considerably. I recorded 23 different categories to which respondents referred when they were prompted to classify the 53 selected plants used in the pile and sort exercise. It seems that because many of the plants are used as both, medicine and/or spice for example, it was often difficult for the respondents to assign the plant to one single category. The candle nut tree (*Aleurites moluccana*) for example, was classified by 17 respondents as a cash crop and by 18 as spice. Some distinctive plants, such as medicinal plants or sacred plants used for religious rituals have a high cultural value and are very specific to the Hindu culture or to the one of the local ethnic groups, Napu and Besoa (non-Hindu respondents).

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Appendix I Questionnaire - specific data of the homegarden

Pertanyaan tentang kebun pekarangan

HOME GARDEN QUESTIONNARE

used by Isaline Mercerat (University of Zürich, Switzerland) for interviewing 50 homegardeners in the Napu valley, Central Sulawesi, Indonesia, 2012
Project: Sustainability of homegardens in Central Sulawesi
In Collaboration with Dr. Katja Kehlenbeck (ICRAF), Indonesian Institute of Sciences (LIPI, Bogor), Universitas Tadulako (UNTAD, Palu) and University of Göttingen (Germany)

Tanggal :
Nama Bapak (nama lengkapdan nama panggil):
Nama Ibu (nama lengkap dan nama panggil):

Kapan anda memutuskan menanam dikebun pekarangan anda?
When did you establish the garden?
Bagaimanakah penggunaan lahan sebelumnya? (garis jawaban yang benar)
How was the land used before?(mark the right answer)
- Kebun pekarangan = KP *(Homegarden)*
- Kebun Kopi *(Coffee plantation)*
- Tanah kosong/padang rumput *(Fallow/grassland)*
- Ladang/kebun campur *(Mixed field)*
- Hutan *(Forest)*
- Lainnya *(Others)*

Jika (a), siapa yang punyai KP ini sebelumnya dan apa yang sudah ditanam?
If it was used as a homegarden before, who was the owner and what kind of plants where already grown?

Biodiversity of homegarden

Jenis rumput apa yang ada dikebun anda dan apakah anda gunakan beberapa rumput tersebut? Jika ya, sebutkan namanya, dan gambarkan bagaimanan?
What kind of weeds do you have in your garden? Please give the local names!

Sebelumnya, apakah anda ingat beberapa tanaman yang tumbuh, tapi sekarang tidak tumbuh lagi (misalnya pohon…)? Jika ya, jenisnya apa, dan mengapa berhenti tumbuh?
In the past, do you remember growing some plants but presently not grow (like tree for example...)? If yes, what species and why did you stop growing them?

Nantinya apakah anda berencana menanam tanaman yang lain?
Jika ya, jenisnya apa, dan mengapa, mengapa belum ada (alasan)?
In the future, would you like to grow some more plant species? If yes, what species or varieties, what is the purpose and why did you not grow it up to now?

Apakah anda memelihara ternak dikebun anda? *Do you keep any livestock in your garden?*
Jika ya, jenisnya apa, berapa banyak, sumber makanannya dari mana dan anda gunakan untuk apa (dikonsumsi sendiri, dijual, sebagai hadiah, dipelihara)?

Tanah – Soil

Apa pendapat anda tentang kualitas tanah dikebun pekarangan anda?
What do you think about the quality of the soil in your garden
1= Subur *(fertile soil)*
2= Kurang subur *(medium fertile soil)*
3= Tidak subur *(less-fertile soil)*

Apakah ada perubahan kualitas tanah sebelumnya?
Has the soil quality changed in the past?
1= Sekarang kurang bagus dari dulu / kemunduran *(regression)*
2= Tetap sama *(same)*
3= Sekarang lebih bagus dari dulu / kemajuan *(progress)*

Apakah anda mempunyai ide cara memperbaiki kesuburan tanah?
Do you have an idea how to improve the soil?

Apakah anda menggunakan pupuk di kebun pekarangan anda? *Do you use fertilizer in your garden?*

Jika tidak menggunakan pupuk dikebun pekarangan anda *If you didn't use fetiliser in your homegarden,*
mengapa tidak? W*hy not?*
apakah anda suka menggunakan pupuk? *Would you like to use fertilizer?*
Jika Anda mau pakai nantinya, sebutkan jenis pupuk yang anda gunakan? *What kind of fertilizer?*

Mengatur – Management

Sepanjang tahun lalu, jenis pekerjaan apa yang sudah dilakukan di kebun pekarangan dan berapa waktu yang dibutuhkan?
What kind of work do you do in your homegarden throughout the year (e.g. hoeing, sowing, planting, weeding, fertilizing, cutting of trees, yielding, ...)?

Secara umum siapa yang paling banyak bekerja di kebun pekarangan (Bapak, Ibu, nenek, tete, anak, sanak family/saudara, atau tetangga)? *In general, who carries out most of the work in your homegarden (e.g. farmer, his wife, children, relatives, neighbours, ...)?*

Selain KP apakah anda mempunyai kebun lain (seperti kebun coklat, kebun campur)?
Jika ya, ada berapa kebun lainnya?
Except your homegarden, did you have other plantation (like cacao plantation, mixed field)? If yes, how many other plantations?

Kalau membandingkan kerja yang ada di pekarangan dengan kerja di kebun dan di sawah,
If you compare the work in your homegarden, your paddy rice fields and your coffee/cacao plantation,
- kerja di mana yang paling banyak
where do you work the most time
- yang paling keras/berat
where is the work hardest

Kalau membandingkan ongkos di dalam satu tahun yang dipakai di (A) kebun pekarangan, (B) kebun atau di (C) sawah, ongkos yang apa paling tinggi untuk…
When comparing the cost for one year related to management of your (A) homegarden, (B) your coffee/cacao plantation or (C) your rice fields, where do you have to pay most?

Anda punya tractor sendiri atau menyewa tractor untuk sawa?
Do you have you own tractor or do you rent it?

Fungsi – Function

Untuk kehidupan Bapak dan Ibu kebun pekarangan ini sangat penting, penting atau tidak penting? (menggaris jawab)
For the life of you and your family, is your homegarden very important, important or not important at all?

Silakan urutkan fungsi yang paling penting di kebun pekarangan anda
Please rank the function of your homegarden

Bertemu dengan orang-orang
Tempat bermain (anak-anak)
Tanaman obat
Pelindung dekat rumah
Hiasan rumah
Tempat binatang (ayam, babi)
Tanaman sayur, bumbu, buah
Tempat ibadah
Anda jual hasil panen dari sawah atau hanya untuk konsumsi keluarga anda?
Kalau dijual, berapa percen dari hasil panen anda jual?
Do you sold a part of the yield from your paddy rice field or did you only use it for your own consumption? If you sold a part of the yield, how many percent?

Kalau membandingkan persen hasil untuk dijual dari (A) kebun pekarangan dengan yang dari (B) kebun dan sawah (kalau jual hasil panen!), mana yang paling tinggi untuk pendapatan Bapak/Ibu?
If you compare the yield of „cash crops“ for sale coming from your (A) homegarden, your (B) coffee/cacao plantation your (C) paddy rice fields, from where comes the highest portion. If possible, can you please give the portion in percent (%) of cash income coming from your: garden, paddy rice field and plantation.

Masalah - Problems

Apakah ada masalah dengan hama, penyakit atau rumput di kebun pekarangan anda?
Are there any problems with weeds or pests and diseases in your homegarden?
Jika ya, tanaman apa yang terkena, sebutkan namanya dan gambarkan bagaimana mengontrolnya, apaka berhasil?

Silakan urutkan masalah yang paling sulit di kebun pekarangan anda.
Please rate the importance of following problems in managing your homegarden (very serious, serious, medium, no problem).

Tanah yang kurang subur
Rumput
Penyakit/hama tanaman
Tidak cukup waktu
Jenis tanaman yang kurang cocok dengan tanah
Gangguan binatang
Gangguan Anak-anak
Masalah air
Iklim (prediksi sulit…)
Lainnya

Apakah pernah ada „penyuluhan“ tentang kebun pekarangan?
Was there ever any „extension service“ for home gardens (include "village competition")
Jika ya, siapa yang melakukan penyuluhan? *If yes, what organization gave the extension?*
berapa kali/kapan yang terakhir kali? *How often/when the last time?*
apakah sangat berguna? *Was it helpful for you?*

Anda sudah pernah dapat bantuan pertanian proyek (pemerintah atau swasta)?
Jika ya, dari siapa, kapan, berapa kali, dapat apa (jikat bibit, pupuk atau obat rumput tulis sejenis)?
Did you and your family ever get some agricultural support from NGO's or the government? If yes, please describe what kind, how often, from whom?

Kalau ada bantuan dari pemerintah atau swasta untuk memperbaiki kebun pekarangan, barang/hal apa yang paling penting? Silakan urutkan tipe bantuan dari yang paling penting sampai yang kurang penting.
If there would be some agricultural support from NGO's or the government, what kind of assistance do you need? Please rate the importance of the item.

Pupuk (jenis apa)
Bibit (jenis apa)
Hewan (jenis apa)
Penyuluhan
Pelajaran cara pertanian yang modern
Obat semprot

Pohon coklat

Sebelumnya, waktu Bapak/Ibu pertama kali menaman pohon coklat… menaman pertama beberapa pohon di kebun pekarangan atau menaman pertama di kebun coklat?
Before when you plant the first cocoa tree, was is in your homegarden or directly in plantation ?

Tahun berapa Bapak/Ibu menaman pohon coklat pertama kali di kebun coklat?
Anda ingat waktu dulu harga coklat ?
Which year do you plant for the first time cocoa tree as plantation ?
Do you remember what was the price of cocoa at this time ?

Tahun berapa Bapak/Ibu menaman pohon coklat pertama kali di kebun pekarangan?
Anda ingat waktu dulu harga coklat ?
Which year do you plant for the first time cocoa tree in your homegarden ?
Do you remember what was the price of cocoa at this time ?

Biasanya Bapak/Ibu panen coklat dari kebun pekarangan dan dijual bersama dengan coklat yang dari kebun coklat atau tidak?
Usually did you harvest the cocoa tree in your homegarden and sold the yield together with the cocoa from you plantation ?

Jika tidak dijual coklat dari KP, kenapa ?
If you don't sold cocoa from your homegarden, why ?

Jika dipanen coklat dari KP, berapa kilo satu hasil panen dari KP dan yang dari kebun coklat (untuk perbandingkan)?
If you harvest the cocoa of your homegarden, how many kg is one yield from your homegarden and one from your cocoa plantation (for comparison)?

Misalnya harga coklat rendah berlansung lama sekali (seperti kurang dari 10'000 Rps/kg)… Jadi Bapak/Ibu berpikir akan kasih potong pohon coklat di kebun pekarangan supaya ada tempat lagi untuk menaman tanaman yang lain?
If for example the price of cocoa go down during a very long period (like less that 10'000 Rps/kg) do you think you will cut the cocoa tree in your homegarden in order to have more place for other plants?

Bapak/Ibu sudah pernah dengar itu ada banyak semut yang di dalam pohon coklat yang tidak menyebabkan penyakit atau kanker tapi semutnya makan serangga yang menyebabkan kanker?
Do you ever heard that there are a lot of ants which are feeding on the insects which cause "cancer"?

Appendix II List of the useful plant species cultivated in the 45 inventoried homegardens (HG) in five villages of the Napu valley, Central Sulawesi, Indonesia

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
1	*Abelmoschus manihot* (L.) Medik.	Malvaceae	Sunset hibiscus	Sayur gedi	Lambera	Làngguru'	11	2	5		
2	*Acalypha caturus* Blume	Euphorbiaceae			Beranahe	Beranahe	11	7	5		
3	*Acalypha marginata* Spreng.	Euphorbiaceae			Ampana (?)	Ampala'	4	7	16		
4	*Acorus calamus* L.	Acoraceae	Sweet flag	Kariango, dringo, jeringau	Kariango	Kariango'	33	5	17	Yes	
5	*Aleurites moluccana* (L.) Willd.	Euphorbiaceae	Candle nut tree	Kemiri	Beau	Be'au'	31	4	5;7;8;13	Yes	
6	*Allium cepa* L. Aggregatum Group *(*var. *ascalonicum)*	Amaryllidaceae	Shallot	Bawang merah	Lehune malei	Pia' to malei	2	4			
7	*Allium fistulosum* L.	Amaryllidaceae	Spring onion	Bawang daun	Tawe lehune	Tawe' pia'	56	4	5;13	Yes	
8	*Allium ramosum* L. (= *A. tuberosum* Rottler ex Sprengel)	Amaryllidaceae	Chinese chives	Bawang kucai	Lehune mpipi	Pia' pipi'	24	5	4		
9	*Allium schoenoprasum* L.	Amaryllidaceae	Chives	Bawang piara	Lehune nkundu	Pia' tiu	22	4	5	Yes	
10	*Aloe barbadensis* Mill.	Xanthorrhoeaceae	True aloe	Lidah boaya			13	5	12		
11	*Alpinia galanga* (L.) Willd.	Zingiberaceae	Great galanga	Lengkuas			58	4	5	Yes	
12	*Alpinia* sp.	Zingiberaceae			(bumbu talas)		2	4	5		
13	*Amaranthus tricolor* L.	Amaranthaceae	Amaranth	Bayam		Màmbie	42	2	5;13	Yes	
14	*Anacardium occidentale* L.	Anacardiaceae	Cashew	Jambu monyet			2	1			
15	*Ananas comosus* (L.) Merr.	Bromeliaceae	Pineapple	Nenas	Mpanda	Nanasi	49	1	5;13;14; 15;16	Yes	
16	*Annona muricata* L.	Annonaceae	Soursop	Sirsak		Sirikaya'	9	1	5		
17	*Apium graveolens* L. var. *secalinum* Alef.	Apiaceae	Celery	Seledri	Suderei	Siderei	36	4	5	Yes	

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
18	*Arachis hypogaea* L.	Fabaceae	Groundnut	Kacang tanah	Wirengo	Wurengo'	18	4	13		
19	*Areca catechu* L.	Arecaceae	Betelnut palm	Palem pinang		Harao	2	3	5		
20	*Arenga pinnata* (Wurmb.) Merr.	Arecaceae	Sugar palm	Enau	Kanau	Baru	11	3	1;2;13; 14		
21	*Artocarpus altilis* (Parkinson) Fosberg	Moraceae	Breadfruit	Sukun	Kamonji, tara (?)	Kàmonji'	7				
22	*Artocarpus heterophyllus* Lam.	Moraceae	Jackfruit	Nangka		Nangka	58	2	1;5;6;10	Yes	
23	*Basella alba* var. *rubra*	Basellaceae	Malabar spinach, Indian spinach	Binahong		Binahong	24				
24	*Bischofia javanica* Blume	Euphorbiaceae	Bishop wood, Java cedar	Gintungan (Java)	Pepolo	Pepolo'	2	7	5;16		
25	*Blumea balsamifera* (L.) DC.	Asteraceae	Camphor plant	Sembung	Tobobure, Toboburi (?)		9	5			
26	*Brassica juncea* (L.) Czernjaew	Brassicaceae	Indian mustard	Sawi	Hahawi	Dui'à	27	2	13	Yes	
27	*Brassica oleracea* L. ssp. *oleracea* convar. *capitata* (L.) Alef. var. *capitata* L. *forma alba*	Brassicaceae	White cabbage	Kol	Kolo	Kolo'	4	2	13		
28	*Breynia racemosa (Blume) Miq.*	Euphorbiaceae				Teturu'	2				
29	*Cajanus cajan* (L.) Millsp.	Fabaceae	Pigeonpea	Kacang undis, kacang gude			7	2			
30	*Camellia sinensis* (L.) Kuntze	Theaceae	Tea	Teh			4	3	5;12;16		
31	*Cananga odorata* (Lam.) Hook.f. & Thoms.	Annonaceae	Ilang-ilang	Kenanga, kayu sandat (Bali)	Andolia	Andolià	2	7	15		
32	*Canna edulis* Ker-Gawl.	Cannaceae	Queensland arrowroot	Ganyong	Canna gonyong		4	6			
33	*Capsicum annuum* L.	Solanaceae	Chilli	Cabe rawit, lombok rawit	Kulagoa	Marisa'	87	4	2;5;13; 15	Yes	
34	*Carica papaya* L.	Caricaceae	Papaya	Pepaya	Gampaya	Gampaya'	73	1	2;5;10;	Yes	

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
									13		
35	*Casuarina sp.*	Casuarinaceae	Silk-cotton tree	Casuarina			4				
36	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Green soko	Kapok	Kakawu	Kakawu'	7	9	14		
37	*Centella asiatica* (L.) Urb. in Mart.	Apiaceae	Asiatic pennywort	Tapal kuda	Tapu kuda, kaki kuda	Kànu dàrà	4	5			
38	cf. *Pogostemon cablin*	Lamiaceae	Patchouli	Nilam			2				IM.44 (LL)
39	*Cinnamomum burmanii* (Nees) Blume	Lauraceae	Indonesian cassia	Kayu manis	Kanino	Kanino'	7	4			
40	*Citrullus lanatus ssp. vulgaris* Dessert Group	Cucurbitaceae	Watermelon	Semangka	Ndola	Balongka'	2	1			
41	*Citrus aurantiifolia* (Christm. & Panz.) Swingle	Rutaceae	Lime	Jeruk nipis		Lemo bou	16	1	4;5;13		
42	*Citrus* cf. *hystrix*	Rutaceae	Kaffir lime	Jeruk nipis			11				
43	*Citrus* cf. *hystrix*	Rutaceae	Kaffir lime	Jeruk swangi	Lemo podunu (?)		2				
44	*Citrus hystrix* DC.	Rutaceae	Kaffir lime	Jeruk purut, jeruk ikan, daun jeruk	Lemo podundu (?)	Lemo bou'	9	4	1		
45	*Citrus maxima* (Burm.) Merr.	Rutaceae	Pummelo	Jeruk besar		Lemo to mahile	40	1	5;13;15	Yes	
46	*Citrus medica* L.	Rutaceae	Citron	Jeruk doku			9	1	4		
47	*Citrus reticulata* Blanco	Rutaceae	Mandarin	Jeruk manis		Lemo to màtàni	60	1	4;5;13;15	Yes	
48	*Citrus sinensis* (L.) Osbeck	Rutaceae	Sweet orange	Jeruk cina			22	1	13;15		
49	*Clematis smilacifolia* Wall.	Ranunculaceae			(obat gigi)		2	5			
50	*Clerodendron minahassae* Teijsm. & Binn.	Verbenaceae		Lelem	Dongato	Bonati'	24	2	5		
51	*Clerodendron paniculatum* L.	Verbenaceae	Pagoda Flower		(obat usus buntu)		7				

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
52	*Clerodendrum fragrans* (Vent.) Willd.	Verbenaceae		Patatulang	Lelimbanua	Lelimbànuà	11				IM.03 (LL)
53	*Cocculus orbiculatus* (L.) DC.	Menispermaceae	Queen Coralbead		(daluman kecil, cingcau)		2				IM.10 (LL)
54	*Cocos nucifera* L.	Arecaceae	Coconut palm	Kelapa	Kaluku	Kàluku	53	1	2;5;11; 13;14;15	Yes	
55	*Coffea arabica* L.	Rubiaceae	Arabica coffee	Kopi arabika			67	3	5;13	Yes	
56	*Coffea canephora* Pierre ex Froehner	Rubiaceae	Robusta coffee	Kopi robusta			73	3	5;14	Yes	
57	*Coffea liberica* Bull.	Rubiaceae	Liberica coffee	Kopi liberika	(kopi belulang)		2	3			
58	*Coix lacryma-jobi* L.	Poaceae	Job´s tears	Jagung jali	Kalide	Tenderete	18	9	12;15		
59	*Colocasia esculenta* (L.) Schott ex Schott & Endl.	Araceae	Taro	Keladi merah, talas	Upe (?)	Kadue' toitoro	49	6	2;10	Yes	
60	*Cordyline fruticosa* (L.) Goepp.	Asteliaceae	Palm lily	Andong, hanjuang (Sunda)	Taroka	Tàbà	2	5	12;17		
61	*Costus speciosus* (Koenig in Retz.) J.E. Sm.	Costaceae	Crepe ginger	Pacing tawar	Tuwu tuwu (?)		22	5			
62	*Crescentia cujete* L.	Bignoniaceae	Calabash tree	Maja, buah maja	Bila (?)	Bilà'	9	7	14;16		
63	*Cucumis sativus* L.	Cucurbitaceae	Cucumber	Ketimun	Temu	Temu	2	2	5		
64	*Cucurbita mochata* L.	Cucurbitaceae	Pumpkin	Labu, waluh (Java)	Balongka	Katedo'	67			Yes	
65	*Curcuma longa* L.	Zingiberaceae	Turmeric	Kunyit	Bada	Bàdà'	84	4	5;13	Yes	
66	*Curcuma xanthorrhiza* Roxb.	Zingiberaceae		Temu lawak	Bada	Bàdà'ntomate	51	5		Yes	
67	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Lemon grass	Serai, daun sere	Hare	Hàre	60	4	5	Yes	
68	*Cymbopogon flexuosus* (Steud.) Stapf	Poaceae	Malabar lemon grass		(daun serai belanda)		2	4	5		

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
69	*Dendrocalamus* spp.	Poaceae	Giant bamboo	Bambu	Tala	Tàlà	13				
70	*Dichrocephala integrifolia* (L.f.) Kuntze	Asteraceae			Panaramanu	Pànàràmanu	2	5			
71	*Dimocarpus longan* Lour.	Sapindaceae	Longan	Klengkeng			9	1			
72	*Dioscorea bulbifera* L.	Dioscoreaceae	Aerial yam	Yam, sekapo, uwi gantung (Java)	Tali ngaru (?)		7	6			
73	*Diplazium* cf. *esculentum* (Retz.) Sw. Schrad.	Woodsiaceae	(edible fern)	Sayur pakis, paku	Sayur paku	Bàre'à	31			Yes	
74	*Durio zibethinus* Murray	Bombacaceae	Durian	Durian	Tamadue		49	1	5;13	Yes	
75	*Elaeis guineensis* Jacq.	Arecaceae	African oil palm, guinea oil palm, oil palm	Kelapa sawit			2				
76	*Eleutherine palmifolia* (L.) Merr.	Iridaceae		Mala-bawang	Lehune topeole	Pia topeole	11	5			
77	*Elmerrillia ovalis* (Miq.) Dandy	Magnoliaceae		Cempaka	Uru	Uru	4	7			
78	*Enydra fluctuans* Lour.	Asteraceae	Buffalo spinach		(sayur taugaruk)		2	2			
79	*Equisetum debile* Roxb.	Equisetaceae		Rumput betung, paku ekor kuda	Uhouhou, tikel balung		2	5			
80	*Erythrina* cf. *fusca*	Fabaceae		Delundung (Bali)			4				IM.13 (LL)
81	*Erythrina subumbrans* (Hassk.) Merrill (=variegata) (orientalis?)	Fabaceae	Coral tree	Dadap	Rodo, randa (?)	Randa'	36	8	2;5;10; 16	Yes	
82	*Etlingera elatior* (Jack) R.M. Sm.	Zingiberaceae	Torch ginger	Cicang, bongkot (Bali)			13	2	12		
83	*Etlingera* sp.	Zingiberaceae		Bongkot (Bali)			4				
84	*Eucalyptus deglupta* Blume	Myrtaceae	Rainbow eucalyptus		Leda	Ledà	7				
85	*Euonymus javanicus* Blume	Celastraceae			Patingka (?)		7	7	16		

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
86	*Ficus* cf. *septica* Burm.f.	Moraceae			Tagalolo, dodonga (?)		22				IM.35 (LL)
87	*Ficus septica* Burm.f.	Moraceae			Leboni	Lewunu	2	7	5;11		
88	*Ficus* sp. 1	Moraceae			Dodonga	Dodongà	11	7			
89	*Ficus* sp. 2	Moraceae				Làmbà'	2	7	14		
90	*Flemingia macrophylla* (Willd.) Blume ex Miq.	Fabaceae		Apa-apa, hahapaan, pok-kepokan	Ingan-ingan		4	8	16		
91	*Foeniculum vulgare* Mill.	Apiaceae	Fennel	Adas			2	4	2;5		
92	*Fragaria x ananassa* Duch.	Rosaceae	Strawberry, garden strawberry	Strawberry			7				
93	*Garcinia mangostana* L.	Clusiaceae	Mangosteen	Manggis			4	1			
94	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	Fabaceae	Mother of cocoa	Gamal			98	8	2;5;10; 16	Yes	
95	*Glochidion* cf. rubrum	Phyllanthaceae			Tambone	Burebure	2				
96	*Glycine max* (L.) Merr.	Fabaceae	Soya bean	Kedelai	Kadele	Kadele	4	2			
97	*Gmelina arborea* Roxb.	Verbenaceae	White teak, beechwood, goomar teak, Kashmir tree		(jati putih)		2	7	13		
98	*Gossypium barbadense* L.	Malvaceae	Cotton	Kapas		Kakawu' (?)	4	9	12;14;15		
99	*Graptophyllum pictum* (L.) Griff.	Acanthaceae	Carricature plant	Daun wungu (Indo), Handeuleum (Sunda), Godhong wungu (Java)	(daun teman)		2	5	15		
100	*Gynura procumbens* (Lour.) Merr.	Asteraceae		Sambung Nyawa			4	5			

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
101	*Hedychium coronarium* Koenig in Retz.	Zingiberaceae	Butterfly ginger	Bunga lily (?)	Pambuku	Kàndoho' (?)	4	2	5		
102	*Heliconia indica* Lam. *(marginata?)*	Heliconiaceae	False bird-of-paradise	Pisang hias	Tawe pampotoa (daun bungkus)	Tawe iki'	36			Yes	
103	*Hibiscus sabdariffa*	Malvaceae	False roselle	Rosela			4				
104	*Hippeastrum puniceum* (Lam.) Voss	Amaryllidaceae	Barbados lily	Kembang torong (?)	(bunga oktober)		2	5	12		
105	*Homalanthus populneus* Pax	Euphorbiaceae		Tutup abang (Java)	Belante	Belante'	20	7	5;16		
106	*Homalomena cordata* Schott	Araceae		Angrek talas (?)	Kalomba (?)		4	5	17		
107	*Ipomoea aquatica* Forsskal	Convolvulaceae	Water spinach	Kangkung	Tanggo	Tanggo	47	2	4;5;10	Yes	
108	*Ipomoea batatas* (L.) Lam.	Convolvulaceae	Sweet potato	Ubi jalar, ubi merah	Uwi ntepuu	Uwi	82	6	2;5;10; 13	Yes	
109	*Jatropha curcas* L.	Euphorbiaceae	Purging nut	Jarak pagar, pohon pagar	Tatanga, belacair	Tantanga'	40	5	7;16	Yes	
110	*Kaempferia galanga* L.	Zingiberaceae	East Indian galangal	Kencur	Huku (?)	Huku	22	4	5		
111	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae	Floppers	Sosor bebek	Lompo-lompo	Lolompo'	18	5	12		
112	*Lablab purpureus* (L.) Sweet	Fabaceae	Hyacinth bean	Karu koma (Bali), lablab			16	2			
113	*Lansium domesticum* Correa	Meliaceae	Langsat	Langsat, duku	Babuno	Lonja'	11	1	5;13		
114	*Leucaena leucocephala* (Lam.) De Wit	Fabaceae	Horse tamarind	Lamtoro, klandingan, petai cina		Lamtoro	7	8	2;4;5;10		
115	*Limnocharis flava* (L.) Buchenau	Butomaceae	Sawah lettuce	Genjer		Kidi	16	2	12		
116	*Luffa acutangula* (L.) Roxb.	Cucurbitaceae	Ridged gourd	Gambas			2	2			
117	*Lycopersicon esculentum* Miller	Solanaceae	Tomato	Tomat	Tamate	Tamate	67	2	4;5;13	Yes	

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
118	*Mangifera indica* L.	Anacardiaceae	Mango	Mangga	Asa	Taipa	82	1	5;13;15	Yes	
119	*Manihot esculenta* Crantz	Euphorbiaceae	Cassava	Ubi kayu	Uwi kau	Wikau	87	6	2;10;13;16	Yes	
120	*Manihot glaziovii* Müll. Arg. in Mart.	Euphorbiaceae	Tree cassava	Ubi karet			16	8	2;5;10		
121	*Manilkara zapota* (L.) van Royen	Sapotaceae	Sapodilla	Sawo			4	1			
122	*Marantha arundinacea* L.	Maranthaceae	Arrowroot	Garut	Parus	Kadue' (?)	2				
123	*Mentha x piperita* L.	Lamiaceae	Peppermint	Pepermin	Tangkada, solasi		13	4	5		
124	*Momordica charantia* L.	Cucurbitaceae	Bitter gourd	Paria, pare, peria		Paria	31	4	2;5		
125	*Morinda citrifolia* L.	Rubiaceae	Indian mulberry	Mengkudu			2	5			
126	*Morus nigra* L. (oder alba? s.Med1)	Moraceae	Black mulberry		Mulberi		9				
127	*Musa x paradisiaca* L.	Musaceae	Banana	Pisang	Loka	Loka'	84	1	2;5;10;11;13;15	Yes	
128	*Nauclea orientalis (*L.) L.	Rubiaceae			Kayu telur (?)	Towote'	7	7			
129	*Nephelium lappaceum* L.	Sapindaceae	Rambutan	Rambutan			51	1	13	Yes	
130	*Nicotiana tabacum* L.	Solanaceae	Tobacco	Tembakau	Tabako	Tabako'	22	3	5;12	Yes	
131	*Ocimum basilicum* L.	Lamiaceae	Basil	Kemangi	Balakama	Pangkabau'	67	4	5;13	Yes	
132	*Orthosiphon aristatus* (Blume) Miq.	Lamiaceae	Cat´s whizkers	Kumis kucing		Humpi soe'	24	5	16		
133	*Oryza sativa* L.	Poaceae	Rice	Padi	Pare	Pare	2	6			
134	*Paederia* cf. *scandens* (Lour.) Merr.	Rubiaceae		Simbukan (Java), kesimukan (Bali)			2				IM.11 (LL)
135	*Pandanus amaryllifolius* Roxb.	Pandanaceae	Fragant screw pine	Pandan wangi	Ponda	Tawe' ponda	69	4	5;11;15	Yes	

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
136	*Pandanus* sp.	Pandanaceae		Pandan hutan		Mpondo' (?)	4				
137	*Paraserianthes falcataria* (L.) Nielsen	Fabaceae	White albizia	Sengon			2	8			
138	*Passiflora edulis* Sims	Passifloraceae	Passionfruit	Markisa hitam			7	1	15		
139	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Redbird cactus, Zig-Zag plant	Sig-sag	(obat gigi)		4				IM.17 (LL)
140	*Pennisetum purpureum* Schum.	Poaceae	Napier grass	Rumput gadjah		Rumpu' gaja'	20	9	10	Yes	
141	*Persea americana* Miller	Lauraceae	Avocado	Adpukat	Alpokat		58	1	5;13	Yes	
142	*Phaleria macrocarpa*	Thymelaeaceae		Makota dewa			4				
143	*Phaseolus lunatus* L.	Fabaceae	Lima bean	Kare manis (Bali)			11	2			
144	*Phaseolus vulgaris* L. ssp. *vulgaris* var. *nanus* (L.) Asch.	Fabaceae	French bean	Kacang merah, buncis		Tambue malei	13	2			
145	*Picria felterrae* Lour.	Scrophulariaceae (?)			(lubi-lubi)		2	5			
146	*Pinus merkusii Jungh. & de Vriese*	Pinaceae	Merkus Pine, Sumatran Pine				2	7	12		
147	*Piper betle* L.	Piperaceae	Betel pepper	Sirih	Baulu	Baulu	22	3	5;15		
148	*Piper caninum* Blume	Piperaceae		Sirih hutan		Bolu kakau	2	5			
149	*Piper nigrum* L.	Piperaceae	Pepper	Merica, lada	Rica jawa	Marisa' jawa	4	4	5;13		
150	*Piper umbellatum* L.	Piperaceae		Sirih		Lepo lepo	9				
151	*Platea* sp.	Icacinaceae			Nkanona (?)	Salamate (?)	2	7			
152	*Plectranthus amboinicus* (Lour.) Spreng.	Lamiaceae	Indian borage		(daun tebal)		4	5	4		
153	*Pluchea indica* L.	Asteraceae	Indian camphorweed	Bluntas			2				IM.12 (LL)

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
154	*Pometia pinnata* J.R. Forster & G. Forster ?	Sapindaceae	Kasai tree	Matoa			2	1			
155	*Premna serratifolia* L.	Lamiaceae			Arogo	Arogo	9	7	2;5;16		
156	*Psidium guajava* L.	Myrtaceae	Guava	Jambu biji	Gambu	Gàmbu	93	1	4;5;10	Yes	
157	*Psophocarpus tetragonolobus* (Stickm.) DC.	Fabaceae	Winged bean	Kecipir	Betuba	Betubà	9	2			
158	*Ricinus communis* L.	Euphorbiaceae	Castor bean	Jarak	Lawu	Lawu'	2	5			
159	*Rubus rosifolius* Sm.	Rosaceae	Queensland raspberry	Arbei, strawbery hutan	Lole-lole	Lole lole'	18	1	5		
160	*Ruellia malacosperma* Greenm.	Acanthaceae			(obat batuk)		2				
161	*Saccharum officinarum* L.	Poaceae	Sugar cane	Tebu	Tuwu	Tuwu	33	3	5;13;15; 16	Yes	
162	*Salacca zalacca* (Gaertner) Voss	Arecaceae	Salak palm	Salak			2	1	14;15		
163	*Salix* sp.	Salicaceae			(pohon hiasan)		11				
164	*Sambucus canadensis* L.	Caprifoliaceae	Canadian elder		Doda		20	7	15		
165	*Sauropus androgynus* (L.) Merr.	Euphorbiaceae	Star gooseberry	Katuk (daun manis)			11	2	5		
166	*Sechium edule* (Jacq.) Swartz	Cucurbitaceae	Chayote	Labu siam	Bisa	Bisa	69	2	5;10	Yes	
167	*Senna alata* (L.) Roxb.	Fabaceae	Ringworm bush	Ketepeng			2	5			
168	*Solanum aethiopicum* L.	Solanaceae	Bitter tomato		Palolakao	Sereka	36	2	5	Yes	
169	*Solanum macrocarpon* L.	Solanaceae	African eggplant	Terong kelapa	Poki poki kaluku/moleogu	Poki poki kàluku	22	2	5;13		
170	*Solanum melongena* L.	Solanaceae	Eggplant	Terong		Poki poki'	47	2	13;15	Yes	
171	*Solanum torvum* Sw.	Solanaceae	Devil's fig	Terong hutan	Palola nua (?)	Palolà tungka'	9	2			

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172	*Solenostemon scutellarioides* (L.) Codd	Lamiaceae	Painted nettle	Miyana	Bunga mayana	Bunga' mayana	31	5	2;12	Yes	
173	*Spondias cytherea* Sonnerat	Anacardiaceae	Great hog plum, Jamaican plum, Spanish plum, purple mombin		Onco (daun asam)	Onco	4				IM.06 (LL)
174	*Stephania corymbosa* (Blume) Spreng.	Menispermaceae		Daluman (Bali), cincau daun besar			4	9	5		IM.09 (LL)
175	*Strobilanthes crispa* (L.) Blume	Acanthaceae	Cone head	Pecah beling, keji beling (Indo)	(obat rheuma)		11	5	12		
176	*Symphytum officinale* L.	Boraginaceae	Common comfrey		(obat jamu)		9	5			
177	*Synadenium grantii* Hook.f.	Euphorbiaceae	African milk bush		(obat panas)		4	5			
178	*Syzygium aqueum* (Burm.f.) Alston	Myrtaceae	Water apple	Jambu air	Tambe	Tambe	36	1	5;10;13; 14;15	Yes	
179	*Syzygium malaccense* (L.) Merr. & Perry	Myrtaceae	Malay apple	Jambu bol	Gora	Maku'	9	1	13;15		
180	*Talinum paniculatum* (Jacq.) Gaertn.	Portulacaceae	Fame flower	Ginseng			7	5			
181	*Talinum triangulare* (Jacq.) Willd.	Portulacaceae	Surinam purslane	Ginseng			13	5	12		
182	*Tamarindus indica* L.	Fabaceae	Tamarind	Asam jawa			2	4	5		
183	*Tectona grandis* L.f.	Verbenaceae	Teak wood	Jati			7	7	13		
184	*Tephrosia vogelii* Hook.f. in Hook.	Fabaceae	Fish poison bean		Gereng-gereng (?)	Rengko rengko (?)	4	8			
185	*Theobroma cacao* L.	Malvaceae	Cacao	Coklat			98	3	13	Yes	
186	*Tinospora crispa* Miers	Menispermaceae		Bratawali, tali pahit, pancar sona (Bali)		Tali pai'	4	5			

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
187	*Trema orientalis* (L.) Blume	Ulmaceae	Indian charcoal tree		Bono (?)		2	7			
188	*Trema* sp.	Ulmaceae			Ntowiroe (?)	Ntowiroe	2	7			
189	*Vanilla planifolia* Andr.	Orchidaceae	Vanilla	Vanilla		Vanili	20	4	13		
190	*Vigna radiata* (L.) R. Wilczek	Fabaceae	Mung bean		(kacang hijau)	Tambue makodara'	2	2			
191	*Vigna* sp.	Fabaceae			(kacang duduk)		2	2	13		
192	*Vigna unguiculata* (L.) Walp. ssp. *sesquipedalis*	Fabaceae	Yard-long bean	Kacang panjang	Tambue ngkararu, tambue mendoa (?)	Tambue tokararu	40	2	5;13	Yes	
193	*Vitis vinifera* L.	Vitaceae	Common grape vine	Anggur			2				
194	*Wedelia trilobata* Hitchc.	Asteraceae			(obat luka)		2				IM.34 (LL)
195	*Wendlandia paniculata* (Roxb.) DC.	Rubiaceae		Parahoa	Urio (?)	Pàhoroà (?)	2	7	5		
196	*Wendlandia* sp.	Rubiaceae		Urio	Urio	Urio	2	7			
197	*Xanthosoma nigrum* (Vell.) Mansf.	Araceae	New cocoyam	Keladi hitam	Daupe tokampuda (?)	Kadue' to maiti	27				
198	*Xanthosoma sagittifolium* (L.) Schott ex Schott & Endl.	Araceae	Blue taro, cocoyam	Keladi putih	Daupe balanda (?)	Kadue' bàlandà	82	6	5;10	Yes	
199	*Youngia japonica* (L.) DC. (=*Crepis jap*.)	Asteraceae			Sayur sawi bunga, hahawi (?)		2	2			
200	*Zea mays* L.	Poaceae	Maize	Jagung	Gogoa	Goa'	22	6	2;5;10;13	Yes	
201	*Zingiber aromaticum* Val.	Zingiberaceae		Puyang	Gambongan (?)		11	5	4;15;17		
202	*Zingiber officinale* Roscoe	Zingiberaceae	Ginger	Jahe	Kula pare	Kula'	69	4	5;13	Yes	
203	*Zingiber purpureum* Roscoe	Zingiberaceae	Bengal ginger	Banglai, bangle	Bangali	Bangali'	49	5	2	Yes	

Nr.	Species	Family (APGIII)	English	Indonesia	Napu/ Pekurehua	Besoa/ Behoa	Freq. of oc. in HG [%]	Main use cat. Kehl.	Second. uses cat. Kehl.	Sele-ction 53 sp.	Speci-mens
204	*Zingiber* sp.	Zingiberaceae		Goraka			2				
205	sp.1				(pohon daun kecil)		2				IM.47 (LL)
206	sp.2				(pohon hutan, kahio)		2				IM.53 (LL)
207	sp.3				(pohon juhet)		2				IM.46 (LL)
208	sp.4				(pohon kunia)		2				IM.42 (LL)
209	sp.5				(ruellia)		2				IM.36 (LL)
210	sp.6				Tambone (?)		13				IM.02 (LL)

Codes for main and secondary uses; established by Kehlenbeck (2007): 1=Fruit; 2=Vegetable; 3=Stimulant; 4=Spice; 5=Medicine; 6=Staple; 7=Wood; 8=MPU; 10=Fodder; 11=Wrapping; 12=Ornamental; 13=Cash; 14=Handicraft; 15=Sacrifices; 16=Fence; 17=Mystic

Appendix III Basic socio-economic data of the households (n=45) related to the homegardens surveyed in the five villages of the Napu valley, Central Sulawesi, in 2012.

HH_ no.	Village	Religion	Religion_ hindu_or_ not	No_small _children (0-5)	No_school _children_(5-14)	No_adults _female_(15-67)	No_adult s_male_(15-67)	No_el dery_(>67)	Total_H H_mem bers	All_Kid- 14	All_adu lt>14	Dependance_ ratio_(no.chil dren/totalHH member)	Age_He ad_of_H H	Origin_ Head_o f_HH	Formatio n_Head_ of_HH	1.Job_H ead_of_ HH	2.Job_H ead_of_ HH	Expenses_ Head_of_H H_1000_IR	Age_wif e_head _of_HH	Origin_wife _head_of_ HH	Formation_w ife_head_of_ HH	1.Job_w ife_head _of_HH	2.Job_w ife_head _of_HH	Expenses_ wife_head _of_HH_1 000_IR	Total_exp enses_all _family_[j uta]	Main_Gar dener_Int erviewed_ gender	dener_Int erviewed_ ethnicity_ details	Main_Gardener_I nterviewed_ethni city_3codes	Main_Gar dener_Inte rviewed_a ge
1	1	1	0	1	2	1	1	2	7	3	4	43	75	1	5	1	10	300	68	1	3	7	1	300	4,6	1	1	1	75
2	1	1	0	0	1	2	2	2	7	1	6	14	62	1	8	1	10	500	48	1	5	1	7	500	3,5	2	1	1	48
3	1	2	0	0	3	3	2	2	10	3	7	30	72	1	7	10	1	500	67	1	7	10	7	500	7,0	1	1	1	72
4	1	2	0	0	1	1	1	0	3	1	2	33	52	2	7	1	2	1000	52	1	6	2	7	1000	3,0	1	2	0	52
5	1	2	0	0	4	1	5	0	10	4	6	40	63	1	4	1	0	0	56	1	2	1	7	0	0,8	1	1	1	63
6	1	1	0	2	0	1	2	0	5	2	3	40	44	1	2	1	0	100	43	1	2	7	0	100	0,7	2	1	1	43
7	1	1	0	1	0	3	2	1	7	1	6	14	77	1	7	10	0	500	66	1	5	10	7	500	3,2	2	1	1	66
8	1	1	0	1	0	1	3	0	5	1	4	20	48	1	5	1	0	200	52	1	3	7	1	250	0,9	2	1	1	52
9	1	1	0	1	3	3	4	0	11	4	7	36	60	1	8	1	10	500	60	1	5	1	7	500	6,4	1	1	1	60
10	1	1	0	1	1	1	3	1	7	2	5	29	#	1	#	#	#	#	75	1	3	7	10	100	0,7	2	1	1	75
11	2	1	0	0	2	1	1	0	4	2	2	50	64	1	3	1	0	50	64	1	3	7	1	50	0,3	1	1	2	64
12	2	1	0	0	1	1	1	0	3	1	2	33	36	1	3	1	0	300	24	1	3	1	7	300	1,6	2	1	2	24
13	2	2	0	2	2	2	6	0	12	4	8	33	46	7	3	1	0	500	45	7	2	1	7	500	1,8	1	7	0	46
14	2	1	0	0	2	1	1	0	4	2	2	50	33	1	4	1	0	300	35	1	7	2	7	100	1,4	2	1	1	35
15	2	1	0	0	1	1	4	1	7	1	6	14	60	1	5	1	5	300	55	1	3	1	7	300	2,5	2	1	2	55
16	2	1	0	1	3	3	3	0	10	4	6	40	65	1	7	1	10	0	#	1	#	#	#	#	7,0	1	1	2	65
17	2	3	0	0	1	1	2	0	4	1	3	25	65	1	3	1	5	200	40	1	3	1	7	100	0,8	2	1	2	40
18	2	1	0	1	1	2	3	0	7	2	5	29	53	1	4	1	0	500	51	1	3	1	7	500		1	1	2	53
19	3	4	0	1	2	2	1	1	7	3	4	43	43	3	7	1	5	150	36	5	3	1	5	100	1,8	1	3	0	43
20	3	8	0	0	2	1	1	0	4	2	2	50	60	3	2	5	1	0	40	3	1	5	7	0	0,0	1	3	0	60
21	3	5	1	1	1	1	1	0	4	2	2	50	45	6	7	1	2	150	40	6	2	7	1	150	0,9	1	6	0	45
22	3	5	1	0	0	1	1	0	2	0	2	0	50	6	8	3	1	500	49	6	6	7	1	500	1,0	1	6	0	50
23	3	5	1	0	0	1	2	0	3	0	3	0	42	6	5	1	0	600	40	6	2	2	7	500	2,1	1	6	0	42
24	3	5	1	0	1	3	4	0	8	1	7	13	50	6	2	5	1	500	40	6	1	5	7	500	8,0	1	6	0	50
25	3	5	1	0	0	1	1	0	2	0	2	0	49	6	3	1	5	300	45	6	3	1	5	300	0,9	1	6	0	49
26	3	5	1	0	0	1	2	0	3	0	3	0	40	6	2	1	0	500	37	6	1	1	7	500	1,8	2	6	0	37
27	4	5	1	0	0	2	1	0	3	0	3	0	49	6	2	1	2	500	48	6	2	1	7	500	2,0	1	6	0	49
28	4	5	1	1	1	1	1	1	5	2	3	40	40	6	2	1	2	200	32	6	2	1	7	200	1,0	2	6	0	32
29	4	5	1	0	1	2	1	0	4	1	3	25	45	6	8	1	2	1000	40	6	7	3	7	1000	5,0	1	6	0	45
30	4	5	1	0	0	1	1	0	2	0	2	0	57	6	2	1	2	250	53	6	2	1	7	250	0,5	1	6	0	57
31	4	5	1	0	0	1	3	0	4	0	4	0	45	6	3	1	2	300	31	6	3	2	7	1000	9,3	1	6	0	45
32	4	5	1	1	1	1	1	0	4	2	2	50	50	6	2	2	1	300	43	6	2	2	7	300	1,5	2	6	0	43
33	4	5	1	1	0	2	2	0	5	1	4	20	49	6	2	1	2	1000	45	6	2	7	2	1000	4,5	1	6	0	49
34	4	5	1	0	2	1	1	2	6	2	4	33	75	6	5	10	2	250	70	6	1	10	7	250	4,0	2	6	0	70
35	4	5	1	0	0	1	1	0	2	0	2	0	50	6	2	1	0	500	45	6	3	1	7	500	1,0	1	6	0	50
36	5	7	0	0	0	1	2	0	3	0	3	0	52	2	3	1	0	100	55	2	3	1	7	100	0,3	1	2	0	52
37	5	1	0	0	0	1	3	0	4	0	4	0	28	1	6	6	1	200	53	1	2	1	7	200	0,8	2	1	1	53
38	5	1	0	1	0	2	4	1	8	1	7	13	#	1	#	#	#	#	57	1	2	1	7	300	5,1	2	1	1	57
39	5	1	0	0	1	1	1	2	5	1	4	20	55	1	7	12	1	500	42	1	7	7	1	500	1,7	1	1	1	55
40	5	1	0	0	0	3	3	1	7	0	7	0	78	1	5	10	1	100	63	1	3	7	1	100	2,2	1	1	1	78
41	5	1	0	1	1	2	3	0	7	2	5	29	56	1	3	1	13	500	57	1	3	1	7	500	3,0	2	1	1	57
42	5	1	0	0	0	2	2	0	4	0	4	0	52	1	5	3	1	500	47	1	3	7	1	800	3,1	1	1	1	52
43	5	1	0	0	1	1	2	0	4	1	3	25	61	2	3	1	0	500	58	1	2	7	1	500	2,0	1	2	0	61
44	5	1	0	0	0	3	1	1	5	0	5	0	73	1	5	10	1	500	#	1	#	#	#	#	4,7	1	1	1	73
45	5	1	0	0	1	1	1	0	3	1	2	33	50	8	7	15	1	500	45	1	7	7	1	500	1,3	1	8	0	50

1=Protestant (GKST)
2=Pentecost
3=Catholic
4=Muslim
5=Hindu
7=Salvation army (BK)
8=Toraja church (gereja Toraja)

1=Wuasa
2=Rompo
3=Siliwanga
4=Mekarsari
5=Wanga

0=Non-Hindu
1=Hindu
1=Hindu

Codes for formation:
1=Never attended (tdk sekola)
2=Attended prim. School (SD)
3=Finished prim. School (selesai SD)
4=Attended junior high school (SMP)
5=Finished junior high school (selesai SMP)
6=Attended senior high school (SMA)
7=Finished senior high school (selesai SMA)
8=University/academy

1=Napu
2=Central Sulawesi
3=Toraja
4=North Sulawesi
5=Java
6=Bali
7=South Sulawesi
8=Sumatra

1=Farmer (petani)
2=Self-employed (wira swasta)
3=Civil servant (pegawai/PNS)
4=Craftmen (pengrajin)
5=Farm worker (buruh lepas pertanian)
6=Wage labouror (pekerja tetap di luar bidang
7=Housewife (IRT)
8=Student (pelajar)
9=Unemployment (pengangguran)
10=Pensioner (beristirahat atau pensium)
12=Pastor (pendeta)
13=Fisherman (nelayan)

1= Napu or Besoa
2=Central Sulawesi
3=Toraja
4=North Sulawesi
5=Java
6=Bali
7=South Sulawesi
8=Sumatra

1=man
2=woman

1=Napu (Pekurehua)
2=Besoa (Behoa)
0=Other ethnicity

#=deceased

(continued)

Year_establishment_HG	land_use_before	size_HG_2004	Work_first	Work_second	Work_third	Food_subsitence_1.	Food_subsitence_2.	Food_subsitence_3.	Income_first	Income_first	Income_first	Other_cash_income	Other_cash_income_non_farm_activity	Kiosk	Agricultural_support_last_time	Agricultural_support_frequency	Buffaloes	Horses	Cows	Pigs	Ducks
1970	3	640	1	2	3	1	2	3	1	2	3	5	1	0	2011	3	0	0	0	1	1
1978	4	1070	2	1	3	1	2	3	2	3	0	2	1	0	2011	3	0	0	1	1	2
1968	1	310	2	3	3	1	2	3	2	1	0	1	1	0	0	1	0	0	0	0	0
1978	1	470	2	1	3	1	2	3	2	1	3	1	1	1	2007	2	0	0	2	1	8
1983	4	640	2	3	0	2	3	0	2	3	0	4	0	0	0	1	0	0	0	0	2
1998	1	280	1	2	3	1	2	3	2	0	0	0	0	0	2010	3	0	0	0	2	4
1967	1	860	1	2	3	1	2	3	1	2	3	3	1	0	2000	2	0	0	0	4	7
1986	4	530	2	3	0	2	3	0	2	3	0	5	1	0	2009	2	0	0	1	1	0
1981	4	860	1	2	3	1	2	3	1	2	3	2	1	0	0	1	0	0	0	2	2
1974	4	900	3	2	0	3	2	0	2	3	0	4	0	0	0	1	0	0	0	1	1
1999	5	1440	2	3	0	2	3	0	2	3	0	0	0	0	0	1	0	0	0	1	4
2005	1	450	2	1	3	1	2	3	2	3	0	0	0	0	2011	3	0	0	0	1	6
2004	1	1320	2	3	0	2	3	0	2	3	0	4	0	0	2010	3	0	0	0	2	0
2009	3	510	2	3	0	2	3	0	2	3	0	1	1	1	2011	3	0	0	0	2	20
1984	1	370	1	2	3	1	2	3	1	2	3	0	0	0	2009	2	0	0	0	1	8
2000	2	280	2	1	3	1	2	3	2	1	0	5	1	0	2011	3	0	0	0	0	15
2001	3	640	1	2	3	1	2	3	2	3	0	4	0	0	2010	2	0	0	0	2	0
1980	2	670	1	2	3	1	2	3	2	3	0	1	1	1	1999	2	0	0	0	3	4
1996	1	710	1	2	3	1	2	3	1	2	3	4	0	0	2011	3	0	0	2	0	0
1995	3	470	2	3	0	2	3	0	2	3	0	4	0	0	0	1	0	0	0	0	0
1995	3	2210	2	3	0	2	3	0	2	3	0	1	1	0	2007	2	0	0	3	0	0
1993	1	930	1	3	2	1	3	2	1	2	3	2	1	0	2011	3	0	0	3	2	0
2010	3	630	2	3	0	2	3	0	2	3	0	1	1	1	2010	2	0	0	15	0	0
1993	3	1000	2	3	0	2	3	0	2	3	0	4	0	0	2011	3	0	0	0	2	0
1993	3	2420	1	2	3	1	2	3	1	2	3	0	0	0	2011	3	0	0	0	1	0
1993	3	870	1	2	3	1	2	3	1	2	3	4	0	0	2012	3	0	0	4	1	0
1993	5	1900	1	2	3	1	2	3	1	2	3	1	1	0	2012	3	0	0	0	13	3
1993	1	2280	1	2	3	1	2	3	1	2	3	1	1	1	2010	2	0	0	0	15	7
1993	5	2220	2	3	0	2	3	0	2	1	0	3	1	0	0	1	0	0	0	4	0
1993	3	2300	2	3	0	3	2	0	2	3	0	5	1	0	2012	3	0	0	0	3	0
1994	3	2310	1	2	3	1	2	3	1	2	0	1	1	1	1995	2	0	0	0	2	0
2001	1	720	2	3	0	2	3	0	2	3	0	1	1	1	0	1	0	0	0	1	0
1993	3	2220	1	2	3	1	2	3	1	2	3	1	1	1	0	1	0	0	0	5	0
1998	1	2350	2	1	3	1	2	3	2	1	3	1	1	1	2012	3	0	0	0	0	11
1994	3	2450	1	2	3	1	2	3	1	2	3	0	0	0	0	1	0	0	0	13	0
1993	3	1280	2	3	0	2	3	0	2	3	0	0	0	0	2005	2	0	0	0	0	0
1990	3	540	3	2	1	1	2	3	2	3	0	4	0	0	2012	3	0	0	*3*	0	10
1980	3	250	2	3	0	2	3	0	2	0	0	5	1	0	2011	3	0	0	1	0	0
1997	1	650	2	1	3	1	2	3	2	1	3	3	1	0	2011	3	0	0	0	2	4
1982	3	310	2	3	1	1	2	3	2	1	3	5	1	0	2011	3	0	0	0	4	0
1982	1	440	2	1	3	1	2	3	2	3	0	5	1	0	2011	3	0	0	1	0	2
1996	1	430	1	3	0	1	3	0	3	0	0	2	1	0	0	0	0	0	0	1	0
1983	3	680	1	2	3	1	2	3	2	3	0	5	1	0	2011	3	0	0	0	1	1
1991	3	1400	2	1	3	1	2	3	2	1	3	2	1	0	2011	3	0	0	0	1	0
2000	1	1720	3	0	0	3	0	0	3	0	0	5	1	0	2007	2	0	0	0	0	0

1=Homegarden (kebun pekarangan)
2=Coffee plantation (kebun kopi)
3=Grassland (padang rumput, tanah kosong)
4=Unirrigated arable land (ladang, kebun campur)
5=Forest (hutan)

1=Paddy field (sawah)
2=Cocoa/coffee plantation (kebun)
3=Homegarden (kebun pekarangan)
(0=No further answer because the respondent does not work on or does not get subsistence from his/her paddy field or plantations)

0=No other cash income
1=Self-employed (wira swasta)*
2=Civil servant (pegawai/PNS)*
3=Wage labouror (pekerja tetap di luar bidang pertanian)*
4=Farm worker (buruh lepas pertanian)*
5=Others (lainnya)
*at least one member of the household

0=no 0=no
1=yes 1=yes

1=never
2=iregul
3=1x/year

Appendix IV Farm-specific data of the households (n=53) related to the homegardens surveyed in the five villages of the Napu valley, Central Sulawesi, in 2012.

Paddy_rice_exploited_[are]	Rice_harvested_[kg/year]	Zea_mays_[are]	Total_land_used_[ha]	Total_land_used_pro_HH_members	Total_non_used_land_[are]	Total_land_possesion_[ha]	First_source_rice_global	Rice_cooked_weekly	Rice_self_subsitence_[weeks]	Fish_consumption_[per_week]	Sugar_consumption_[per_week]	Cooking_oil_consumption_[per_week]	Rooms_total	Room_pro_HH_member	Car	Motocycle	Tractor	Handphone	Value_transport_assets_1000_IR	Value_all_assets_1000_IR
50	1680	0	1.1	0.2	100	2.1	1	14.0	2	7.0	3.0	1.5	3	0.4	0	1	0	3	2000	6000
30	1000	20	1.2	0.2	85	2.0	1	18.0	2	5.0	2.0	2.0	4	0.6	0	2	0	5	14300	21000
250	13600	100	4.0	0.4	100	5.0	1	21.0	6	5.0	2.0	2.0	7	0.7	0	3	0	6	25	31300
40	1000	0	3.7	1.2	0	3.7	1	28.0	0	3.0	1.0	2.0	5	1.7	0	1	0	2	4000	8700
0	0	200	6.1	0.6	90	7.0	2	14.0	0	2.0	3.0	1.0	2	0.2	0	0	0	2	0	2250
50	0	0	0.7	0.1	0	0.7	1	14.0	0	0.0	1.0	1.0	4	0.8	0	1	0	1	3000	4600
60	3600	0	2.7	0.4	1300	15.7	1	28.0	2	7.0	3.0	1.5	5	0.7	0	4	1	5	39000	48000
0	0	100	1.5	0.3	0	1.5	4	14.0	1	2.0	1.0	1.0	2	0.4	0	0	0	1	0	2700
130	4000	0	2.2	0.2	0	2.2	1	42.0	2	7.0	4.0	3.0	5	0.5	0	3	0	4	24000	34700
0	0	0	0.3	0.0	35	0.6	2	10.5	0	1.0	1.0	1.0	3	0.4	0	0	0	0	0	0
0	0	50	0.6	0.1	10	0.7	4	10.5	0	0.0	0.5	0.25	3	0.8	0	0	0	0	0	0
20	200		1.0	0.3	150	2.5	1	21.0	0	1.0	2.0	1.0	3	1.0	0	2	0	2	14000	15700
50	1000	20	1.3	0.1	0	1.3	4	21.0	0	2.0	1.5	0.8	3	0.3	0	0	0	3	0	1200
0	0	100	3.4	0.9	300	6.4	4	10.5	24	7.0	1.0	1.0	1	0.3	0	1	1	1	23600	28500
130	2360	120	3.6	0.5	850	12.1	1	42.0	0	0.0	2.0	1.5	3	0.4	0	0.5	0	0	6100	6600
100	4800	110	5.6	0.6	2250	28.1	1	42.0	0	7.0	10.5	4.0	4	0.4	0	1	1	8	15000	18600
50	900	50	1.0	0.3	0	1.0	1	14.0	4	0.0	1.0	0.5	3	0.8	0	1	1	0	9000	10300
80	1680	0	1.4	0.2	600	7.4	1	42.0	5	7.0	3.0	3.0	3	0.4	0	1	0	1	13	14400
150	800	0	2.6	0.4	100	3.6	1	14.0	7	0.0	2.0	1.0	2	0.3	0	0	0	2	100	850
0	0	0	0.8	0.2	100	1.8	2	7.0	0	0.0	0.0	0.2	2	0.5	0	0	0	1	100	400
0	0	0	1.3	0.3	1000	11.3	4	10.5	4	0.5	1.0	1.0	3	0.8	0	2	0	2	13000	14750
50	1100	0	1.5	0.8	375	5.3	1	7.0	14	1.0	1.0	0.5	3	1.5	0	2	0	2	12200	13800
0	0	0	5.0	1.7	200	7.0	4	10.5	5	7.0	1.0	1.0	5	1.7	0	3	0	2	15200	17900
0	0	0	1.0	0.1		1.0	2	14.0	0	0.5	1.0	1.2	5	0.6	0	2	0	1	6200	7700
100	2200	0	2.0	1.0	100	3.0	1	7.0	29	1.0	0.5	1.0	3	1.5	0	0	1	1	6000	8800
70	1200	0	2.0	0.7	100	3.0	1	14.0	4	0.25	1.0	1.0	3	1.0	0	2	0	2	2000	3500
400	16000	0	6.0	2.0		6.0	1	10.0	0	7.0	2.0	2.0	3	1.0	1	2	2	2	78000	84400
100	1400	0	2.3	0.5		2.3	1	14.0	0	1.0	1.0	1.0	3	0.6	1	1	1	2	58500	59000
100	2000	2800	30.3	7.6	1100	41.3	4	14.0	7	7.0	1.0	5.0	3	0.8	1	7	1	5	242000	281000
15	430	0	2.4	1.2		2.4	1	7.0	0	2.0	1.0	1.0	3	1.5	0	1	0	1	5000	5650
100	3000	0	2.8	0.7	0	2.8	1	14.0	14	2.0	1.5	2.0	3	0.8	0	1	1	3	13000	16900
0	0	0	0.8	0.2	0	0.8	4	1.0	100	2.0	2.0	0.5	3	0.8	0	2	0	2	4000	6500
130	4000	0	2.6	0.5		2.6	1	14.0	0	7.0	1.0	1.0	5	1.0	0	3	1	2	12000	19300
60	1200	0	4.4	0.7	200	6.4	1	17.5	0	7.0	2.0	2.5	3	0.5	0	2	0	3	21200	23600
200	1200	0	5.0	2.5		5.0	1	7.0	7	7.0	1.0	0.5	2	1.0	0	2	0	1	17000	18500
0	0	200	3.0	1.0	100	4.0	0	10.5	0	0.0	2.0	0.5	3	1.0	0	1	0	1	3000	4300
30	400	80	2.3	0.6	0	2.3	1	7.0	1	0.0	1.2	1.0	2	0.5	0	0	0	3	0	3900
0	0	0	2.0	0.3	500	7.0	0	28.0	0	1.0	3.0	1.0	4	0.5	0	1	0	2	4000	5500
60	2000	0	8.6	1.7	50	9.1	0	2.0	8	4.0	2.0	0.5	5	1.0	0	2	0	3	9200	14300
50	1000	0	3.1	0.4	750	10.6	1	17.5	1	7.0	7.0	3.0	4	0.6	0	1	0	4	4000	7000
50	2520	140	3.0	0.4	200	5.0	1	14.0	0	7.0	2.0	1.0	4	0.6	0	0	0	2	0	3400
40	480	0	0.7	0.2	400	4.7	1	7.0	1	7.0	2.0	1.0	3	0.8	0	1	0	3	6000	9600
100	0	30	1.6	0.4	0	1.6	1	7.0	2	0.5	1.0	0.5	4	1.0	0	1	0	2	7000	14500
150	1800	40	2.6	0.5	250	5.1	1	10.5	1	4.0	2.0	1.0	5	1.0	0	1	0	2	10000	17750
0	0	25	0.5	0.2	100	1.5	0	7.0	2	1.0	1.0	1.0	4	1.3	0	1	0	1	3000	143000

1=Own paddy field
2=Rice field of other people (kerja buruh lepas; "makan gaji")
3=Own paddy but worked by others and share recolt
4=Buy rice
5=To beg for (minta keluarga)
6=Goverment help (bantuan pemerintah)

Appendix V Cards of the 53 selected plants used for the ethnobotanical exercises

 coklat	Coklat *Theobroma cacao* Sterculiaceae
 bawang daun	Bawang daun *Allium fistulosum* Alliaceae

 ubi jalar	Ubi jalar *Ipomoea batatas* Convolvulaceae
 ubi kayu	Ubi kayu *Manihot esculenta* Euphorbiaceae
 kopi robusta	Kopi robusta *Coffea canephora* Rubiaceae

 keladi putih	Keladi putih *Xanthosoma sagittifolium* Araceae
 gamal	Gamal *Gliricidia sepium* Fabaceae
 cabe	Cabe *Capsicum annuum* Solanaceae

 jambu biji	Jambu biji *Psidium guajava* Myrtaceae
 kopi arabika	Kopi arabica *Coffea arabica* Rubiaceae
 pisang	Pisang *Musa x paradisiaca* Musaceae

 keladi merah	Keladi merah *Colocasia esculenta* Araceae
 kunyit	Kunyit *Curcuma longa* Zingiberaceae
 kemangi	Kemangi *Ocimum basilicum* Lamiaceae

 jagung	Jagung *Zea mays* Poaceae
 tomat	Tomat *Lycopersicon esculentum* Solanaceae
 kangkung	Kangkung *Ipomoea aquatica* Convolvulaceae

 jahe	Jahe *Zingiber officinale* Zingiberaceae
 nenas	Nenas *Ananas comosus* Bromeliaceae
 mangga	Mangga *Mangifeta indica* Anacardiaceae

 pandan	Pandan *Pandanus amaryllifolius* Pandanaceae
 labu	Labu *Cucurbita pepo* Cucurbitaceae
 pepaya	Pepaya *Carica papaya* Caricaceae

 jeruk manis	Jeruk manis *Citrus reticulata* Rutaceae
 labu siam	Labu siam *Sechium edule* Cucurbitaceae
 sere	sere *Cymbopogon citratus* Poaceae

 alpukat	Alpukat *Persea americana* Lauraceae
 lengkuas	Lengkuas *Alpinia galanga* Zingiberaceae
 temu lawak	Temu lawak *Curcuma xanthorrhiza* Zingiberaceae

 terong	Terong biasa *Solanum melongena* Solanaceae
 rambutan	Rambutan *Nephelium lappaceum* Sapindaceae
 nangka	Nangka *Artocarpus heterophyllus* Bombacaceae

 kelapa	Kelapa *Cocos nucifera* Arecaceae
 bayam	Bayam *Amaranthus tricolor* Amaranthaceae
 daun bungkus =tawe pampotoa (Napu) = tawe pepoto (Behoa)	Daun bungkus =tawe pampotoa (Napu) = tawe pepoto (Behoa) *Heliconia indica* Heliconiaceae

 bangali	Bangali *Zingiber purpureum* Zingiberaceae
 seledri	Seledri *Apium graveolens* Apiaceae
 Balacai = jarak pagar = tatanga	Balacai = jarak pagar = tatanga *Jatropha curcas* Euphorbiaceae

 durian	Durian *Durio zibethinus* Bombacaceae
 bawang piara = lehune nkundu (Napu) = pia ngkalolu (Behoa)	bawang piara (Bahasa Indonesia) = lehune nkundu (Bahasa Napu) = pia ngkalolu (Bahasa Behoa) *Allium schoenoprasum* Alliaceae
 kacang	Kacang panjang *Vigna unguiculata* Fabaceae

 Terong	palolakao *Solanum aethiopicum* Solanaceae
 sawi	Sawi *Brassica juncea* Brassicaceae
rumput gajah	Rumput gajah *Pennisetum purpureum* Poaceae

 tebu	Tebu *Saccharum officinarum* Poaceae
 dadap	Dadap *Erythrina subumbrans* Fabaceae
 jeruk besar = jeruk bali	Jeruk besar *Citrus maxima* Rutaceae

 bunga mayana	Bunga mayana *Solenostemon scutellarioides* Lamiaceae
 sayur paku	Sayur paku *Athyrium esculentum* Woodsiaceae
 kemiri	Kemiri *Aleurites moluccana* Euphorbiaceae

 kariango	Kariango *Acorus calamus* Araceae/Acoraceae
 Tembakau = Tabako	Tembakau = Tabako *Nicotiana tabacum* Solanaceae
 jambu air	Jambu air *Syzygium aqueum* Myrtaceae

Appendix VI Comparison between inventoried plants and gardener's preferences

Methods

To investigate the relation between the gardener's preferences and the inventoried plants in homegardens (for the 53 selected plants), I used Spearman rank correlation tests because the data were not normal distributed (except for the frequency of inventoried plants).

I first compared the mean abundance of the 53 selected plants in the 45 inventoried homegardens with the means of the scores of the three ethnobotanical ranking exercises. Then, I performed the same analysis by using the frequencies. I used the frequency of the 53 inventoried plants in the homegardens because some of them had a high abundance due to the plants' growth habit and dynamics (e.g., *Ipomea batatas, Allium fistulosum, Manihot esculenta, Xanthosoma sagittifolium*). Concerning the ranking exercises, it was convenient to use to frequency of the ranked plants, because not all the plants had to be ranked by the respondents, but only ten or five among the 53 plants (see 2.2.3 Ranking Data).

In addition, to explore more in detail the relation between the gardener's preferences and the inventoried plants, I performed the same analysis (Spearman rank correlation) on two groups of plants. It has to be noted that these two groups were chosen from the results of the pile sort exercise (cluster analysis). The first group consisted of spices and medicinal plants (n=21), whereas the second group included vegetables and fruits (n=20). In a second step, we included four plants from the cash crops groups (*Theobroma cacao, Coffea arabica, Coffea canephora, Zea mays*) that were also often considered to be fruits by the respondents. In addition, I also performed the correlation analyse by excluding the edible fern (*Diplazium* cf. *esculentum*) from the vegetables and fruit group. Although the respondents considered this plant as a vegetable, it was recurrently selected in the list of the unimportant plants in a homegarden.

Results

Comparing the mean abundance of the 53 selected plants in the 45 inventoried homegardens, there were significant correlations with the means of the scores of the three ranking exercises "new homegarden setup - top ten crops" ($R^2 = 0.53$; $p<0.001$), "unimportant plants in a homegarden - removal of ten useless plants" ($R^2 = -0.31$; $p=0.023$) and "favourite useful plants - general top five crops" ($R^2 = 0.44$; $p=0.001$). Moreover, when we compared the frequency of the 53 selected plants in the 45 inventoried homegardens, there were also significant correlations with the frequency of mentions of the species in the three ranking exercises "new homegarden setup - top ten crops" ($R^2 = 0.52$; $p<0.001$), "unimportant plants in a homegarden - removal of ten useless plants" ($R^2 = -0.46$; $p<0.001$) and "favourite useful plants - general top five crops" ($R^2 = 0.42$; $p=0.002$). All results are presented in Table 3..

Thus, the plants from the 53 ones which were preferentially chosen by the respondents to set up a new homegarden were the same as those most often cultivated in the inventoried homegardens. Similarly, the general favourite plants, selected by the gardeners among the 53, also correlated with the same plants cultivated in the 45 homegardens. In conclusion, the overall preferences of the gardeners for some plants were reflected in the overall abundance and frequency of these plants in their homegardens. On the other hand, the plants that people considered as unimportant were negatively correlated with the abundance and frequency of

these plants in the homegardens. Thus, the scarcity of these plants in the inventoried homegardens was related to the determination of the gardeners to remove these plants.

In addition to this broad approach, based on all the plants, I performed the same test, but on specific groups of plants. The groups were the ones resulting from the consensus analysis of the pile sort exercise. For the group of spices and medicinal plants (n=21), I found significant correlations when comparing the mean abundance in the homegardens with the means of the scores of the two ranking exercises "new homegarden setup - top ten crops" (R^2 = 0.61; p=0.004) and "favourite useful plants - general top five crops" (R^2 = 0.56; p=0.008).

There was no correlation between the mean abundance of spices and medicinal plants in homegarden and the means of the scores of the ranking exercise "unimportant plants in a homegarden - removal of ten useless plants" (R^2=-0.24; p=0.302). There were significant correlations between the frequency of the 21 spices and medicinal plants in the 45 inventoried homegardens and the frequency of mentions of these species in the three ranking exercises "new homegarden setup - top ten crops" (R^2 = 0.62; p=0.003), "unimportant plants in a homegarden - removal of ten useless plants" (R^2 = -0.51; p=0.019) and "favourite useful plants - general top five crops" (R^2 =0.51; p=0.018).

For the group of vegetables and fruits (n=20), the only significant correlation was found between the mean abundance of the species in the homegardens and mean of the scores for the ranking exercise "unimportant plants in a homegarden - removal of ten useless plants" (R^2 = -0.50; p=0.026). For the group of vegetables and fruits, including the four plants cash crops (*Theobroma cacao, Coffea arabica, Coffea canephora, Zea mays*) (n=20), there only was a significant correlations when comparing the mean abundance in the homegardens with the frequency of mention of these plants in the general to-five crop ranking exercise (R^2=0.50, p=0.013). I obtained almost the same results when I excluded the fern (*Diplazium* cf. *esculentum*) from the group of vegetables and fruits (n=23).

I thus found that there was a marked relationship between the gardener's preferences and the inventoried plants in homegardens for the group of spices and medicinal plants, but not for the group of vegetables and fruits. These results provide support for the general hypothesis that homegardens' plant diversity is a mirror of the gardener's perception and valuation of plants.

Table 3 Spearman rank correlation tests for different plant groups of the 53 selected plants

	New homegarden setup - top ten crops		Unimportant plants in a homegarden - removal of ten useless plants		Favourite useful plants - general top five crops	
	means of the scores	frequency	means of the scores	frequency	means of the scores	frequency
All the selected plants (n=53)	R2 = 0.53; p<0.001*	R2 = 0.52; p<0.001*	R2= - 0.31; p=0.023*	R2= - 0.46; p<0.001*	R2 = 0.44; p=0.001*	R2 = 0.42; p=0.002*
Spices and medicinal plants (n=21)	R2 = 0.61; p=0.004*	R2 = 0.62; p=0.003*	R2=-0.24; p=0.302	R2 = -0.51; p=0.019*	R2 = 0.56; p=0.008*	R2 =0.51; p=0.018*
Vegetables and fruits (n=20)	R2= 0.26; p=0.262	R2= 0.29; p=0.217	R2= - 0.50; p=0.026*	R2= - 0.31; p=0.185	R2= 0.12; p=0.608	R2= 0.24; p=0.311
Vegetables and fruits incl. cash crops (n=24)	R2= 0.39; p=0.062	R2= 0.22; p=0.307	R2= - 0.31; p=0.150	R2= - 0.28; p=0.187	R2= 0.50; p=0.013*	R2= 0.27; p=0.194
Vegetables and fruits incl. cash crops, but without the fern (n=23)	R2= 0.31;, p=0.155	R2= 0.14; p=0.525	R2= - 0.21; p=0.329	R2= - 0.20; p=0.370	R2= 0.47; p=0.024*	R2= 0.24; p=0.271

Limitations

I tested if the respondents who own a homegarden with a poor plant richness have different perceptions on plant classification (reflected by the cluster analysis of the pile sort exercise) than the ones who grow a homegarden with a high plant richness. Plant richness is, however, a simple biodiversity indicator that does not truly reflect the complex structure and diversity of a homegarden. It might be interesting to calculate other diversity indices of the homegarden, which takes into account the species composition and not only the species richness and to build new groups among the respondents for comparing if respondents' agreement on plant classification is linked to the current plant diversity and composition of their homegarden.

Appendix VII Emic categories used to classify the 53 plants (pile and sort exercise) and comparison with the categories used by Kehlenbeck.

Species	fruits	fruits ripe on the tree	fruits that falling by themself	vegetables	vegetables used to mix with	vegetables edible fresh	spices	medicinals	medicinal plants for animals	drink	animals fooder	substitute of rice	root crops	cash crop	plantation ecosystem	protection trees/fences	wrapping	decorative, ornamental	ritual, sacred offering	small sized plants	shrub with leaves like small	alone	unknowed plant	Sum of the different categories	Number of respondents for the main category (n=45)	Main use category pile and sort exercise	Main use category (Kehlenbeck, 2007)	Secondary use (Kehlenbeck, 2007)	Agreement between main use cat. pile and sort and Kehlenbeck
Acorus calamus	0	0	0	1	0	0	1	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	43	8	5	17	ok
Aleurites moluccana	7	0	0	0	0	0	18	0	0	0	0	0	0	17	2	1	0	0	0	0	0	0	0	5	18	7	4	5;7;8;13	ok
Allium fistulosum	0	0	0	11	0	0	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	33	7	4	5;13	ok
Allium schoenoprasum	0	0	0	1	0	0	21	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	21	7	4	5	ok
Alpinia galanga	0	0	0	0	0	0	39	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	39	7	4	5	ok
Amaranthus tricolor	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	5;13	ok
Ananas comosus	41	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	4	41	1	1	5;13;14;15;16	ok
Apium graveolens	0	0	0	2	0	2	40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	40	7	4	5	ok
Artocarpus heterophyllus	37	0	1	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	37	1	2	1;5;6;10	Different
Brassica juncea	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	13	ok
Capsicum annuum	0	0	0	1	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	7	4	2;5;13;15	ok
Carica papaya	33	1	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	33	1	1	2;5;10;13	ok
Citrus maxima	44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	5;13;15	ok
Citrus reticulata	44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	4;5;13;15	ok
Cocos nucifera	19	0	1	0	0	0	0	0	0	0	0	0	0	21	3	0	0	0	1	0	0	0	0	5	21	14	1	2;5;11;13;14;15	Different
Coffea arabica	1	1	0	0	0	0	0	0	0	3	0	0	0	34	6	0	0	0	0	0	0	0	0	5	34	14	3	5;13	Different
Coffea canephora	1	1	0	0	0	0	0	0	0	3	0	0	0	34	6	0	0	0	0	0	0	0	0	5	34	14	3	5;14	Different
Colocasia esculenta	0	0	0	3	0	0	0	0	0	0	2	10	30	0	0	0	0	0	0	0	0	0	0	4	30	13	6	2;10	ok
Cucurbita pepo	0	0	0	44	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	4	2	5,10	ok
Curcuma longa	0	0	0	0	0	0	35	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	35	7	4	5;13	ok
Curcuma xanthorrhiza	0	0	0	0	0	0	1	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	8	5	-	ok
Cymbopogon citratus	0	0	0	0	0	0	41	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	41	7	4	5	ok
Diplazium cf. esculentum	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	13	ok
Durio zibethinus	42	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	42	1	1	5;13	ok
Erythrina subumbrans	0	0	0	0	0	0	0	3	0	0	1	0	0	0	5	35	0	0	1	0	0	0	0	5	35	16	8	2;5;10;16	(ok)
Gliricidia sepium	0	0	0	0	0	0	0	0	0	0	2	0	0	0	6	37	0	0	0	0	0	0	0	3	37	16	8	2;5;10;16	(ok)
Heliconia indica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	28	1	0	0	1	3	9	7	28	17	9	5;11	ok

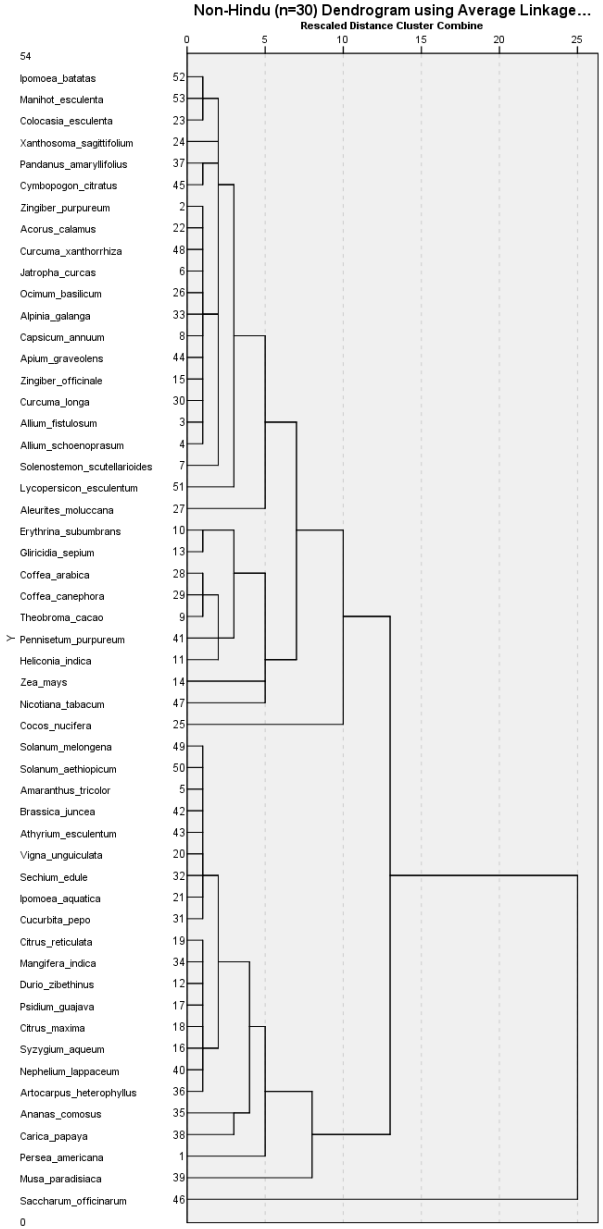
Species	fruits	fruits ripe on the tree	fruits that falling by themself	vegetables	vegetables used to mix with	vegetables edible fresh	spices	medicinals	medicinal plants for animals	drink	animals fooder	substitute of rice	root crops	cash crop	plantation ecosystem	protection trees/fences	wrapping	decorative, ornamental	ritual, sacred offering	small sized plants	shrub with leaves like small	alone	unknowed plant	Sum of the different categories	Number of respondents for the main category (n=45)	Main use category pile and sort exercise	Main use category (Kehlenbeck, 2007)	Secondary use (Kehlenbeck, 2007)	Agreement between main use cat. pile and sort and Kehlenbeck
Ipomoea aquatica	1	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	4	2	4;5;10	ok
Ipomoea batatas	0	0	0	2	1	0	0	0	0	0	0	11	31	0	0	0	0	0	0	0	0	0	0	4	31	13	6	2;5;10;13	ok
Jatropha curcas	0	0	0	0	0	0	1	38	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4	4	38	8	5	7;16	ok
Lycopersicon esculentum	0	0	0	15	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	30	7	2	4;5;13	Different
Mangifera indica	44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	5;13;15	ok
Manihot esculenta	0	0	0	2	1	0	0	0	0	0	0	11	31	0	0	0	0	0	0	0	0	0	0	4	31	13	6	2;10;13;16	ok
Musa x paradisiaca	36	1	0	0	1	0	0	0	0	0	0	1	0	3	0	0	1	0	0	2	0	0	0	7	36	1	1	2;5;10;11;13;15	ok
Nephelium lappaceum	44	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	13	ok
Nicotiana tabacum	0	0	0	0	0	0	0	22	1	0	0	0	0	3	1	0	0	0	2	0	0	16	0	6	22	8	3	5;12	(Different)
Ocimum basilicum	0	0	0	2	0	2	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	41	7	4	5;13	ok
Pandanus amaryllifolius	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	1	8	1	1	0	0	5	34	7	4	5;11;15	ok
Pennisetum purpureum	0	0	0	0	0	0	0	2	1	0	40	0	0	0	0	0	0	0	0	1	1	0	0	5	40	11	9	10	ok
Persea americana	37	0	1	0	0	0	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	4	37	1	1	5;13	ok
Psidium guajava	44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	4;5;10	ok
Saccharum officinarum	1	0	0	0	0	0	0	4	0	1	0	0	0	9	1	1	0	0	4	2	1	21	0	10	21	22	3	5;13;15;16	Different
Sechium edule	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	5;10	ok
Solanum aethiopicum	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	2	32	4	2	5	ok
Solanum melongena	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	13;15	ok
Solenostemon scutellarioides	0	0	0	5	0	0	0	30	0	0	0	0	0	0	0	0	0	1	1	0	0	0	8	5	30	8	5	2;12	ok
Syzygium aqueum	44	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	44	1	1	5;10;13;14;15	ok
Theobroma cacao	2	1	0	0	0	0	0	0	0	0	0	0	0	36	6	0	0	0	0	0	0	0	0	4	36	14	3	13	(Different)
Vigna unguiculata	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	4	2	5;13	ok
Xanthosoma sagittifolium	0	0	0	2	0	0	0	0	0	0	2	10	30	0	1	0	0	0	0	0	0	0	0	5	30	13	6	5;10	ok
Zea mays	3	0	0	3	0	0	0	0	0	0	1	9	0	26	2	0	0	0	0	1	0	0	0	7	26	14	6	2;5;10;13	Different
Zingiber officinale	0	0	0	0	0	0	33	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	33	7	4	5;13	ok
Zingiber purpureum	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	45	8	5	2	ok
Total of plants per category	20	7	9	24	5	2	15	17	2	3	6	6	4	11	12	6	2	3	6	7	6	3	5						

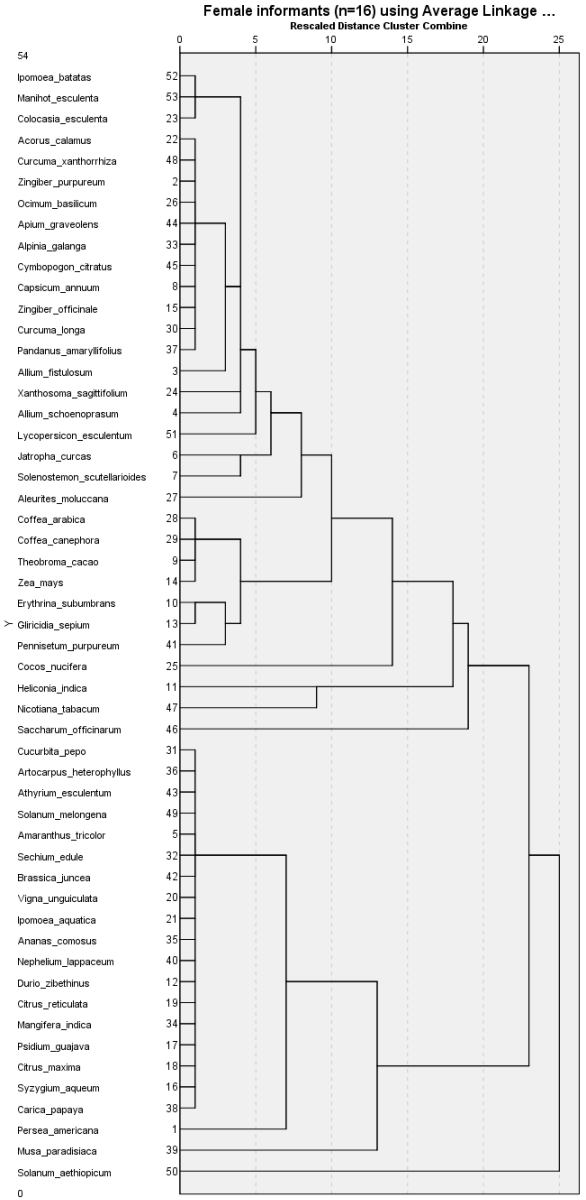
Note: For each plant, the sum of the different categories as well as the number of respondents for the main category are indicated.

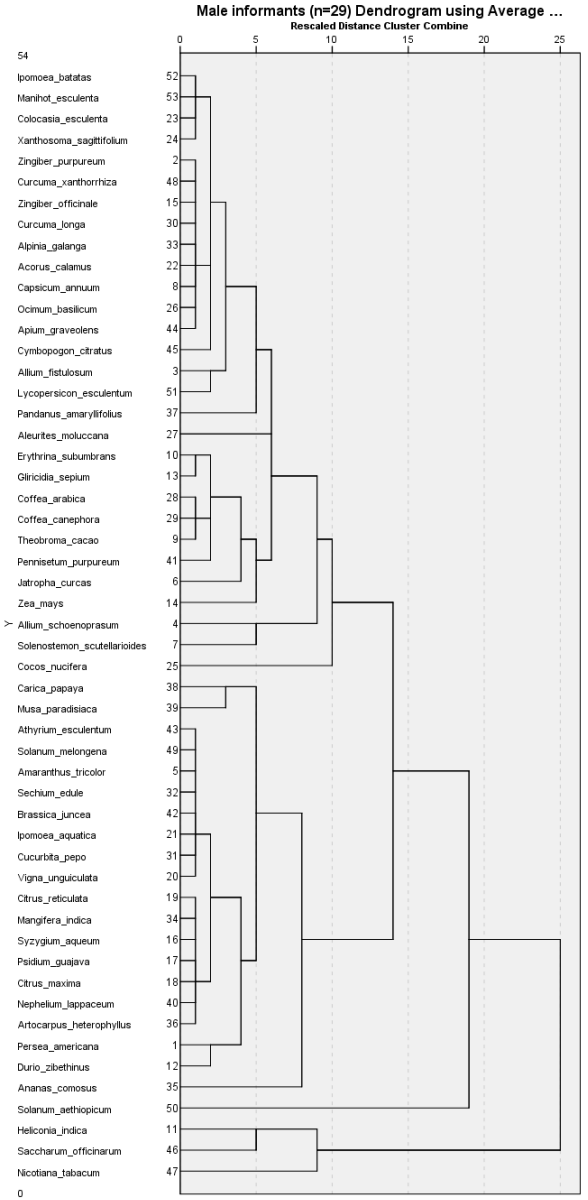
Code fort main use (category pile and sort exercise): 1=fruits; 2=fruits ripe on the tree; 3=fruits that falling by themself when ripe; 4=vegetables; 5=vegetables used to mix with meat 6=vegetables edible fresh , 7=spices , 8=medicines , 9=medicinal plants for animals; 10=drink; 11=animals fooder; 12=substitute of rice; 13=root crops; 14=cash crop (incl. economic plants which needs to be processed); 15=plantation ecosystem (not only cash crops); 16=protection trees/fences; 17=wrapping; 18=decorative, ornamental; 19=ritual, sacred offering; 20=small sized plants; 21=shrub with leaves like small palm; 22="alone"; 23=unknown plant.

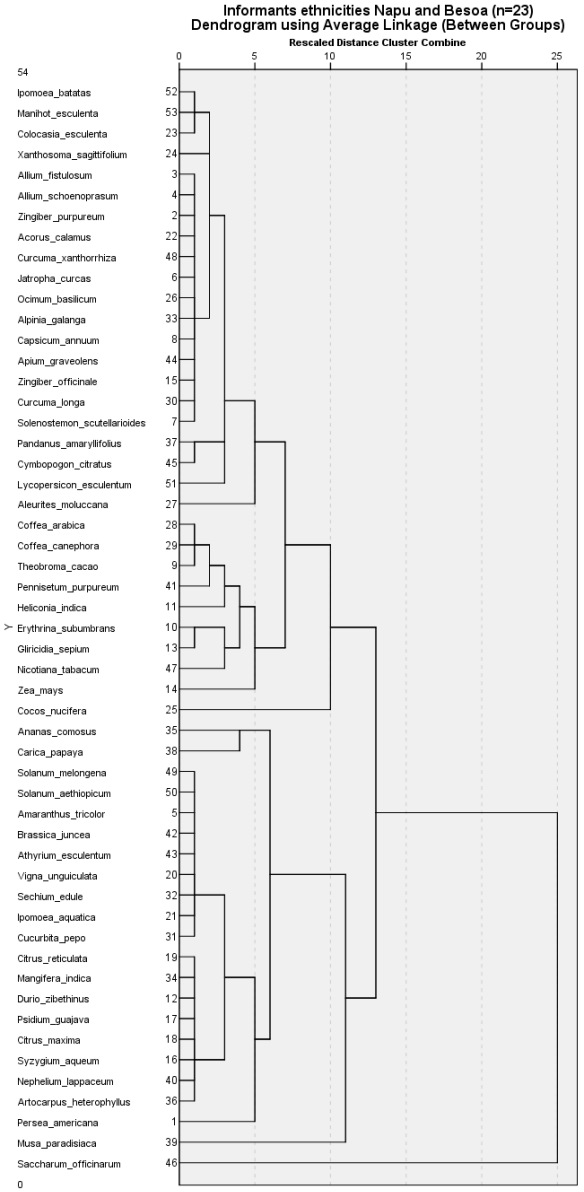
Codes for main and secondary uses; established by Kehlenbeck (2007): 1=Fruit; 2=Vegetable; 3=Stimulant; 4=Spice; 5=Medicine; 6=Staple; 7=Wood; 8=MPU; 10=Fodder; 11=Wrapping; 12=Ornamental; 13=Cash; 14=Handicraft; 15=Sacrifices; 16=Fence; 17=Mystic. Codes for main uses pile and sort exercise: see table 4.

Appendix VIII Cladogram resulting from the cluster analysis of the pile and sort exercise (for different groups of respondents)

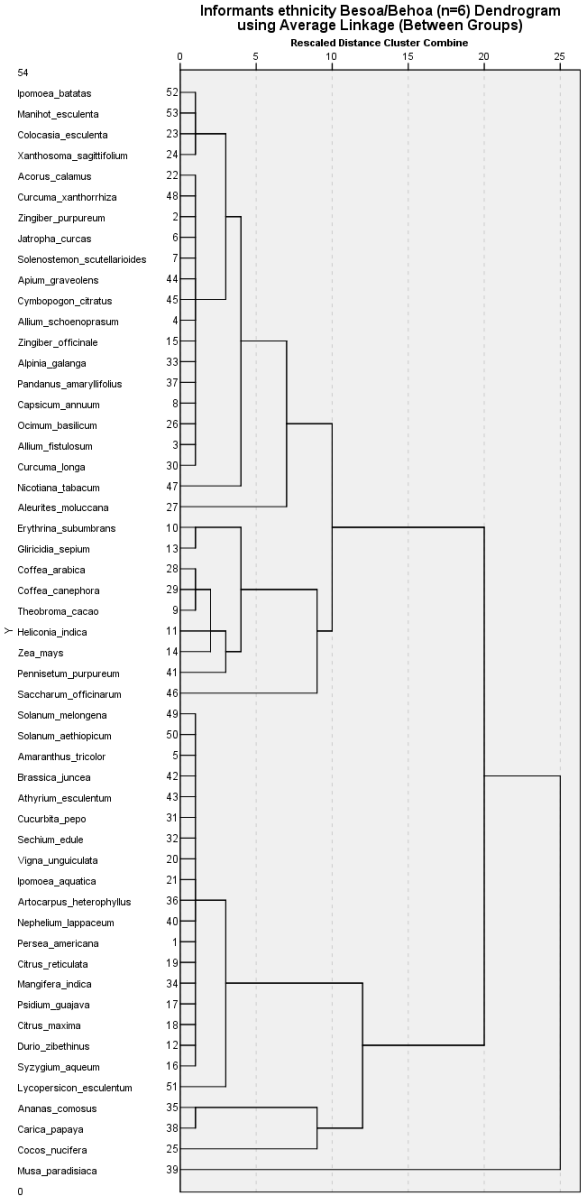


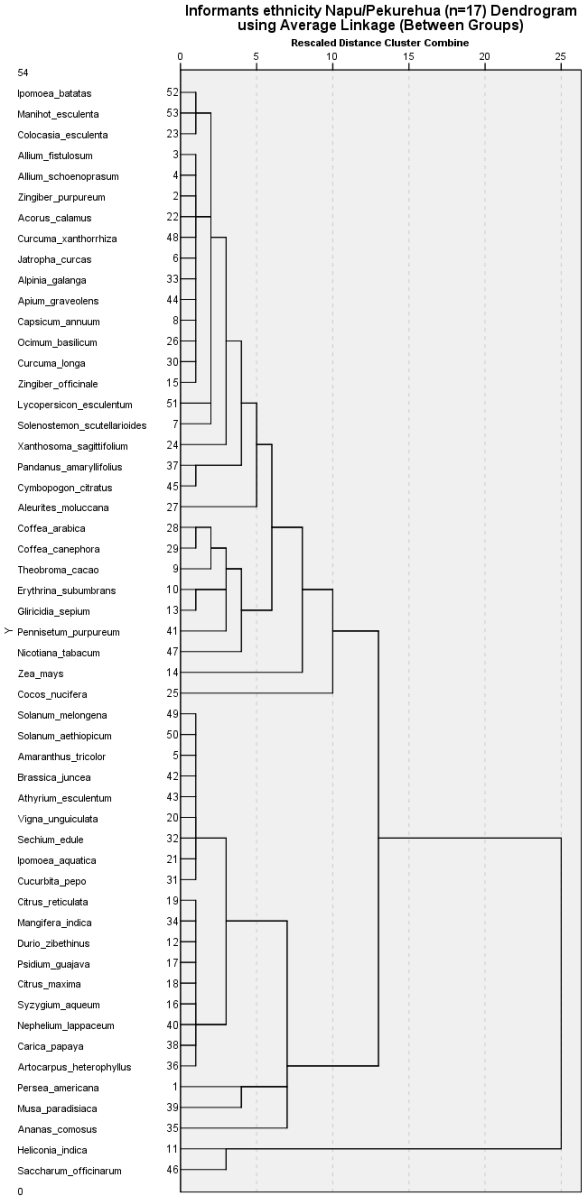

Female informants (n=16) using Average Linkage ...
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Zingiber_purpureum 2
Ocimum_basilicum 26
Apium_graveolens 44
Alpinia_galanga 33
Cymbopogon_citratus 45
Capsicum_annuum 8
Zingiber_officinale 15
Curcuma_longa 30
Pandanus_amaryllifolius 37
Allium_fistulosum 3
Xanthosoma_sagittifolium 24
Allium_schoenoprasum 4
Lycopersicon_esculentum 51
Jatropha_curcas 6
Solenostemon_scutellarioides 7
Aleurites_moluccana 27
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Zea_mays 14
Erythrina_subumbrans 10
Gliricidia_sepium 13
Pennisetum_purpureum 41
Cocos_nucifera 25
Heliconia_indica 11
Nicotiana_tabacum 47
Saccharum_officinarum 46
Cucurbita_pepo 31
Artocarpus_heterophyllus 36
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Vigna_unguiculata 20
Ipomoea_aquatica 21
Ananas_comosus 35
Nephelium_lappaceum 40
Durio_zibethinus 12
Citrus_reticulata 19
Mangifera_indica 34
Psidium_guajava 17
Citrus_maxima 18
Syzygium_aqueum 16
Carica_papaya 38
Persea_americana 1
Musa_paradisiaca 39
Solanum_aethiopicum 50
0

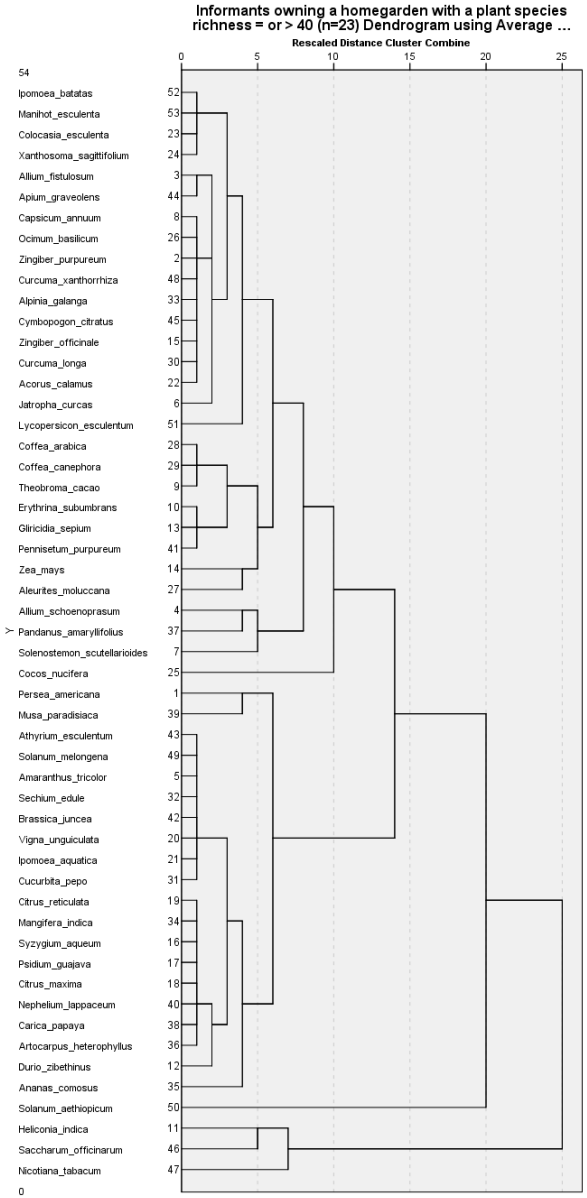

Male informants (n=29) Dendrogram using Average ...
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Zingiber_purpureum 2
Curcuma_xanthorrhiza 48
Zingiber_officinale 15
Curcuma_longa 30
Alpinia_galanga 33
Acorus_calamus 22
Capsicum_annuum 8
Ocimum_basilicum 26
Apium_graveolens 44
Cymbopogon_citratus 45
Allium_fistulosum 3
Lycopersicon_esculentum 51
Pandanus_amaryllifolius 37
Aleurites_moluccana 27
Erythrina_subumbrans 10
Gliricidia_sepium 13
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Pennisetum_purpureum 41
Jatropha_curcas 6
Zea_mays 14
Allium_schoenoprasum 4
Solenostemon_scutellarioides 7
Cocos_nucifera 25
Carica_papaya 38
Musa_paradisiaca 39
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Ipomoea_aquatica 21
Cucurbita_pepo 31
Vigna_unguiculata 20
Citrus_reticulata 19
Mangifera_indica 34
Syzygium_aqueum 16
Psidium_guajava 17
Citrus_maxima 18
Nephelium_lappaceum 40
Artocarpus_heterophyllus 36
Persea_americana 1
Durio_zibethinus 12
Ananas_comosus 35
Solanum_aethiopicum 50
Heliconia_indica 11
Saccharum_officinarum 46
Nicotiana_tabacum 47
0

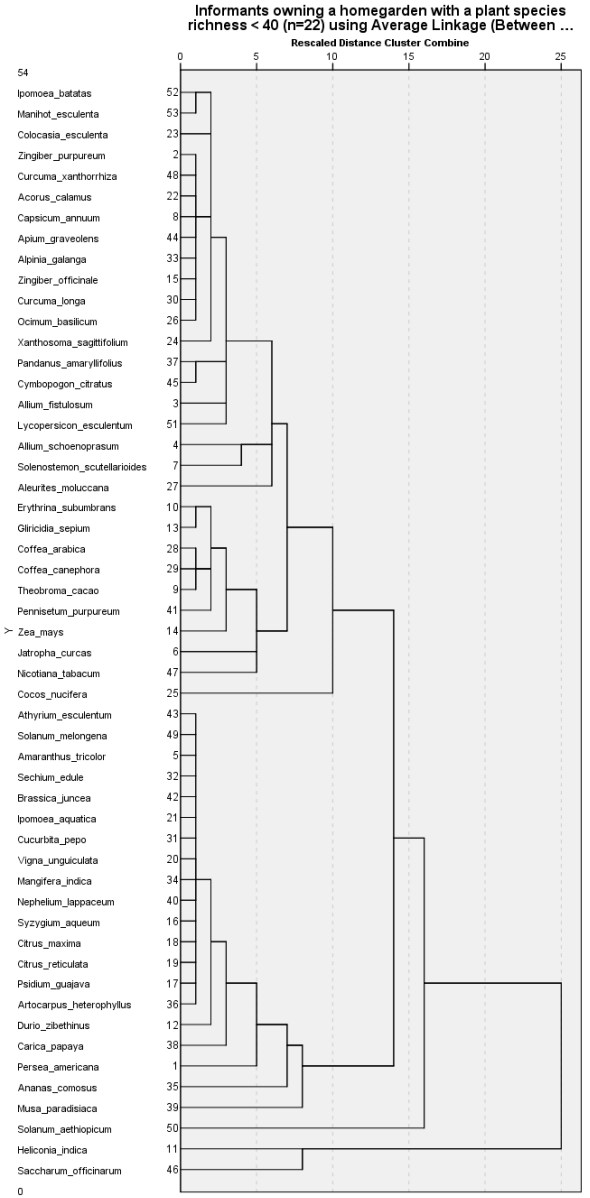

Informants ethnicities Napu and Besoa (n=23)
Dendrogram using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine
0
5
10
15
20
25
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Allium_fistulosum 3
Allium_schoenoprasum 4
Zingiber_purpureum 2
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Jatropha_curcas 6
Ocimum_basilicum 26
Alpinia_galanga 33
Capsicum_annuum 8
Apium_graveolens 44
Zingiber_officinale 15
Curcuma_longa 30
Solenostemon_scutellarioides 7
Pandanus_amaryllifolius 37
Cymbopogon_citratus 45
Lycopersicon_esculentum 51
Aleurites_moluccana 27
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Pennisetum_purpureum 41
Heliconia_indica 11
Erythrina_subumbrans 10
Gliricidia_sepium 13
Nicotiana_tabacum 47
Zea_mays 14
Cocos_nucifera 25
Ananas_comosus 35
Carica_papaya 38
Solanum_melongena 49
Solanum_aethiopicum 50
Amaranthus_tricolor 5
Brassica_juncea 42
Athyrium_esculentum 43
Vigna_unguiculata 20
Sechium_edule 32
Ipomoea_aquatica 21
Cucurbita_pepo 31
Citrus_reticulata 19
Mangifera_indica 34
Durio_zibethinus 12
Psidium_guajava 17
Citrus_maxima 18
Syzygium_aqueum 16
Nephelium_lappaceum 40
Artocarpus_heterophyllus 36
Persea_americana 1
Musa_paradisiaca 39
Saccharum_officinarum 46

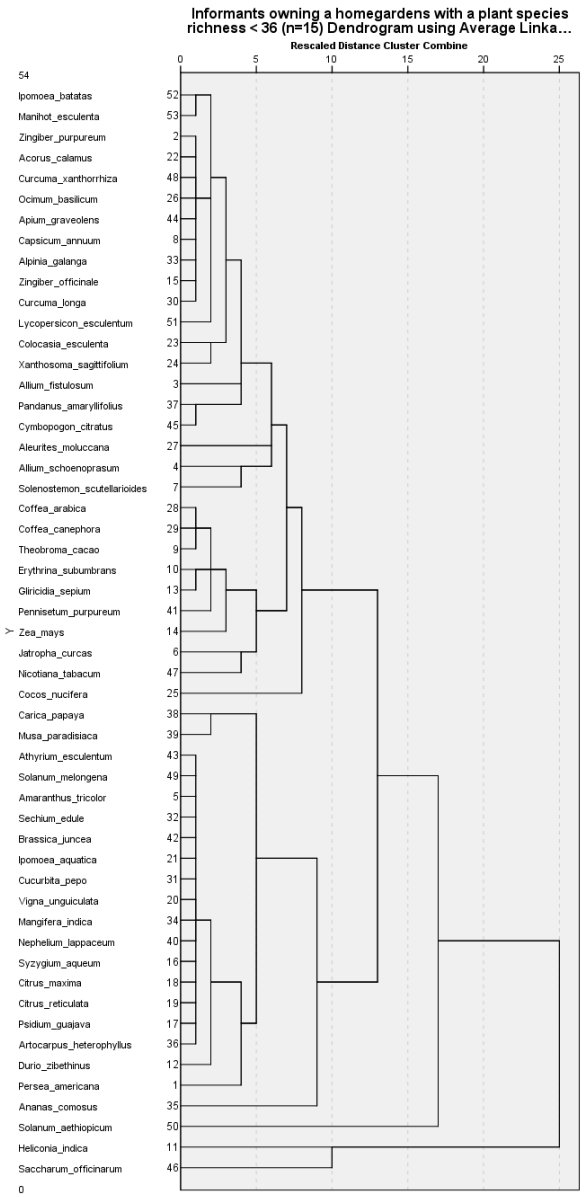

Informants other ethnicity (not Napu/Besoa) (n=22)
Dendrogram using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine
0
5
10
15
20
25
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Zingiber_purpureum 2
Curcuma_xanthorrhiza 48
Zingiber_officinale 15
Curcuma_longa 30
Alpinia_galanga 33
Cymbopogon_citratus 45
Acorus_calamus 22
Capsicum_annuum 8
Apium_graveolens 44
Ocimum_basilicum 26
Allium_fistulosum 3
Lycopersicon_esculentum 51
Aleurites_moluccana 27
Pandanus_amaryllifolius 37
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Erythrina_subumbrans 10
Gliricidia_sepium 13
Pennisetum_purpureum 41
Zea_mays 14
Jatropha_curcas 6
Cocos_nucifera 25
Allium_schoenoprasum 4
Solenostemon_scutellarioides 7
Persea_americana 1
Durio_zibethinus 12
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Ipomoea_aquatica 21
Cucurbita_pepo 31
Vigna_unguiculata 20
Mangifera_indica 34
Nephelium_lappaceum 40
Syzygium_aqueum 16
Citrus_maxima 18
Citrus_reticulata 19
Psidium_guajava 17
Artocarpus_heterophyllus 36
Carica_papaya 38
Musa_paradisiaca 39
Ananas_comosus 35
Heliconia_indica 11
Nicotiana_tabacum 47
Saccharum_officinarum 46
Solanum_aethiopicum 50

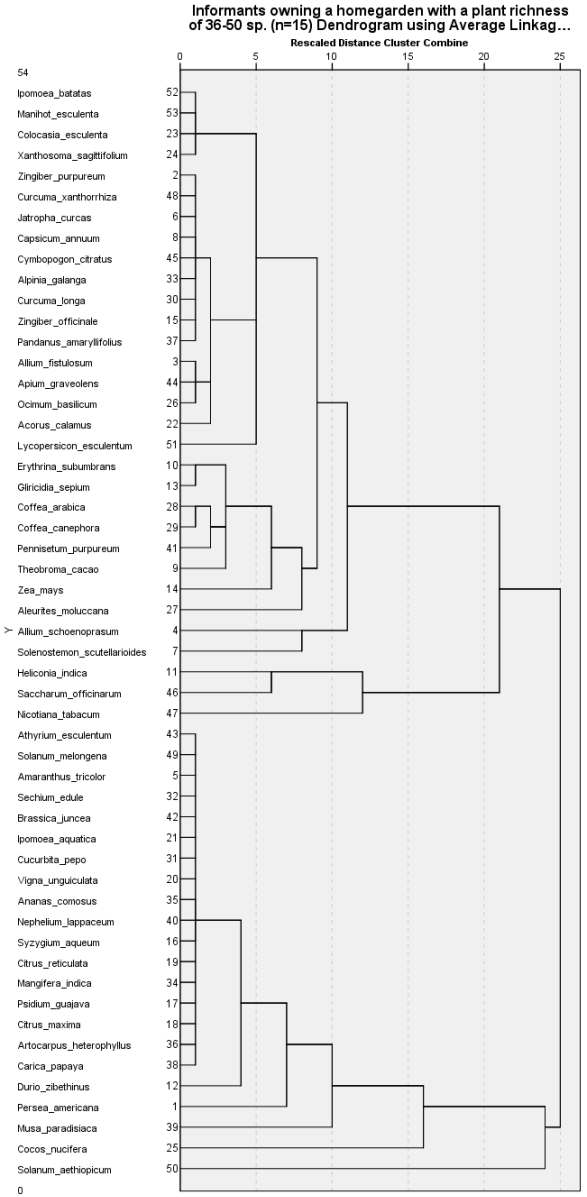

Informants ethnicity Besoa/Behoa (n=6) Dendrogram
using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Zingiber_purpureum 2
Jatropha_curcas 6
Solenostemon_scutellarioides 7
Apium_graveolens 44
Cymbopogon_citratus 45
Allium_schoenoprasum 4
Zingiber_officinale 15
Alpinia_galanga 33
Pandanus_amaryllifolius 37
Capsicum_annuum 8
Ocimum_basilicum 26
Allium_fistulosum 3
Curcuma_longa 30
Nicotiana_tabacum 47
Aleurites_moluccana 27
Erythrina_subumbrans 10
Gliricidia_sepium 13
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Heliconia_indica 11
Zea_mays 14
Pennisetum_purpureum 41
Saccharum_officinarum 46
Solanum_melongena 49
Solanum_aethiopicum 50
Amaranthus_tricolor 5
Brassica_juncea 42
Athyrium_esculentum 43
Cucurbita_pepo 31
Sechium_edule 32
Vigna_unguiculata 20
Ipomoea_aquatica 21
Artocarpus_heterophyllus 36
Nephelium_lappaceum 40
Persea_americana 1
Citrus_reticulata 19
Mangifera_indica 34
Psidium_guajava 17
Citrus_maxima 18
Durio_zibethinus 12
Syzygium_aqueum 16
Lycopersicon_esculentum 51
Ananas_comosus 35
Carica_papaya 38
Cocos_nucifera 25
Musa_paradisiaca 39
0

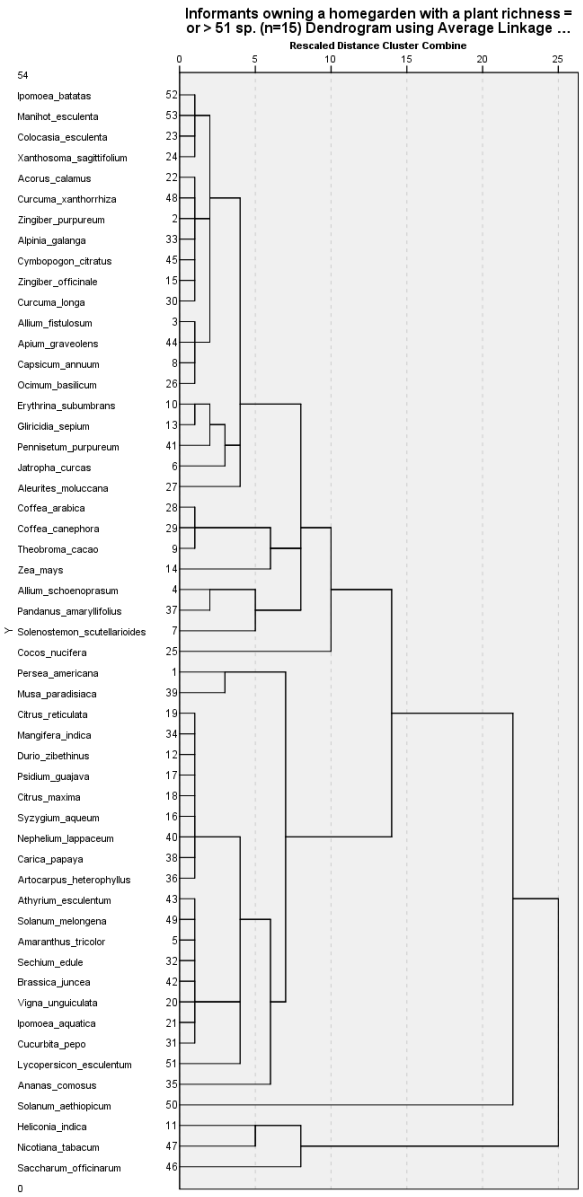

Informants ethnicity Napu/Pekurehua (n=17) Dendrogram
using Average Linkage (Between Groups)
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Allium_fistulosum 3
Allium_schoenoprasum 4
Zingiber_purpureum 2
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Jatropha_curcas 6
Alpinia_galanga 33
Apium_graveolens 44
Capsicum_annuum 8
Ocimum_basilicum 26
Curcuma_longa 30
Zingiber_officinale 15
Lycopersicon_esculentum 51
Solenostemon_scutellarioides 7
Xanthosoma_sagittifolium 24
Pandanus_amaryllifolius 37
Cymbopogon_citratus 45
Aleurites_moluccana 27
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Erythrina_subumbrans 10
Gliricidia_sepium 13
Pennisetum_purpureum 41
Nicotiana_tabacum 47
Zea_mays 14
Cocos_nucifera 25
Solanum_melongena 49
Solanum_aethiopicum 50
Amaranthus_tricolor 5
Brassica_juncea 42
Athyrium_esculentum 43
Vigna_unguiculata 20
Sechium_edule 32
Ipomoea_aquatica 21
Cucurbita_pepo 31
Citrus_reticulata 19
Mangifera_indica 34
Durio_zibethinus 12
Psidium_guajava 17
Citrus_maxima 18
Syzygium_aqueum 16
Nephelium_lappaceum 40
Carica_papaya 38
Artocarpus_heterophyllus 36
Persea_americana 1
Musa_paradisiaca 39
Ananas_comosus 35
Heliconia_indica 11
Saccharum_officinarum 46
0


Informants owning a homegarden with a plant species richness = or > 40 (n=23) Dendrogram using Average ...
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Allium_fistulosum 3
Apium_graveolens 44
Capsicum_annuum 8
Ocimum_basilicum 26
Zingiber_purpureum 2
Curcuma_xanthorrhiza 48
Alpinia_galanga 33
Cymbopogon_citratus 45
Zingiber_officinale 15
Curcuma_longa 30
Acorus_calamus 22
Jatropha_curcas 6
Lycopersicon_esculentum 51
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Erythrina_subumbrans 10
Gilricidia_sepium 13
Pennisetum_purpureum 41
Zea_mays 14
Aleurites_moluccana 27
Allium_schoenoprasum 4
Pandanus_amarylifolius 37
Solenostemon_scutellarioides 7
Cocos_nucifera 25
Persea_americana 1
Musa_paradisiaca 39
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Vigna_unguiculata 20
Ipomoea_aquatica 21
Cucurbita_pepo 31
Citrus_reticulata 19
Mangifera_indica 34
Syzygium_aqueum 16
Psidium_guajava 17
Citrus_maxima 18
Nephelium_lappaceum 40
Carica_papaya 38
Artocarpus_heterophyllus 36
Durio_zibethinus 12
Ananas_comosus 35
Solanum_aethiopicum 50
Heliconia_indica 11
Saccharum_officinarum 46
Nicotiana_tabacum 47
0


Informants owning a homegarden with a plant species richness < 40 (n=22) using Average Linkage (Between ...
Rescaled Distance Cluster Combine
0
5
10
15
20
25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Zingiber_purpureum 2
Curcuma_xanthorrhiza 48
Acorus_calamus 22
Capsicum_annuum 8
Apium_graveolens 44
Alpinia_galanga 33
Zingiber_officinale 15
Curcuma_longa 30
Ocimum_basilicum 26
Xanthosoma_sagittifolium 24
Pandanus_amarylifolius 37
Cymbopogon_citratus 45
Allium_fistulosum 3
Lycopersicon_esculentum 51
Allium_schoenoprasum 4
Solenostemon_scutellarioides 7
Aleurites_moluccana 27
Erythrina_subumbrans 10
Gilricidia_sepium 13
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Pennisetum_purpureum 41
Zea_mays 14
Jatropha_curcas 6
Nicotiana_tabacum 47
Cocos_nucifera 25
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Ipomoea_aquatica 21
Cucurbita_pepo 31
Vigna_unguiculata 20
Mangifera_indica 34
Nephelium_lappaceum 40
Syzygium_aqueum 16
Citrus_maxima 18
Citrus_reticulata 19
Psidium_guajava 17
Artocarpus_heterophyllus 36
Durio_zibethinus 12
Carica_papaya 38
Persea_americana 1
Ananas_comosus 35
Musa_paradisiaca 39
Solanum_aethiopicum 50
Heliconia_indica 11
Saccharum_officinarum 46
0


Informants owning a homegardens with a plant species richness < 36 (n=15) Dendrogram using Average Linka…
Rescaled Distance Cluster Combine
0 5 10 15 20 25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Zingiber_purpureum 2
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Ocimum_basilicum 26
Apium_graveolens 44
Capsicum_annuum 8
Alpinia_galanga 33
Zingiber_officinale 15
Curcuma_longa 30
Lycopersicon_esculentum 51
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Allium_fistulosum 3
Pandanus_amaryllifolius 37
Cymbopogon_citratus 45
Aleurites_moluccana 27
Allium_schoenoprasum 4
Solenostemon_scutellarioides 7
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Erythrina_subumbrans 10
Gliricidia_sepium 13
Pennisetum_purpureum 41
Y Zea_mays 14
Jatropha_curcas 6
Nicotiana_tabacum 47
Cocos_nucifera 25
Carica_papaya 38
Musa_paradisiaca 39
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Ipomoea_aquatica 21
Cucurbita_pepo 31
Vigna_unguiculata 20
Mangifera_indica 34
Nephelium_lappaceum 40
Syzygium_aqueum 16
Citrus_maxima 18
Citrus_reticulata 19
Psidium_guajava 17
Artocarpus_heterophyllus 36
Durio_zibethinus 12
Persea_americana 1
Ananas_comosus 35
Solanum_aethiopicum 50
Heliconia_indica 11
Saccharum_officinarum 46
0


Informants owning a homegarden with a plant richness of 36-50 sp. (n=15) Dendrogram using Average Linkag…
Rescaled Distance Cluster Combine
0 5 10 15 20 25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Zingiber_purpureum 2
Curcuma_xanthorrhiza 48
Jatropha_curcas 6
Capsicum_annuum 8
Cymbopogon_citratus 45
Alpinia_galanga 33
Curcuma_longa 30
Zingiber_officinale 15
Pandanus_amaryllifolius 37
Allium_fistulosum 3
Apium_graveolens 44
Ocimum_basilicum 26
Acorus_calamus 22
Lycopersicon_esculentum 51
Erythrina_subumbrans 10
Gliricidia_sepium 13
Coffea_arabica 28
Coffea_canephora 29
Pennisetum_purpureum 41
Theobroma_cacao 9
Zea_mays 14
Aleurites_moluccana 27
Y Allium_schoenoprasum 4
Solenostemon_scutellarioides 7
Heliconia_indica 11
Saccharum_officinarum 46
Nicotiana_tabacum 47
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Ipomoea_aquatica 21
Cucurbita_pepo 31
Vigna_unguiculata 20
Ananas_comosus 35
Nephelium_lappaceum 40
Syzygium_aqueum 16
Citrus_reticulata 19
Mangifera_indica 34
Psidium_guajava 17
Citrus_maxima 18
Artocarpus_heterophyllus 36
Carica_papaya 38
Durio_zibethinus 12
Persea_americana 1
Musa_paradisiaca 39
Cocos_nucifera 25
Solanum_aethiopicum 50
0


Informants owning a homegarden with a plant richness = or > 51 sp. (n=15) Dendrogram using Average Linkage …
Rescaled Distance Cluster Combine
0 5 10 15 20 25
54
Ipomoea_batatas 52
Manihot_esculenta 53
Colocasia_esculenta 23
Xanthosoma_sagittifolium 24
Acorus_calamus 22
Curcuma_xanthorrhiza 48
Zingiber_purpureum 2
Alpinia_galanga 33
Cymbopogon_citratus 45
Zingiber_officinale 15
Curcuma_longa 30
Allium_fistulosum 3
Apium_graveolens 44
Capsicum_annuum 8
Ocimum_basilicum 26
Erythrina_subumbrans 10
Gliricidia_sepium 13
Pennisetum_purpureum 41
Jatropha_curcas 6
Aleurites_moluccana 27
Coffea_arabica 28
Coffea_canephora 29
Theobroma_cacao 9
Zea_mays 14
Allium_schoenoprasum 4
Pandanus_amaryllifolius 37
Y Solenostemon_scutellarioides 7
Cocos_nucifera 25
Persea_americana 1
Musa_paradisiaca 39
Citrus_reticulata 19
Mangifera_indica 34
Durio_zibethinus 12
Psidium_guajava 17
Citrus_maxima 18
Syzygium_aqueum 16
Nephelium_lappaceum 40
Carica_papaya 38
Artocarpus_heterophyllus 36
Athyrium_esculentum 43
Solanum_melongena 49
Amaranthus_tricolor 5
Sechium_edule 32
Brassica_juncea 42
Vigna_unguiculata 20
Ipomoea_aquatica 21
Cucurbita_pepo 31
Lycopersicon_esculentum 51
Ananas_comosus 35
Solanum_aethiopicum 50
Heliconia_indica 11
Nicotiana_tabacum 47
Saccharum_officinarum 46
0

Appendix IX Results ranking exercise: New homegarden setup - top ten crops

Species	% of the maximal score			% Frequency		
	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)
Acorus calamus	1	1	1	7	7	7
Aleurites moluccana	1	2	0	2	7	0
Allium fistulosum	27	14	34	49	27	60
Allium schoenoprasum	3	0	4	4	0	7
Alpinia galanga	2	0	3	4	0	7
Amaranthus tricolor	7	17	2	13	27	7
Ananas comosus	1	3	0	4	7	3
Apium graveolens	6	3	7	20	20	20
Artocarpus heterophyllus	9	12	7	16	27	10
Diplazium cf. esculentum	0	0	0	0	0	0
Brassica juncea	5	3	6	7	7	7
Capsicum annuum	77	83	74	100	100	100
Carica papaya	12	3	17	22	7	30
Citrus maxima	0	0	0	0	0	0
Citrus reticulata	4	2	5	13	13	13
Cocos nucifera	5	8	3	7	13	3
Coffea arabica	4	7	2	11	13	10
Coffea canephora	7	9	6	16	20	13
Colocasia esculenta	0	1	0	2	7	0
Cucurbita pepo	6	0	8	9	0	13
Curcuma longa	21	30	17	47	53	43
Curcuma xanthorrhiza	0	0	0	0	0	0
Cymbopogon citratus	17	22	15	40	40	40
Durio zibethinus	4	9	2	16	27	10
Erythrina subumbrans	2	7	0	2	7	0
Gliricidia sepium	5	8	3	9	20	3
Heliconia indica	1	0	1	4	0	7
Ipomoea aquatica	4	11	0	7	20	0
Ipomoea batatas	19	25	16	38	47	33
Jatropha curcas	2	7	0	4	13	0
Lycopersicon esculentum	36	23	43	58	33	70
Mangifera indica	5	3	6	9	13	7
Manihot esculenta	51	39	57	76	67	80
Musa x paradisiaca paradisiaca	53	55	52	87	87	87
Nephelium lappaceum	4	8	3	18	33	10
Nicotiana tabacum	0	0	0	0	0	0
Ocimum basilicum	8	3	10	22	7	30
Pandanus amaryllifolius	4	11	0	7	20	0
Pennisetum purpureum	0	0	0	0	0	0
Persea americana	0	1	0	2	7	0
Psidium guajava	4	0	6	4	0	7
Saccharum officinarum	0	1	0	2	7	0
Sechium edule	6	10	4	11	20	7
Solanum aethiopicum	3	0	4	7	0	10
Solanum melongena	27	21	31	51	40	57
Solenostemon scutellarioides	1	0	1	2	0	3
Syzygium aqueum	1	0	2	2	0	3
Theobroma cacao	21	27	18	40	40	40
Vigna unguiculata	13	19	10	22	27	20
Xanthosoma sagittifolium	1	0	1	2	0	3
Zea mays	33	12	43	47	20	60
Zingiber officinale	27	31	25	56	53	57
Zingiber purpureum	1	0	1	2	0	3

Appendix X Results ranking exercise: unimportant plants in a homegarden - removal of ten useless plants

	% of the maximal score			% Frequency		
Species	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)
Acorus calamus	3	5	2	11	20	7
Aleurites moluccana	16	13	18	33	33	33
Allium fistulosum	1	0	1	2	0	3
Allium schoenoprasum	21	53	4	27	67	7
Alpinia galanga	3	7	1	4	7	3
Amaranthus tricolor	3	3	3	7	7	7
Ananas comosus	2	0	3	7	0	10
Apium graveolens	0	0	0	0	0	0
Artocarpus heterophyllus	1	0	2	4	0	7
Diplazium cf. esculentum	50	31	60	82	60	93
Brassica juncea	3	9	0	9	27	0
Capsicum annuum	0	0	0	0	0	0
Carica papaya	0	0	0	0	0	0
Citrus maxima	14	11	16	36	27	40
Citrus reticulata	0	0	0	0	0	0
Cocos nucifera	32	18	40	67	40	80
Coffea arabica	5	1	7	13	7	17
Coffea canephora	4	0	5	11	0	17
Colocasia esculenta	20	12	24	38	27	43
Cucurbita pepo	1	1	1	7	13	3
Curcuma longa	0	0	0	0	0	0
Curcuma xanthorrhiza	2	5	0	4	13	0
Cymbopogon citratus	0	0	0	0	0	0
Durio zibethinus	7	3	9	18	7	23
Erythrina subumbrans	38	7	53	53	13	73
Gliricidia sepium	40	19	51	64	40	77
Heliconia indica	35	80	13	51	100	27
Ipomoea aquatica	1	0	1	2	0	3
Ipomoea batatas	3	0	5	9	0	13
Jatropha curcas	8	13	6	22	33	17
Lycopersicon esculentum	0	0	0	0	0	0
Mangifera indica	3	3	3	7	7	7
Manihot esculenta	2	0	3	2	0	3
Musa x paradisiaca paradisiaca	0	0	0	0	0	0
Nephelium lappaceum	2	1	2	4	7	3
Nicotiana tabacum	38	49	33	76	93	67
Ocimum basilicum	2	1	2	4	7	3
Pandanus amaryllifolius	1	0	1	2	0	3
Pennisetum purpureum	69	49	79	82	67	90
Persea americana	3	4	2	11	13	10
Psidium guajava	16	14	17	33	27	37
Saccharum officinarum	26	19	29	40	27	47
Sechium edule	4	0	6	9	0	13
Solanum aethiopicum	18	48	3	27	73	3
Solanum melongena	1	3	0	2	7	0
Solenostemon scutellarioides	17	43	4	31	73	10
Syzygium aqueum	10	3	14	27	13	33
Theobroma cacao	0	0	1	2	0	3
Vigna unguiculata	0	1	0	2	7	0
Xanthosoma sagittifolium	15	9	18	36	20	43
Zea mays	6	7	5	11	13	10
Zingiber officinale	0	0	0	0	0	0
Zingiber purpureum	3	3	3	9	7	10

Appendix XI Results ranking exercise: favourite useful plants - general top five crops

Species	% of the maximal score			% Frequency		
	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)	All respondent (n=45)	Hindu (n=15)	Non-Hindu (n=30)
Acorus calamus	0	0	0	2	0	3
Aleurites moluccana	0	0	0	0	0	0
Allium fistulosum	2	3	2	11	13	10
Allium schoenoprasum	0	0	1	2	0	3
Alpinia galanga	0	0	0	0	0	0
Amaranthus tricolor	0	0	0	0	0	0
Ananas comosus	0	0	0	0	0	0
Apium graveolens	0	0	0	0	0	0
Artocarpus heterophyllus	1	3	0	7	20	0
Diplazium cf. esculentum	0	0	0	0	0	0
Brassica juncea	0	0	0	2	0	3
Capsicum annuum	26	26	25	91	93	90
Carica papaya	1	0	1	2	0	3
Citrus maxima	0	0	0	0	0	0
Citrus reticulata	0	0	1	2	0	3
Cocos nucifera	4	8	1	9	20	3
Coffea arabica	5	11	2	18	33	10
Coffea canephora	12	17	10	40	53	33
Colocasia esculenta	0	0	0	0	0	0
Cucurbita pepo	1	0	1	4	0	7
Curcuma longa	1	3	1	4	7	3
Curcuma xanthorrhiza	0	0	1	4	0	7
Cymbopogon citratus	0	0	0	0	0	0
Durio zibethinus	2	2	2	9	13	7
Erythrina subumbrans	0	1	0	2	7	0
Gliricidia sepium	0	0	1	2	0	3
Heliconia indica	0	0	0	0	0	0
Ipomoea aquatica	0	0	0	0	0	0
Ipomoea batatas	2	3	2	11	7	13
Jatropha curcas	0	0	0	0	0	0
Lycopersicon esculentum	6	4	7	29	20	33
Mangifera indica	0	0	0	0	0	0
Manihot esculenta	14	8	16	44	20	57
Musa x paradisiaca paradisiaca	8	16	4	31	53	20
Nephelium lappaceum	0	0	0	0	0	0
Nicotiana tabacum	0	0	0	0	0	0
Ocimum basilicum	0	0	0	0	0	0
Pandanus amaryllifolius	0	0	0	0	0	0
Pennisetum purpureum	0	0	0	0	0	0
Persea americana	1	0	1	2	0	3
Psidium guajava	0	0	0	0	0	0
Saccharum officinarum	0	0	0	0	0	0
Sechium edule	0	1	0	2	7	0
Solanum aethiopicum	0	0	0	0	0	0
Solanum melongena	3	4	2	11	13	10
Solenostemon scutellarioides	0	0	0	0	0	0
Syzygium aqueum	0	0	0	0	0	0
Theobroma cacao	37	31	40	91	80	97
Vigna unguiculata	1	2	0	2	7	0
Xanthosoma sagittifolium	0	0	0	0	0	0
Zea mays	21	7	28	56	27	70
Zingiber officinale	1	1	1	7	7	7
Zingiber purpureum	0	0	0	0	0	0