



**SYSTEMATIC CONSERVATION PLANNING
OF WILD RELATIVES OF FOOD CROPS IN INDONESIA**

By

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Declaration

Chapter 2 has already been published in the Genetic Resources and Crop Evolution. The work presented in Chapters 3 and 4 has been submitted for publication in the Biodiversity and Conservation and Global Ecology and Conservation, respectively. The text of those three chapters is identical to the manuscripts prepared for publication.

All the chapters were written by me and represent my own work.

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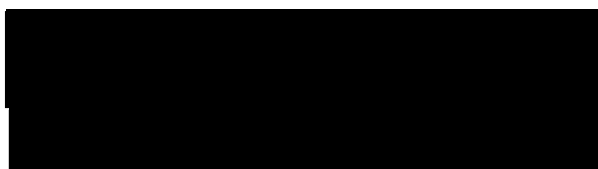
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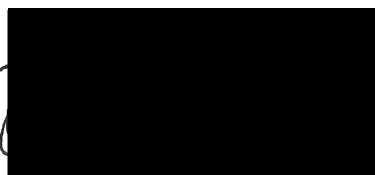
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ABSTRACT

The increasing demand for food by the global population and the uncertainty of global environmental changes in the future require our attention to anticipate for the worst scenario, the global collapse of the living systems on Earth. Crops, as the main source of human food, should be maintained to increase their yields and resiliency to sustain the future of food security when most of the production system components become more limited and degraded. Therefore, crop improvement is a crucial step to boost their production capacity. For this, a wide range of genetic diversity is required to develop new varieties since genetic drift/bottleneck syndromes tend to lower the crop resilience capacity. One of a promising and increasingly used source as the plant genetic resources for crop improvement is Crop Wild Relatives (CWR).

CWR as wild species are threatened by anthropogenic disturbances. Conservation of these resources is a key to preserve their existence and prolong their availability for crop improvement. Then, systematics conservation planning is required for efficiency and effectiveness of the allocation of conservation resources and to mainstream in the development sectors. Since food security and environmental protection are national responsibilities, conservation planning of CWR at the national level will support the country's achievement for the global agendas. Indonesia, as a country with serious problems with biodiversity degradation and food insecurity, not yet have systematic conservation planning for its CWR. Therefore, this study aims to fill this gap.

Systematic conservation planning of CWR for food crops in Indonesia was developed by several steps such as setting the priorities of CWR, conservation gap analysis in current in situ and ex situ conservation, climate change impact analysis, and novel threat assessment. About 1,968 taxa were identified as CWR of food crops. 234 of them were selected as national priorities. 66% of the priority CWR have no recorded ex situ collections. 28% have no presence records within the existing protected area network although 60 of them are predicted to exist in the existing protected area based on their predicted distribution model. At least, 40 complementary protected areas are required to conserve those CWR with records within the existing protected area. These 40 complementary areas are suggested as the initial areas for CWR genetic reserves network in Indonesia. The climate change impact analysis found that one to six of priority CWR, depend on the scenario, are predicted to have a significant negative

impact in terms of their distribution range contraction. The existing protected areas that serve as climatic refugia and those containing holdouts population were identified for their in situ and ex situ conservation action targets. About 127 of priority CWR have novel threat assessments. 40 taxa are threatened, 32 are Near Threatened, 31 taxa are Least Concern, and 24 taxa are Data Deficient. 62% of threatened CWR inhabit the Sundaland area, one of the global biodiversity hotspots.

The result of this study is a starting point for more discussion and comprehensive conservation planning of CWR that included more stakeholders. Feedbacks from all the related stakeholders will improve the conservation planning. The establishment of this conservation planning and its implementation will provide a path for effective long term conservation of CWR in Indonesia.

For Abdurachman (late), E. Kusmiati, Marisa, Qanita, Jaka and Naura

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CHAPTER 1

GENERAL INTRODUCTION

1.1. Planetary boundaries and food security

The future existence of humanity and biodiversity depends on the sustainability of the earth systems (Rockström *et al.*, 2009; Chapin *et al.*, 2011; Foley *et al.*, 2011; Steffen *et al.*, 2015). The growing human population requires more resources to fulfil their need while the availability of the resources themselves are limited. Moreover, the activity to search and use the resources had caused ecosystem degradation (Chapin *et al.*, 2011). As consequences, the earth systems will shift to a new state of stability or totally fail to support all the living systems within (Steffen *et al.*, 2015; Brooks, Ellis and Buettel, 2018; Garnett, 2018; Montoya, Donohue and Pimm, 2018). The concept of planetary boundaries framework aims to develop a warning system of the earth systems capacity to response environmental changes, primarily the biophysical component, by the human activity (Steffen *et al.*, 2015). Using the Holocene state as the baseline for calibrating the stable condition, a safe operating space was defined (Steffen *et al.*, 2015). They found that two of nine of the earth systems processes, biogeochemical flows and biosphere integrity, have exceeded the safe limit at the global level. Even though, they said that these two components do not directly affected the probability of the earth system to shift to dangerous risk level, it warned us that the systems are weakening (Steffen *et al.*, 2015). However, Brook and collabolators (2018) revealed that the threshold values used to define the safe limit for the nine earth system processes is based on unclear theoretical mechanism, without any evidences and speculative, except for the climate change and ocean acidification. Lenton and William (2013) argued that in biosphere, the possible threshold value of safe space or tipping points, in the past, occurred at local scale and required long period as in the shifting of gymnosperms by the angiosperms. Therefore, it is unlikely to up-scale the local biosphere regime shifts into planetary scale. However, despite these debates, they all agreed that the biosphere needs our stewardships (Chapin *et al.*, 2011; Steffen *et al.*, 2011; Lenton and Williams, 2013; Brooks, Ellis and Buettel, 2018).

Since entering the Anthropocene, the relationship of human–nature became much more in disharmony (Chapin *et al.*, 2011; Ellis, 2015). Considering this, a global movement to re-integrate human society with the nature accumulated in the early of the current century was flagged by the Millennium Ecosystem Assessment (2005). This then become the precursor for the global assessment of The Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (Bridgewater *et al.*, 2019). These reports put the human sociocultural as part of the ecosystems and agent of its changes to what Ellis (2015) called as Anthroecology.

The concept of Anthropocene, as a new geological epoch, has triggered a new perspective in many interdisciplinary subjects including conservation science and social science. Based on Steffen and collaborators (2007), since 2015, the Anthropocene has entered its third stage. After industrial era (the first stage of Anthropocene: 1800-1945) and following its great acceleration era (the second stage of Anthropocene: 1945-2015), now in third stage, science and technology are fostering to cope the unpredictable environmental changes in the future. Since then, some critics have been thrown when the concept has reached the global policies level. In conservation science, Montoya and collaborators (2018) criticised the planetary boundary, as the idea that birth from this concept, to be harmful to biodiversity conservation when it is used as the background to develop policies. They argued that the idea is lacking operational definition for the local environmental managers, potentially lowering the credibility of science as an objective source in developing policies, and potentially increasing ecological ignorance society when their activity is yet to reach the planetary safe limits. In social science, Löwbrand and collaborators (2015) criticised this concept to paradoxically place the nature as an external object to humankind, neglected the social dynamics as an inherent part of humanity, and reduced the political space to articulate more debates to the policies by consensus that are driven mostly by the techno-environmentalists. Rather than accepting the concept of Anthropocene, some other social scientists gave alternative concepts such as Capitalocene (Moore, 2017), Chthulucene (Haraway, 2016), or Plantationocene (Davis *et al.*, 2019) to challenge that the Anthropocene is just a concept directed by the capitalist society to prolong their hegemony. The multidimensional of the global food system is one frequently used arena for contesting those concepts (Moore, 2015; Vivero-Pol, 2017; Beacham, 2018; Figueroa-Helland, Thomas and Aguilera, 2018; Willett *et al.*, 2019). However, contesting such concepts actually do not resolve the problems to anticipate the future of our food security.

The global population is expected to reach more than 10 billion in the end of this century (United Nations Department of Economic and Social Affairs Population Division, 2019). Kearney (2010) predicted the rates of the global food consumption will increase 30% by the year 2050. It means that the future population will need more food regarding the number of people to feed and consumption rates per capita. On the other hand, the food production systems are at the risk to respond the future demand because of the uncertainty of environmental changes, limitation of input resources and unsustainable producing practices (Foley *et al.*, 2011; Foresight, 2011; Willett *et al.*, 2019; Rockström *et al.*, 2020). Foley and collaborators (2011)

stated that global productions of 174 crops were increased only 28% between the year 1985–2005. A significant increase (up to 47%) was only showed in the production of global major crop groups, such as cereals, oil crops, fruits, and vegetables (Foley *et al.*, 2011). They also stated that the harvested area for the global crops increased approximately three times of the global crop land size within the same period but the yields of global crops within 1985–2005 declines in comparison to the previous period (1965–1985). Foresight (2011) found that the global agricultural land size to produce food per capita decreased from 1.3 ha to only 0.7 ha over the period 1967–2007 but it caused large conversion of natural habitats, from temperate grassland to tropical forest (Foley *et al.*, 2011). In recent decades, most of the new expansion of agricultural land occurred in tropical forests, such as in Argentina, Brazil and Indonesia (Fisher, 2018). As a consequence, the global carbon storage has decreased, the Green House Gases (GHG) emissions and biodiversity loss increased (Foley *et al.*, 2011). Moreover, unsustainable practices of agricultural intensification by using excessive inputs, such as fertilizers (mainly Nitrogen and Phosphorus), pesticides, fuels, and fresh water, degraded environmental quality (Foley *et al.*, 2011). On the other hand, these practices increased price volatility of agricultural products in most global regions (Strzepek and Boehlert, 2010; Woods *et al.*, 2010; Obersteiner *et al.*, 2016). Therefore, our future food security is at high risk.

Food security is included as one of the goals of the global agenda of Sustainable Development Goals (SDGs) (UN, 2019b). At least, five goals in SDGs are related to food security (goals 1, 2, 3, 12,13, and 15) but explicitly stated in goal number 2 (UN, 2019b). Based on the recent report of the SDGs, since 2014, the number of undernourished people is continuing to increase, $\frac{2}{3}$ of them are living in Sub-Saharan Africa and South Asia, and $\frac{2}{3}$ extremely poor-employed workers are working in the agricultural sector (UN, 2019b). The report also stated that: small-scale agriculture holders are part of important solutions to achieve the goals but their income is unequally lower than the larger holders, food prices are extremely high in several regions in Africa and Central America pushing people into food insecurity, and most countries worldwide are lacking investment on agricultural sectors (UN, 2019b).

At political level, the unequal income of the small-scale food producers and food price volatility driven by the liberalization of trades were used as the motive of the food sovereignty movement, an opposite concept to food security (Giménez and Shattuck, 2011). This food movement concept try to embrace the prestige and independency of the local food system over the global food corporate regime that frequently uses the food security framework to legalize

their operations to drive the global markets (Giménez and Shattuck, 2011; Wittman, 2011). Actually, the SDGs, since it declared, already accommodated those values of what food sovereignty offers.

Contrasting the ideas was also used by the French initiatives to build scenarios to anticipate the future of food security, of what they called it as Agrimonde project (INRA and CIRAD, 2009; Hubert *et al.*, 2010; Paillard *et al.*, 2014). Two scenarios are proposed by this project: Agrimonde GO (Global Orchestration) and Agrimonde 1. The Agrimonde GO basically put the global economic growth as the priority, while the opponent is largely prioritizing the ecosystem sustainability (Hubert *et al.*, 2010; Paillard *et al.*, 2014). Considering the strength and weakness of those two scenarios, a win-win solution could be achieved when technological advancement based on Agrimonde GO could be applied to minimize the regional institutional capacity barriers in Agrimonde 1 and therefore, local food productions, with its diversity of products and related socio-cultures, can be used to reduce the number of hunger people (Hubert *et al.*, 2010).

1.2. Agricultural biodiversity and crop wild relatives

Agrobiodiversity is a key component of the future food security (Thrupp, 2000; Khoury *et al.*, 2014; FAO, 2019). Based on the FAO report (2019), biodiversity for food and agriculture is formally defined as “*the variety and variability of animals, plants and micro-organism at the genetic, species and ecosystem levels that sustain the ecosystem structures, functions and processes in and around production systems, and that provide food and non-food agricultural product*”. The report found that agrobiodiversity integrity at genetic, species and ecosystem levels tend to decline globally. Whilst, at the same time, their use for environmental-friendly practices in agriculture are increasing. Therefore, effective management policies are required to maintain sustainable use and effective long term conservation of agrobiodiversity at national and global level.

About 381,910 vascular plants have been estimated globally (Willis, 2017) but only 6,100 have been recorded in cultivation (IPK Leibniz Institute, 2020). Previously, FAO (1993) estimated that 10,000–50,000 plant species are edible but only 150–200 species have significant global production, out of which, only 30 are used as major food sources of the global population (Hammer *et al.*, 2003). The diversity of crop species has been declining globally over the years 1961–2009 (Khoury *et al.*, 2014). Many foreign crops, i.e. crops that originally came from

different world regions where they are known as the centre of their diversity, were cultivated and shifted the local crop species in most countries (Khoury *et al.*, 2015). As a consequence, their *in situ* genetic variation is at risk and there is an increase interdependence among countries (main native range countries vs. main crop producer countries) considering their crop genetic resources and food supply (Khoury *et al.*, 2016).

Declining trends of plant diversity were also reported at genetic level through genetic erosion within the crop species (FAO, 2019). Genetic diversity of crops were already narrowing since they began to be domesticated, known as bottleneck effect or genetic drift (Doebley *et al.*, 2006; Burke *et al.*, 2007). They become much narrow after intensive breeding programs in order to produce superior crop varieties to meet consumer preferences. This process tend to lower the resiliency of the crop to cope with the environmental changes, pests and/or new strain of pathogens (Warschefsky *et al.*, 2014). The crops' genetic vulnerability also increases when one or few modern varieties dominates and eliminates the other locally adaptive varieties in cultivation areas (FAO, 2019). To re-gain genetic diversity of such crops, breeding programs will required broad ranges of genetic resources. One of promising resources is their wild relatives (Maxted *et al.*, 1997, 2006; Ford-Lloyd *et al.*, 2011; Warschefsky *et al.*, 2014; Kell *et al.*, 2017; Zhang *et al.*, 2017).

Crop wild relatives (CWR) are wild plants closely related to crops. Genepool concept (Harlan and de Wet, 1971) or taxon group concept (Maxted *et al.*, 2006) define the relatedness of the wild relatives to the crop. In genepool concept, relatedness is defined by the ability to intercross between wild relatives and their related crop. Whilst, in taxon group it is defined by the taxonomy proximity. Genepool concept divides the wild taxa into three different genepools: primary, secondary, and tertiary (Fig. 1.1). Taxa in the primary genepool (GP-1A and GP-1B) are the easiest to intercrossing with the related crop. GP-1A is the cultivated races or the crop itself, whilst GP-1B is wild form or weedy races of the crop. Secondary genepool (GP-2) includes taxa that could intercross with the related crop, but the hybrid tend to be sterile or has abnormal chromosome pairing as the reproduction barrier exists. Tertiary genepool (GP-3) includes taxa that are hard to hybridize to the related crop by conventional techniques, therefore requiring advanced procedures. In taxon group concept, taxa were divided into five groups (Fig. 1). Taxon Group (TG)-1A which is the crop. TG-1B comprises the taxa under the same species of the related crop. TG-2 includes taxa under similar series or section to the related crop. TG-3

are those taxa under the same subgenus to the crop. TG-4 are those taxa under the same genus to the crop. TG-5 are taxa under the same tribe of the crop.

Vavilov (1926) was a pioneer who identified the importance of CWR as genetic resources for crop improvement. His original work identified five global regions as the centre of origin of crops but then he revised it and broaden the area into 8 regions with some sub regions (Vavilov, 1935). The eight Vavilov main regions are China, India, Central Asia, Near East, Mediterranean, Abyssinia, Central America, and South America. Since then, some other authors (Harlan, 1971; Zeven and Zhukovsky, 1975; Purugganan and Fuller, 2009; Meyer, DuVal and Jensen, 2012) developed his idea and produced different maps. Rather than using the term “centre of origin”, Purugganan and Fuller (2009) and Meyer and collaborators (2012) used “centre of domestication” to encompass the most active regions where plant domestication took place. Purugganan and Fuller (2009) specified 13 main regions and 11 sub-regions of plant domestication. Vincent (2016) elaborated those concepts using 1261 CWR and found that the Vavilov concept has the greatest similarity to the hotspots of the 1261 global CWR.

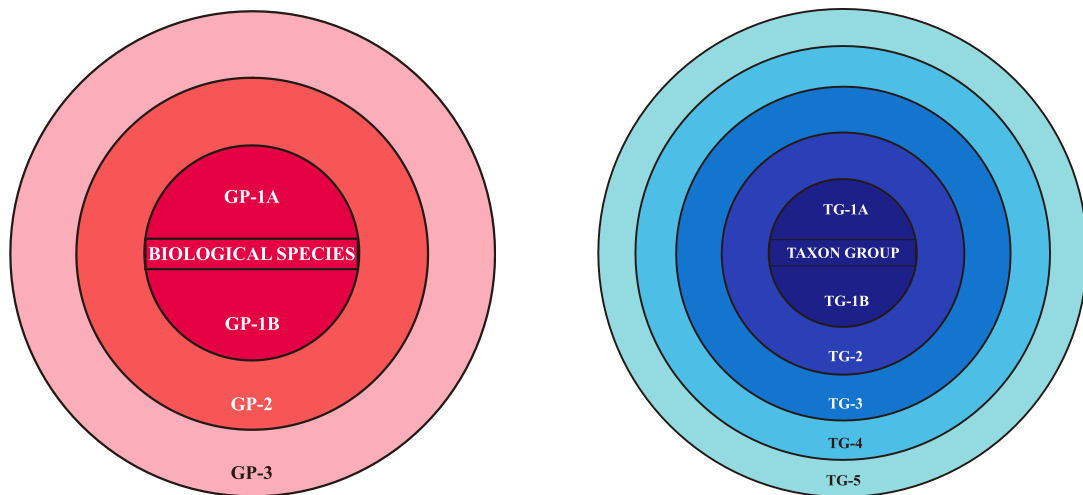


Fig. 1.1 Diagrams of CWR relatedness categories based on genepool concept (Harlan and de Wet, 1971) and taxon group concept (Maxted *et al.*, 2006).

CWR provide genes related to desired traits for future crop improvement (Warschefsky *et al.*, 2014; Zhang *et al.*, 2017). Those traits, such as pest and disease resistance, abiotic tolerance, yield improvement, and quality improvement have been used to develop crop

cultivars (Maxted and Kell, 2009). Trend to use CWR as gene donors is increasing as new techniques on plant breeding become more available to reduce the reproductive barriers (Bevan *et al.*, 2017; Prohens *et al.*, 2017; Zhang *et al.*, 2017). Pimentel and collaborators (1997) estimated the contribution value of CWR in global crop improvement for US\$ 115 billion per year. This value could be much higher since large potential of CWR are still under-explorer. Recent global conservation gap analysis of CWR revealed that CWR in both of *in situ* conservation (Vincent *et al.*, 2019) and *ex situ* conservation (Castañeda-Álvarez *et al.*, 2016) are still under-represented. Therefore, systematic conservation planning to conserve CWR at individual crop, national, regional, and global level becomes more essentials (Maxted *et al.*, 2007; Maxted and Kell, 2009; Vincent *et al.*, 2013; Castañeda-Álvarez *et al.*, 2016; Kell *et al.*, 2016; Kell *et al.*, 2017).

1.3. Systematics conservation planning of crop wild relatives

Systematic conservation planning (SCP) as a subdiscipline in conservation biology offers a scientific framework to guide conservation actions to achieve specific conservation goals (Margules and Pressey, 2000; Pressey *et al.*, 2007; Kukkala and Moilanen, 2013). It is a dynamic process of structured procedures on delivering required conservation actions to be effective and efficient by considering continue feedback and arguments at every stage as a baseline for the decisions (Margules and Pressey, 2000). Basically, SCP is a spatial oriented framework to efficiently identify, prioritize, design and maintain conservation areas of specific targets (Margules and Pressey, 2000; Pressey *et al.*, 2007; Kukkala and Moilanen, 2013).

Sustainable use and long term persistence of genetic diversity are the goal of CWR conservation. It is backed-up by international agreements and global agendas such as the Convention on Biological Diversity (CBD) (United Nations, 1992), Sustainable Development Goals (SDGs) (UN, 2019b), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (FAO, 2009), Global Strategy for Plant Conservation (GSPC) (UNEP, 2002), the Aichi biodiversity targets (UNEP, 2010) and the Second Global Plan Action for the Conservation and Sustainable Utilization of PGRFA (FAO, 2011). The Aichi biodiversity targets explicitly states the need to maintain CWR as important elements of biodiversity in target 13 (UNEP, 2010). The GSPC sets up an ambitious target for CWR conservation in target

9: that “by 2020, 70% of genetic diversity of crops and their wild relatives were conserved and maintained” (Sharrock, 2012).

The second report of the *State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2010) stated that the number of CWR decreased in some protected areas, whilst collecting rates for ex situ conservation is increasing. Maxted and Kell (2009) indicated that CWR are threatened in their habitats by multiple factors such as deforestation, logging, land clearing for expansion of agricultural land and forestry, desertification, wildfire, urbanization and climate change. On the other hand, Vincent and collaborators (2013, 2019) and Castañeda-Álvarez and collaborators (2016) suggested that the current conservation efforts to conserve CWR should obtain more attention globally as well as at national level. Conservation programs of CWR at national level will support the achievement of the country to the international agenda such as CBD and SDGs as those agenda are national responsibilities.

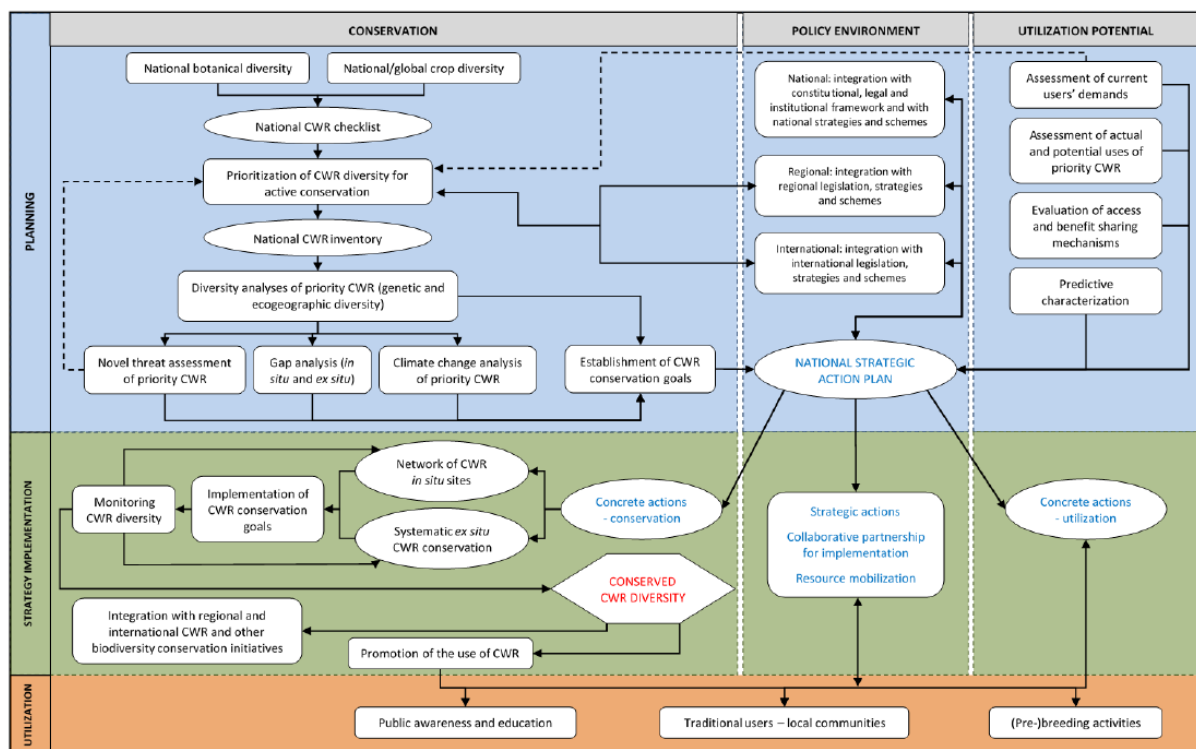


Fig. 1.2 Model for implementation national CWR conservation strategies (reproduced from Magos Brehm et al. (2017)).

Maxted and collaborators (2016) and Magos Brehm and collaborators (2017) developed a model for sustainable use and conservation of CWR at national level. This strategic model

consists of three sections (planning, implementation and utilization) and two directions (conservation, policy environment and utilization potential), as seen in Fig. 1.2. Based on this model, conservation planning plays a fundamental role to create national strategic action plans (or national strategies) and for its implementation, as well as for the sustainable utilization of CWR. The structure of conservation planning in the strategic model is in congruence with those described by Margules and Pressey (2000), Pressey and Bottrill (2009) and McIntosh and collaborators (2017). Feedbacks loop to revise the previous steps shows that the conservation planning process in the model is dynamic. Pressey and Bottrill (2009) and McIntosh and collaborators (2017) incorporated socio-economic value and threats as one step in of SCP as well as in the model (Magos Brehm *et al.*, 2017). In the model, the inclusion of socio-economic value appeared at the process of prioritization where user/stakeholder demands were accommodated. The harmonization of conservation planning between national, regional and international policies was also incorporated in the model. The model also incorporated the climate change analysis in SCP, one step that did not exist previously in the original framework of SCP (Margules and Pressey, 2000; Pressey and Bottrill, 2009). It shows that the model was much more developed.

1.4. Plant conservation in Indonesia

Indonesian archipelago contains more than 17,000 islands, which lay between Asia mainland and Australia. A tectonic plate model (Hall, 2009; Crayn *et al.*, 2015; Kooyman *et al.*, 2019; Joyce *et al.*, 2020) shows that the Asian and Australian element influenced the Indonesian flora. Van Welzen and collaborators (2011) divided the area into three phytogeographic regions: Sunda Shelf in the western part, Wallacea in the centre and Sahul Shelf in the eastern part. Crayn and collaborators (2015) indicated that the migration of flora to the eastern part of the region (Sunda to Sahul) were higher than the opposite. Besides the biogeographic histories, Kooyman and collaborators (2019) stated that the evolutionary speciation played a significant role to shape the rainforest in this region. Roos and collaborators (2004) found that the highest rate of endemism in this region occurred in New Guinea and Borneo Island.

Kartawinata (2013) divided the vegetation in Indonesia into 57 different types based on ecogeographical conditions such as climate, elevation, water condition and soil type. Fifty vegetation types occur in the ever-wet climate (annual precipitation between 1,000–7,100 mm)

and the remaining seven types occur in the monsoon climate (annual precipitation 700–2,900 mm). Based on the elevation distribution, the vegetation can be classified as littoral (mangrove zone), lowland zone (0–1,000 m), montane zone (1,000–3,800 m), subalpine zone (3,800–4,000 m), and alpine zone (> 4,000 m). The alpine zone only can be found in the Papua (Indonesian part of New Guinea island).

About 35,000–40,000 vascular plants are estimated in Indonesia (Widjaja *et al.*, 2011). Based on recent estimates of global plants (Willis, 2017) and its proportion in the country (Butler, 2016), the number of vascular plants in Indonesia could reach more than 40,000 species since the discovering of new species from this region is still ongoing.

However, Indonesia has serious problems with forest loss. Holmes (2002) reported the total of forest loss in Indonesia during the periods 1985–1997 reached up to 20 million ha. The top three areas with the greatest forest loss are Kalimantan (Indonesian Borneo), Sumatra and Sulawesi. Between the year 2000–2012, the total forest loss reached up to 6.02 million ha (Margono *et al.*, 2014). The most devastated habitat are the lowland forests (Holmes, 2002; Margono *et al.*, 2014). Wilcove and collaborators (2013) stated that up to 70% of forest areas in Sundaland (refers to area that include the Peninsular Malaya, Sumatra, Java, Borneo and the surrounding small islands within) have decreased in extent in 2010. Sodhi and collaborators (2004) predicted that by the end of this century only a quarter of natural forest will still remain in South East Asia. The expansion of agricultural land both of small and industrial scales, urban development, and wildfires are the major drivers (Sodhi *et al.*, 2004; Margono *et al.*, 2014; Clough *et al.*, 2016).

Indonesia is one of the countries yet to have a national red list for its biodiversity. Based on global assessments of the IUCN Red List of threatened species (IUCN, 2020), only 2,863 vascular plants in Indonesia have been assessed, 640 out of them are threatened. Many of the remaining species, particularly the rare and national endemics have not been assessed. Budiharta and collaborators (2011) found that the intrinsic biological characteristics, habitat loss, and overexploitation are the main drivers that threatens plants population in Indonesia.

1.5. Food security and agrobiodiversity in Indonesia

The agricultural production in Indonesia has shifted from self-sufficiency oriented into global market supplier since early 2000s (Fuglie, 2010). Since then, plantations of exported products such as palm oil, coffee, and cacao were expanded to almost every province in

Indonesia. On the other hand, Indonesia become one of the largest importer of food products such as wheat and soybean (Fuglie, 2010). Macdonald and collaborators (2015) placed Indonesia as one of the top global cropland exchanger countries. This means that the volume and number of imported products have equal value to the harvested area to which exported. In the context of national food security, this condition can be very disadvantageous, particularly for the poor as the global price volatility of food products increases dramatically (Gilbert and Morgan, 2010).

Most of discourses of food security in Indonesia are much pivotal on the economic and politics of rice (Falcon *et al.*, 2004; Winoto and Siregar, 2008; Freedman, 2013; Neilson and Wright, 2017; McCarthy, 2019; Patunru and Ilman, 2019). To understand these problems, the classical study of the nexus of economic, socio-culture, and ecology of agricultural systems in Indonesia by Geertz (1963) is still relevant today as the starting point. Geertz (1963) found that there was dualism of governance in the Indonesian agricultural systems, the traditional farming practices for producing the peoples' foods and industrial plantation scale practices for exported products of the transnational companies, that are historically related to the colonial periods. This practice caused unequal capital investment for the food farming sectors since the colonial period. Just in the period 1970–1980, the investment in food farming sector was increased by government subsidies. As a result, Indonesia became the net rice exporter during this period (Freedman, 2013). However, this status is not long lasting as the practices of the production were high cost input dependence and caused ecological degradation (Freedman, 2013). Even though, the trend of rice production and the yields were increasing since 1980, it is still inadequate to compensate the rapid growth of the population (Winoto and Siregar, 2008). Moreover, the rising rice dependence of people in region that socio-culturally newly adapted to this source, such as in Papua region, or in region where their cropland dominated by the industrial plantations, such as in Kalimantan, has pushing them into food insecurity (Neilson and Wright, 2017).

About 1,010 plant species are known as food sources by the traditional communities in Indonesia (Indonesian authorities for the second report of the state of PGRFA, 2010). Based on crops statistics (FAO, 2018a) about 53 FAO crop items were cultivated in Indonesia. In total, harvested area for these crop items is reached up to more than 41 million ha by 2018 (FAO, 2018a). The top ten of crops with the largest harvested area are rice, oil palm, maize, coconut, cocoa, coffee, soybean, cassava, cashew nut and sugarcane. The FAO crops items are also

including unspecified tropical fruit crops, root and tubers, sugar crops, and vegetables that contains various crop species. In terms of crops for exported products, oil palm, coconut, coffee, pineapples and cocoa are the major items. In contrast, wheat, soybean, garlic, maize, cassava, and rice are the major items for imported products.

1.6. Research objectives

The study aims to establish the baseline of *ex situ* and *in situ* conservation of wild relatives related to food crops in Indonesia as genetic resources to strengthen national and global food security through a systematic conservation strategy. There are four specific objectives:

1. Setting conservation priorities of CWR taxa in Indonesia. This will involve: a. generation of a checklist of CWR, b. prioritization based on socioeconomic value of the related crop and potential utilization.
2. Conservation gap analyses of priority CWR in Indonesia. This will involve: a. data collation, b. species distribution modelling, c. generation of generalist and species-specific ecogeographical land characterization (ELC) maps, d. gap analyses for *ex situ* and *in situ* conservation, e. complementary analysis, f. proposed locations for further surveys and collecting mission for *ex situ* collections.
3. Climate change impact analysis on the distribution range of priority CWR in Indonesia. This will involve: a. species distribution modelling and its validation process, b. choosing the scenarios of future climate, c. development of species distribution models under the present and future of climate change scenarios, d. analysis of changes in the species distribution range, e. identification of the existing protected areas as climatic refugia, f. identification of holdouts population within the existing protected areas.
4. Develop novel national threat assessments for priority CWR taxa. This will involve: a. collation of biological information, use, trade, and existing conservation actions, b. threat assessments.

CHAPTER 2

SETTING CONSERVATION PRIORITIES FOR THE WILD RELATIVES OF FOOD CROPS IN INDONESIA

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2.1 Abstract

Crop wild relatives (CWR) have been increasingly used as a genetic resource in crop improvement programs, thus, their conservation is essential for future sustainable agriculture and food security. Generally, CWR are threatened but their conservation has just recently come to global attention. *Ex situ* conservation (to ensure the availability of material to plant breeders and reintroduction programs) and *in situ* conservation (to permit their natural evolution) need better planning to ensure success. However, Indonesia as one of the important areas for CWR diversity does not yet have specific plans to conserve these resources. The basis for CWR conservation planning is having a prioritized inventory of CWR upon which to focus CWR conservation actions in Indonesia. Therefore, the initial CWR conservation planning steps reported in this paper are CWR checklist development and subsequent prioritization to permit better allocation of resources and time for conservation action. A total of 1968 taxa were recorded as wild relatives of food crops in Indonesia. About 571 (29%) of those taxa are national endemics and 864 (44%) are narrow regional endemics. After prioritization based on the socio-economic value of the related crops and potential utilization for plant breeding, 234 taxa were established as a priority for conservation. Ninety-five of these priority taxa are important at the national and global levels (such as wild relatives of rice, banana, mango, breadfruit, sugarcane, taro, coconut, sweet potato, melon, sorghum, citrus, and aubergine), 69 are important at the national and regional levels (such as wild relatives of tropical fruits and sugar crops), and 70 taxa are important at global level only (such as wild relatives of yam, figs, and raspberry). Those priority taxa are now the target for further CWR conservation action both of *ex situ* and *in situ* gap analyses and the establishment of a systematic conservation planning strategy for effective conservation action in Indonesia.

Keywords: Conservation planning, crop improvement, crop wild relatives, prioritization, socio-economic value.

2.2 Introduction

Crops, as the result of man-assisted evolution, have been managed since the Neolithic periods (Gepts, 2004). Cultivated varieties evolved from their ancestors, a process known as domestication syndromes (Meyer *et al.*, 2012). Trait evolution continues with the creation of modern varieties that now has entered the post-domestication or super domestication era. Advanced technologies can now resolve selection barriers that naturally occur (Arnold, 2004;

Gepts, 2004; Vaughan *et al.*, 2007; Meyer and Purugganan, 2013; Milla *et al.*, 2015). Concomitant with Darwin's theory of evolution (survival of the fittest), some crop varieties cannot adapt to new environments, such as new abiotic condition (temperature, soil properties, precipitation) or biotic interactions (new strains of disease or pests), or cannot comply with human preferences (yield quantity or quality) (Arnold, 2004; Abbo *et al.*, 2014; Milla *et al.*, 2015; Turcotte *et al.*, 2015). With the uncertainty of future climate conditions and increasing food demand from growing populations, the development of new and more resilient crop varieties is becoming a necessity as one of the critical issues of agriculture to feed the 9 billion people in the world estimated for 2050 (Godfray *et al.*, 2012). Broader genetic diversity of resources are thus required due to the genetic bottleneck of modern cultivars of the major crops (Hyten *et al.*, 2006; McCouch *et al.*, 2007). Thus the genetic resources of crop wild relatives have very promising potential (Maxted *et al.*, 2006; Ford-Lloyd *et al.*, 2011).

Wild relatives of crops have been increasingly used as genetic resources for crop improvement (Hajjar and Hodgkin, 2007; Maxted and Kell, 2009; Dempewolf *et al.*, 2017) as new techniques and methods of speeding plant breeding have been developed (Fedoroff *et al.*, 2010; Schaart *et al.*, 2016; Dempewolf *et al.*, 2017; Zhang *et al.*, 2017; Watson *et al.*, 2018). Based on a literature survey, Dempewolf and collaborators (2017) showed that until recently most of the wild relatives have been used to provide traits to cope with susceptibility of crops to biotic stress (pests and diseases resistance). In the future, the use of CWR will increasingly be used for others purposes as information characterization, at a genomic level, becomes widely available (Smith, 2016). However, one of the constraints to their use in breeding programs is the lack of availability of breeding material as collections from diverse locations are generally limited in *ex situ* collections in gene banks (Castañeda-Álvarez *et al.*, 2016) and *in situ* are largely non existent (Maxted *et al.*, 2016). Therefore, more effort for both *ex situ* and *in situ* conservation should be a global priority.

Magos Brehm and collaborators (2017) suggested several steps for development conservation strategies of CWR at a national level. This scheme has been adopted by many countries to develop their national CWR conservation strategy. The Crop Wild Relatives Global Portal (<http://www.cropwildrelatives.org/cwr-strategies/>) and Magos Brehm and collaborators (2017) list the nations or regions that have already created or initiated systematic conservation of CWR. The initial steps in systematic conservation planning of CWR includes the creation of a checklist, prioritization and inventory of the priority CWR (Maxted *et al.*, 2013; Magos

Brehm *et al.*, 2017) The publication of national CWR inventories is a growing response to the need of international collaboration on CWR conservation as Ford-Lloyd and collaborators (2011) suggested. Kell and collaborators (2016) highlighted the relationship between national and regional CWR checklists and inventory of priority CWR in Europe. They explained the importance of national conservation strategies to initiate or complement regional cooperation in CWR conservation. Maxted and collaborators (2016) showed the interconnection between national, regional, and global approaches on conservation planning and action of CWR.

National strategies for CWR conservation in the Southeast Asia region have not been developed yet. Nevertheless, Castañeda-Álvarez and collaborators (2016) identified the Southeast Asia region as a global priority area for further collecting of CWR for *ex situ* conservation. The conservation strategy should be linked the importance of CWR at national, regional, and global level. At national and regional level, CWR can be used to increase genetic diversity of crops due to genetic erosion. While, at the global level, tropical wild relatives from this region are needed for future cultivar development as the future climate is predicted to change in the tropical belt (Sperling *et al.*, 2004; Seidel *et al.*, 2008). There are evidences of crops genetic erosion in this region through genetic uniformity of most cultivated cultivars that reduced the used of local cultivars, for example rice (Thrupp, 2000; Pfeiffer *et al.*, 2006) and taro (Prana *et al.*, 2010) or by converted traditional agricultural systems to modern monoculture systems that reduced the crops diversity on farm (Michon and Mary, 1994; Rerkasem *et al.*, 2009). Thrupp (2000) stated the effect of genetic uniformity of rice had caused outbreaks the epidemic of tungro virus in Indonesia and Philippines in the year 1970 and caused three millions tons of rice yield loss in Indonesia in 1974. There is also evidence on the tropical belt that has widening since 1979 by at least 2 degrees latitude (Seidel *et al.*, 2008). However, there are also evidences that genetic diversity loss also happened for CWR in Southeast Asia as many of their natural habitats were destroyed and degraded (Kartawinata *et al.*, 2001; Sodhi *et al.*, 2004; Engle and Faustino, 2007; Wilcove *et al.*, 2013).

All countries in the Southeast Asia were included as the global biodiversity hotspots, *i.e.* Indo-Burma, Sundaland, and Wallacea (Myers *et al.*, 2000; Mittermeier *et al.*, 2011) as seen in Table 2.1. It means that Southeast Asian countries are containing high endemism of their biodiversity but at the same time they have high degree of extinction risk. Among the Southeast Asian countries, Indonesia was estimated to contain the highest number of vascular plants with

more than 40,000 plants (Butler, 2016; Willis, 2017), the highest number of global priority CWR (Vincent, 2016), and the second top of threatened plants after Malaysia (IUCN, 2019).

CWR conservation links biodiversity conservation and the future of food security. It is therefore of most importance for Indonesia to initiate systematic conservation planning for its CWR. This paper aims to report the results of the initial steps on conservation planning of wild relatives of food crops in Indonesia, including the creation of a CWR checklist, its prioritization, and inventory of priority CWR.

Table 2.1 Biodiversity hotspots area, estimated number of vascular plants, number of threatened plants, and number of global priority CWR taxa by country in Southeast Asia.

No	Country	Biodiversity hotspot area ¹	Estimated number of vascular plants ²	Number of threatened plants ³	Number of global priority CWR taxa ⁴
1	Brunei Darussalam	Sundaland	8,402	127	4
2	Cambodia	Indo-Burma	8,260*	37	16
3	Indonesia	Sundaland and Wallacea	41,628	458	84
4	Laos	Indo-Burma	11,839	56	27
5	Malaysia	Sundaland	21,769	727	52
6	Myanmar	Indo-Burma	9,930	61	50
7	Philippines	Philippines	12,603	254	36
8	Singapore	Sundaland	2,100**	62	7
9	Thailand	Indo-Burma	16,422	159	54
10	Timor Leste	Wallacea	NA	2	2
11	Vietnam	Indo-Burma	14,894	231	49

¹Based on Myers and collaborators (2000) and Mittermier and collaborators (2011)

² Based on Willis, K.J. (ed.) (2017) and Butler, R.A. (2016)

³ Based on IUCN (2019)

⁴ Based on Vincent, H. (2016)

* Based on Fauna and Flora International, 2019 (available at <https://www.fauna-flora.org/countries/Cambodia>)

** Based on National Parks, Singapore Government, 2018 (available at <https://www.nparks.gov.sg/biodiversity>)

2.3 Methods

2.3.1 The CWR checklist development

The generation of the CWR checklist follows (Magos Brehm *et al.*, 2017) using a monographic approach as there is no complete checklist for Indonesian plant species (compiling a list of all crops and then the related CWR taxa which exist in a specific geographical area). All major cultivated food crops in Indonesia were first extracted from the six volumes of Plant

Resources of South East Asia (PROSEA). Food crops include cereals (Grubben and Soetjptohardjono, 1996), pulses (van Der Maesen and Somaatmadja, 1992), edible fruits and nuts (Verheij and Coronel, 1992), vegetables (Siemonsma and Piluek, 1994), plants-yielding non-seed carbohydrates which are starchy and sugar crops that are mostly vegetatively propagated crops (Flach and Rumawas, 1996), and vegetables oils and fats (Van der Vossen and Umali, 2002). Spices and stimulants/beverages were not included in this study. Crops with global priority CWR identified by Vincent and collaborators (2013) were also included. These included crops listed in the Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (FAO, 2009) and other globally important crops listed in FAO statistics (FAO, 2017). Based on those crops listed and the potential occurrences of their relatives in Indonesia, six groups of crops can be defined. They are: (i) nationally and globally important crops (NGI); (ii) nationally minor important and underutilized crops which have native wild relatives in Indonesia (MUC); (iii) globally important crops but with no significant cultivation at national level and with native wild relatives in Indonesia which were named as less popular crops (LP); (iv) the group of crops which are important at national and global levels but have no native CWR (exotic important (EI)); (v) the group of crops which are nationally important but neither important at global level nor having native relatives (national important (NI)), and (vi) the group of crops which are considered global priority crops but are not significantly cultivated at national level and have no native relatives (global important (GI)). Only the first three crop groups, i.e. NGI, MUC, and LP were considered to generate the CWR checklist as the crops are important at national, regional, and global level and they have wild relatives in Indonesia. The list of genera with numbers of taxa for each crop group is included in Appendix 1.

Multiple volumes of Flora Malesiana series I (van Steenis, 1948) and other taxonomic revisions or monographs (for the families not yet covered by Flora Malesiana) were used to extract the wild relatives of the previously generated crop list. The list of taxonomic references can be found in Appendix 2. Only native and archaeophytes, taxa being present in Indonesia for over 500 years, were considered.

All taxa that belong to the same genus of a crop were used to extract CWR. This method was used by other authors (Maxted *et al.*, 2006, 2007, 2013; Kell *et al.*, 2015). The taxonomic rank and names were cross-checked with the global plant names database, such as plant list (The Plant List, 2013) and USDA germplasm resources information network (GRIN) taxonomy

for plants (available at <https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx>). Based on this harmonization, some unaccepted infraspecific taxa were then excluded from the checklist, while the synonyms were amalgamated. The list of CWR was compiled using the CWR checklist and inventory descriptors (Bioversity International and University of Birmingham, 2017) in the freely downloadable Excel template (Thormann *et al.*, 2017). Ancillary information were compiled to generate additional information to CWR checklist, this comprised: family; genus; species; author; infraspecific sub rank; sub taxon name; related crop; common name of related crops; concept type of relatedness (gene pool or taxon group); concept level of relatedness (GP1B, GP2, GP3, TG1B, TG2, TG3, or TG4); global distribution; global distribution status (endemicity); distributional reference; and gross production value of related FAO crop/crop group (FAO, 2017).

2.3.2 CWR prioritization for conservation

Several criteria and methods of CWR prioritization have already been published (Maxted *et al.*, 1997; Magos Brehm *et al.*, 2010; Kell *et al.*, 2015, 2017; Rubio Teso *et al.*, 2018). Kell and collaborators (2017) reviews the mostly used CWR prioritization criteria and methods and suggests the use of three main criteria: the socioeconomic value of the related crop, the wild relative potential utilization for crop improvement, and the threat status. In this study only two of the three criteria listed above were used, as threat status of many Indonesian CWR taxa is not yet known. Fig. 2.1, illustrates the prioritization steps used in Indonesia.

The first selection criteria, based on socioeconomic value of the related crop, grouped the crops into six different groups of crops. The process of grouped crops was mentioned before in the generation of CWR checklist. Only the MCU crops were further divided, based on the latest national agricultural census (Statistics Indonesia, 2013), into minor crops (MC) which is MUC crops that listed in the agricultural census and underutilized crops (UC) which is MUC crops that did not include in the census result (Appendix 3). The criterion that chose in the agricultural census is the number of farmer household that cultivated crops. It means that MC crops have more significant number of farmer that cultivated them than the UC. Then, only CWR taxa related to NGI, MC and LP crops were selected for further prioritization since the crops are nationally, regionally, and globally important and their wild relatives were found in Indonesia. See the discussion for further explanation for the prioritization and exclusion of taxa related to underutilized crops.

The next step considered the prioritization of the wild relatives of the NGI, MC, and LP crops based on the potential utilization of the wild relative for crop improvement. This criterion used the gene pool concept (Harlan and de Wet, 1971) or the taxon group concept (Maxted *et al.*, 2006) when the information of gene pool was not available. Taxa which belong to the primary or secondary gene pools (GP1b and GP2) or taxon groups 1–3 (TG1b, TG2, and TG3) were selected as well as those wild relatives that either have been used in crop breeding programs or that are known to contain traits of interest for crop improvement (Kell *et al.*, 2017). This was the case for the wild relatives of rice and sorghum. All priority CWR were then separated based on previous grouping categories to three different levels of priority, namely first priority which are those wild species related to the NGI crops, the second priority are those related to the MC crops, and the third priority are those related to the LP crops.

2.4 Result

2.4.1 CWR checklist and their endemism

About 241 major food crops are cultivated in Indonesia based on PROSEA (Figure 2.2). Almost 60% of these have native wild relatives in Indonesia. The edible fruits and nuts group contains the largest number of crops in Indonesia (38%), followed by vegetables (33%) and the plants yielding non-seed carbohydrates (starchy and sugar crops) (11%). In contrast, the pulses contain the smallest number of crops with native wild relatives in Indonesia (25%). Proportionally, the plant-yielding non-seed carbohydrates has the highest number of CWR present in Indonesia (78%) and most vegetables are introduced species without wild relatives in Indonesia.

The checklist of wild relatives of food crops contains 1,968 native taxa. It consists of 53 families, 106 genera, 1,890 species, and 78 infraspecific categories (subspecies/variety) (Table 2.2). It accounts for about 4.73% of the total number of higher plants estimated for Indonesia. Those taxa relate to 33 FAO crops/crop groups. Unspecified FAO crop groups such as vegetables contain 221 taxa distributed among 26 genera and the tropical fruits 571 taxa within 28 genera. While specific crop groups, such as figs (279 taxa) and blueberries (170 taxa) are the top two genera with the highest numbers of wild relatives. Of the cereal group, millet contains 33 taxa within 4 genera, while rice and sorghum have 7 and 4 related taxa, respectively. Edible fruits and nuts have the largest CWR with 1,308 taxa that are related to 43 crops within 13 FAO crop groups. Pulses only have three genera and 15 taxa. Plants-yielding non-seed carbohydrates cover seven FAO crop categories that contain 20 genera and 235 taxa. Vegetables

contain 243 taxa within 30 genera that are separated within five different FAO crop groups. While, vegetable oils and fats contains 126 taxa that are related to five crops.

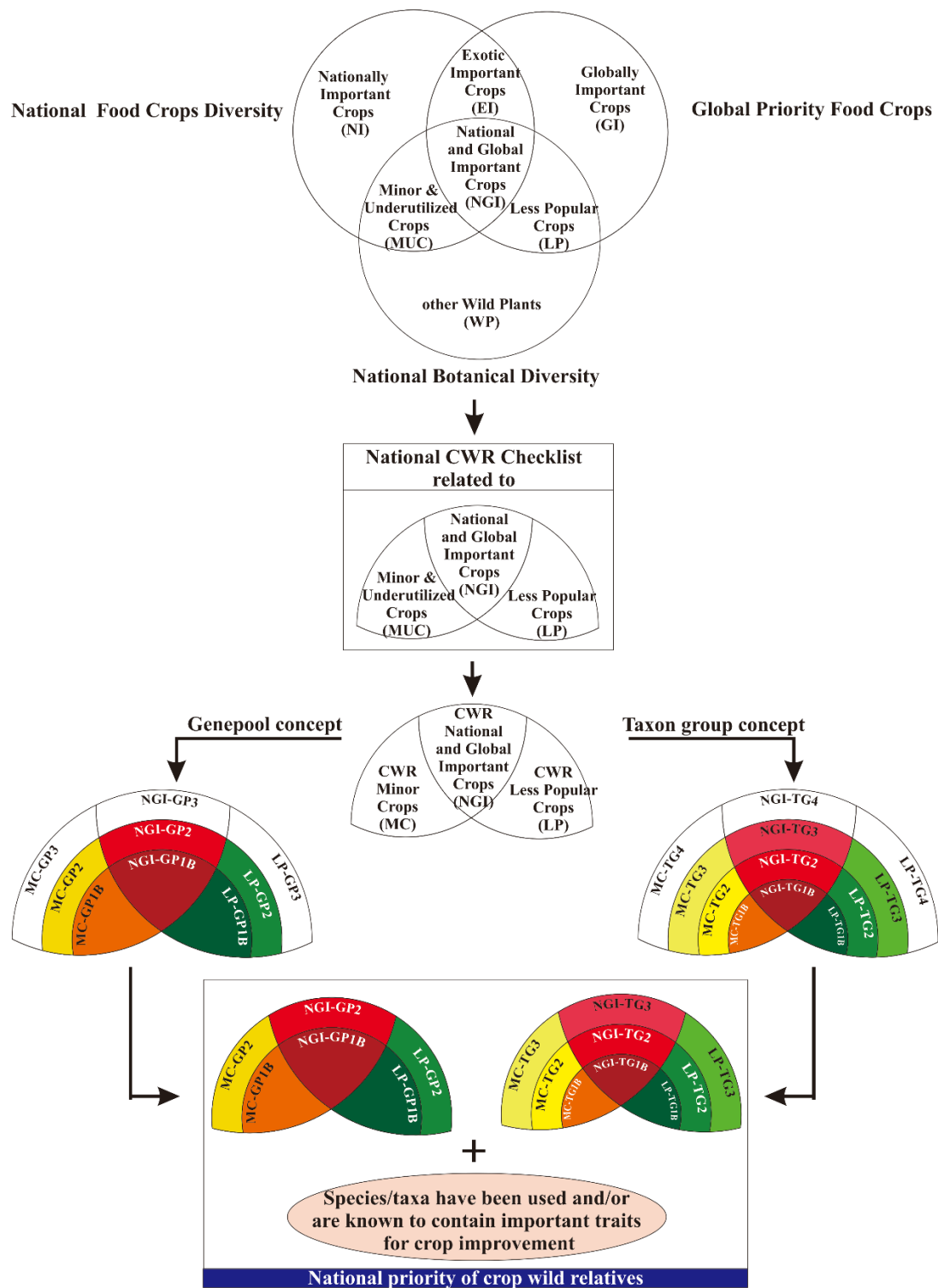


Fig. 2.1 Creation of the CWR checklist of food crops of Indonesia and methodology for prioritizing CWR for conservation

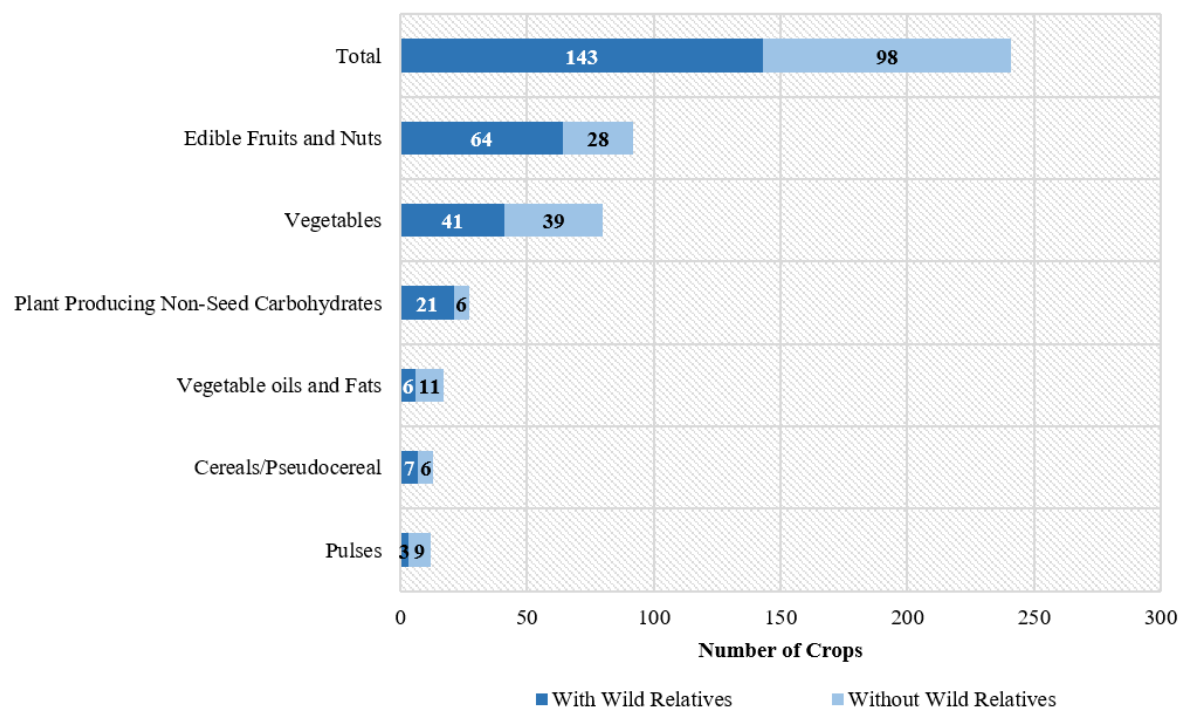


Fig. 2.2 Overview of national food crops with and without wild relatives in Indonesia

Based on the global distribution status, about 571 taxa (29%) of the CWR checklist are endemic to Indonesia (Fig. 2.3 A). They are distributed in the seven major groups of Indonesian islands [Sumatra, Java, Kalimantan (Indonesian Borneo), Sulawesi, Lesser Sunda islands, Moluccas, and Papua (Indonesian Papua)], of which 484 are strictly endemic to those islands groups. Indonesian Papua and Sumatra are the islands with the highest number of national endemics with 147 and 111 endemic taxa, respectively. These endemic taxa mostly belong to wild relatives of blueberries and tropical fruits (Fig. 2.3 B). Almost 44% (864 taxa) are narrow regional endemics, *i.e.* taxa that have a restricted distribution in three or less countries. Most of the narrow regional endemic taxa are located solely on the islands of Borneo (politically divided between Indonesia, Malaysia, and Brunei Darussalam) with 212 CWR taxa and Papua (politically divided between Indonesia and Papua New Guinea) with 193 CWR taxa. These taxa are mostly wild relatives of tropical fruits, figs, and persimmons. Most of the native oilseed relatives (*Shorea* spp.) were found in the island of Borneo since this is the centre of their species diversity.

Table 2.2 List of crop genera that contain native wild relatives in Indonesia

Crop Category (Ref: PROSEA)	Crop (FAO designation)	Genera (number of CWR)	Total taxa
Cereals (Grubben and Soetjptohardjono, 1996)	Millet	<i>Cenchrus</i> (3), <i>Echinochloa</i> (4), <i>Panicum</i> (17), <i>Setaria</i> (9)	33
	Rice	<i>Oryza</i> (7)	7
	Sorghum	<i>Sorghum</i> (4)	4
Edible Fruits and Nuts (Verheij and Coronel, 1992)	Avocados	<i>Persea</i> (3)	3
	Blueberries	<i>Vaccinium</i> (170)	170
	Dates	<i>Phoenix</i> (1)	1
	Figs	<i>Ficus</i> (279)	279
	Fruits (unspecified)	<i>Potentilla</i> (18)	18
	Grapes	<i>Vitis</i> (2)	2
	Melons	<i>Cucumis</i> (2)	2
	Nuts	<i>Canarium</i> (33), <i>Gnetum</i> (18), <i>Macadamia</i> (1), <i>Terminalia</i> (30)	82
	Oranges	<i>Citrus</i> (5)	5
	Persimmons	<i>Diospyros</i> (119)	119
	Raspberries	<i>Rubus</i> (28)	28
	Stone Fruit	<i>Prunus</i> (28)	28
	Tropical Fruits (unspecified)	<i>Anacolsa</i> (3), <i>Antidesma</i> (37), <i>Artocarpus</i> (31), <i>Averhoa</i> (4), <i>Baccaurea</i> (32), <i>Bouea</i> (2), <i>Chrysophyllum</i> (2), <i>Clausena</i> (5), <i>Cynometra</i> (5), <i>Dimocarpus</i> (3), <i>Durio</i> (21), <i>Flacourtia</i> (7), <i>Garcinia</i> (98), <i>Lansium</i> (3), <i>Litchi</i> (1), <i>Manilkara</i> (5), <i>Mangifera</i> (45), <i>Nephelium</i> (12), <i>Pandanus</i> (41), <i>Pometia</i> (2), <i>Pouteria</i> (20), <i>Rhodomyrtus</i> (5), <i>Salacca</i> (7), <i>Sandoricum</i> (4), <i>Spondias</i> (5), <i>Stelechocarpus</i> (2), <i>Syzygium</i> (159), <i>Ziziphus</i> (10)	571
Plant Producing Non-Seed Carbohydrates (Flach and Rumawas, 1996)	Bananas and Plantain	<i>Ensete</i> (1), <i>Musa</i> (25)	26
	Roots and tubers	<i>Amorphophallus</i> (29), <i>Curcuma</i> (19), <i>Cyperus</i> (63), <i>Cyrtosperma</i> (6), <i>Eleocharis</i> (16), <i>Nelumbo</i> (1), <i>Plectranthus</i> (6), <i>Stachys</i> (1), <i>Tacca</i> (5)	146
	Sugarcane	<i>Saccharum</i> (3)	3
	Sugar crops	<i>Arenga</i> (12), <i>Borassus</i> (2), <i>Caryota</i> (6), <i>Metroxylon</i> (1), <i>Nypa</i> (1)	22
	Sweet potatoes	<i>Ipomoea</i> (1)	1
	Taro	<i>Colocasia</i> (2)	2
	Yams	<i>Dioscorea</i> (33)	33
Pulses (van Der Maesen and Somaatmadja, 1992)	Beans, dry	<i>Vigna</i> (7)	7
	Beans, green	<i>Cajanus</i> (6), <i>Lablab</i> (1)	7
Vegetables (Siemonsma and Piluek, 1994)	Asparagus	<i>Asparagus</i> (1)	1
	Eggplants (aubergines)	<i>Solanum</i> (10)	10
	Okra	<i>Abelmoschus</i> (9)	9
	Spinach	<i>Amaranthus</i> (2)	2
	Vegetables (unspecified)	<i>Archidendron</i> (39), <i>Benincasa</i> (2), <i>Breynia</i> (6), <i>Canavalia</i> (6), <i>Cleome</i> (2), <i>Coccinia</i> (1), <i>Emilia</i> (1), <i>Enydra</i> (1), <i>Hibiscus</i> (23), <i>Hydrocotyle</i> (2), <i>Ipomoea</i> (22), <i>Momordica</i> (5), <i>Monochoria</i> (2), <i>Neptunia</i> (4), <i>Ocimum</i> (3), <i>Oenanthe</i> (1), <i>Parkia</i> (5), <i>Pilea</i> (28), <i>Polyscias</i> (17), <i>Portulaca</i> (1), <i>Psophocarpus</i> (1), <i>Rorippa</i> (3), <i>Rungia</i> (9), <i>Sonchus</i> (2), <i>Sonneratia</i> (4), <i>Trichosanthes</i> (31).	221
Vegetable Oils and Fats (Van der Vossen and Umali, 2002)	Coconuts	<i>Cocos</i> (1)	1
	Oilseeds	<i>Aleurites</i> (1), <i>Shorea</i> (117), <i>Triadica</i> (1)	119
	Olives	<i>Olea</i> (6)	6

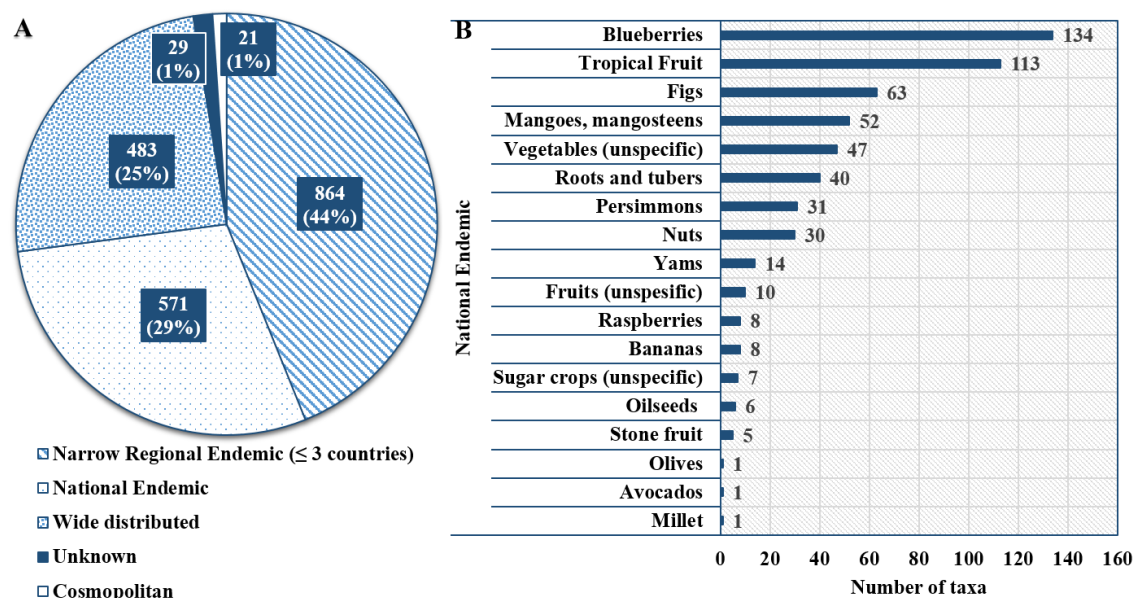


Fig. 2.3 A. The endemism of wild relatives of food crops in Indonesia. B. The number of endemic CWR under similar FAO crops/crop groups

Based on the socio-economic value of the related crops, CWR taxa on the checklist can be grouped into the following: national and globally important crops (NGI); minor crops (MC); less popular crops (LP) and underutilized crops (UC). The UC group contains 633 taxa within 52 genera (Fig. 2.4). While the LP group contains 632 taxa within 20 genera, the MC group covers 533 taxa within 19 genera and the NGI group has 170 taxa among 15 genera.

2.4.2 Priority CWR

The Fifty-five crop genera containing 1,335 taxa of native wild relatives of NGI, MC, and LP crops were further prioritized based on the closeness of their genetic/taxonomic relationship degree to the related crop as an indication of their potential use in crop improvement. As a result, 50 taxa were categorized using the gene pool concept, while 1,285 taxa were categorized using the taxon group concept. Fifty one taxa are primary taxa (GP1B or TG1B), 176 taxa are secondary taxa (GP2, TG2, or TG3), and 1,108 taxa are tertiary taxa (GP3 or TG4) (Fig. 2.5).

A total of 234 priority taxa belonging to 26 families and 36 genera were then identified (Table 2.3). These priority taxa consist of 227 of the primary and secondary taxa with 7 additional taxa that belong to wild relatives of rice (4 taxa) and sorghum (3 taxa) that known to

contain important traits for crop improvement. The priority CWR taxa were then grouped into three levels of priority. The first priority which is related to the NGI category (13 genera, 95 taxa), the second priority is related to the MC category (18 genera, 69 taxa), and the third priority is related to the LP category (4 genera, 70 taxa). The number of priority wild relatives of mango and breadfruit are the highest among CWR related to NGI crops. Durian and Jengkol have the highest number of priority taxa within MC crops. While, figs and yam have most priority wild relatives among the LP crops. Full list of priority taxa as seen in Appendix 4.

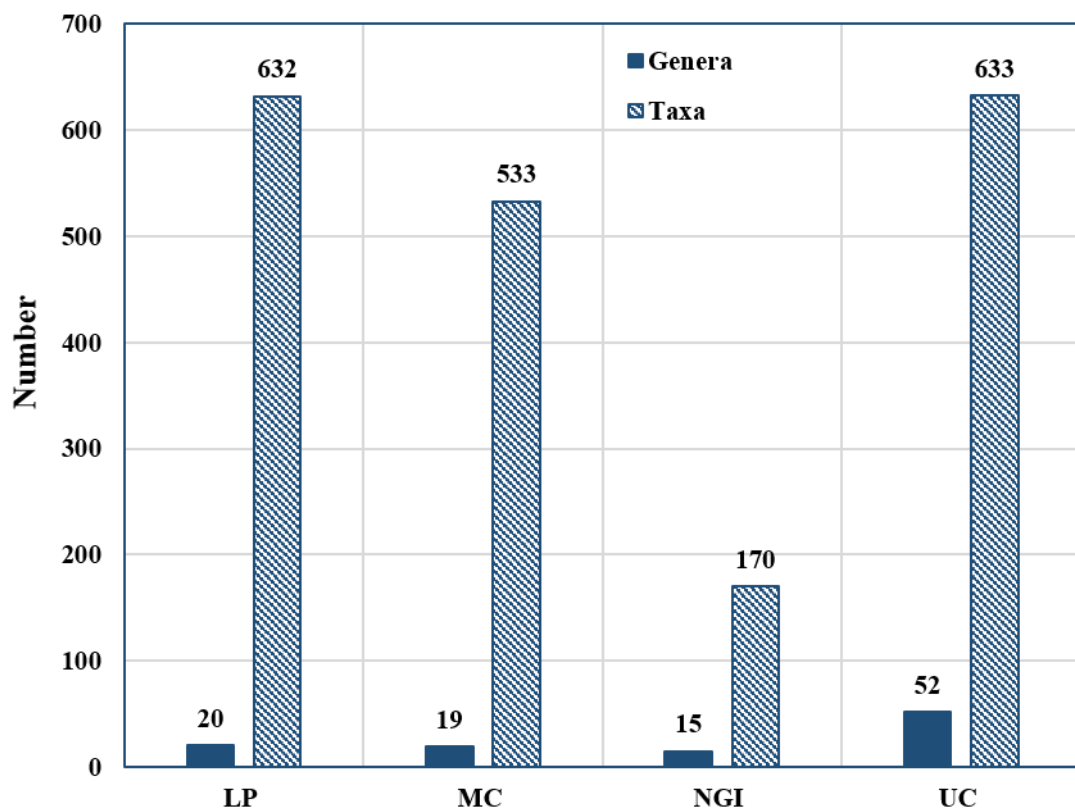


Fig. 2.4 Number of genera and taxa for each of the crop groups in the Indonesia CWR checklist. Less popular crops (LP), minor crops (MC), national and globally important crops (NGI), and underutilized crops (UC)

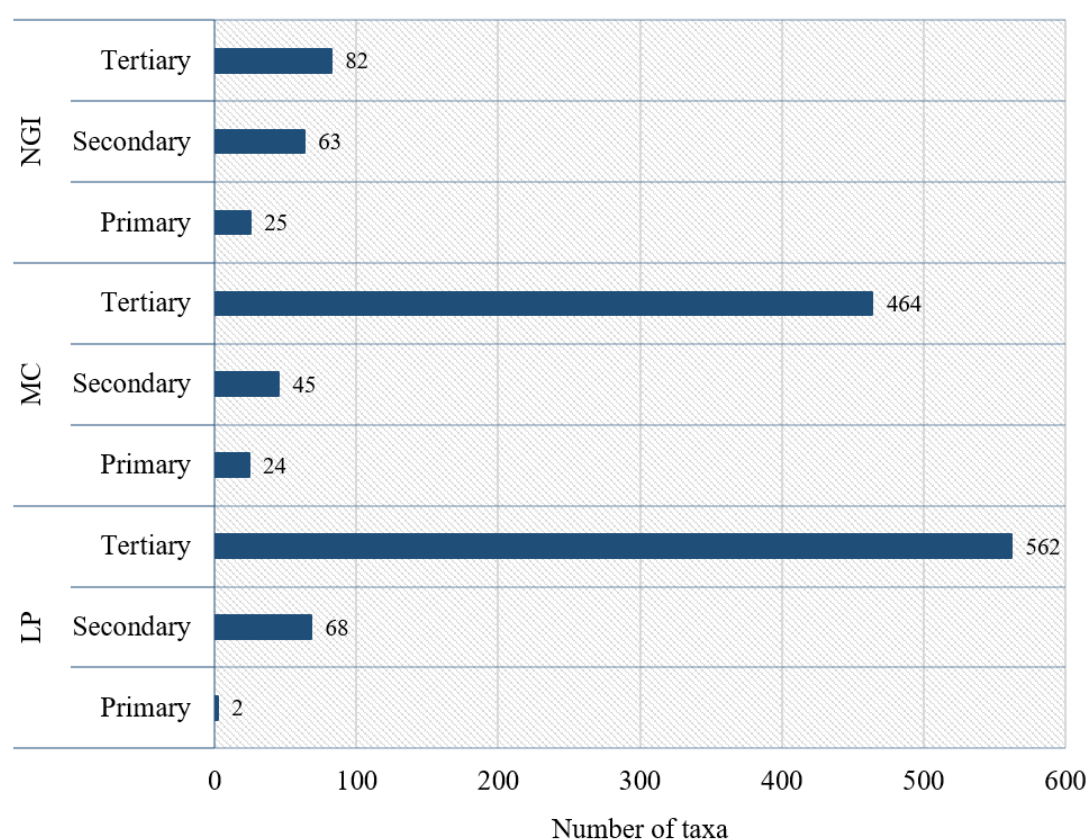


Fig. 2.5 Number of taxa that belongs to different levels of relatedness to related crops for the three priority crop groups: national and globally important crops (NGI); minor crops (MC); and less popular crops (LP). Primary taxa are GP1B and TG1B, secondary taxa (GP2, TG2, and TG3), tertiary taxa (GP3 and TG4)

2.5 Discussion

Setting CWR conservation priorities is an essential step in their conservation planning at the national, regional, and global levels. The present results showed that the checklist of wild relatives to food crops in Indonesia covers about 4.73% of the total vascular plants (Butler, 2016; Willis, 2017) of total flowering plants estimated to occur in Indonesia. This study focused only on the wild relatives of food crops but this does not mean that the socioeconomic importance of other crops was neglected. The conservation of the wild relatives of food crops has a direct link to support food security and other global agendas such as the sustainable development goals (SDG), Aichi targets, Global Strategy for Plant Conservation (GSPC), and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The number of taxa in the present checklist was higher compared to the CWR checklist of food crops only in countries such as Norway (Phillips *et al.*, 2016), Portugal (Magos Brehm *et al.*,

2008), USA (Khoury *et al.*, 2013), SADC region (Allen *et al.*, 2019), and Zambia (Ng'uni *et al.*, 2019) but lower compared to China (Kell *et al.*, 2015).

Table 2.3 Summary of priority taxa of wild relatives of food crops in Indonesia

Genera	Crop	Crop common name	No. CWR taxa	
			Priority	Native total
First Priority (related to NGI crops)				
Artocarpus	Artocarpus altilis (Parkinson) Fosberg	Breadfruit	19	31
	Artocarpus heterophyllus Lamk	Jackfruit	1	
Citrus	Citrus aurantiifolia / Citrus aurantium / Citrus limon / Citrus sinensis	Lime/Lemon/ Oranges	1	5
	Citrus maxima (Burm.) Merr.	Grapefruit	1	
Cocos	Cocos nucifera L.	Coconut	1	1
Colocasia	Colocasia esculenta (L.) Schott	Taro	2	2
Cucumis	Cucumis melo L.	Melon	1	2
Ipomoea	Ipomoea batatas (L.) Lamk	Sweet Potato	2	23
	Ipomoea aquatica Forsskal	Water Lettuce	9	
Mangifera	Mangifera indica L.	Mango	29	45
Musa	Musa acuminata Colla	Banana & Plantain	9	25
	Musa balbisiana Colla		2	
Oryza	Oryza sativa L.	Rice	7	7
Saccharum	Saccharum officinarum L.	Sugarcane	3	3
Solanum	Solanum melongena L.	Aubergines	1	10
Sorghum	Sorghum bicolor L.	Sorghum	4	4
Vigna	Vigna radiata (L.) Wilczek	Mungbean	2	7
	Vigna umbellata (Thunb.) Ohwi&H.Ohashi	Rice bean	2	
Subtotal			95	165
Second Priority (related to MC crops)				
Amaranthus	Amaranthus tricolor L.	Amaranth	1	2
Archidendron	Archidendron jiringa (Jack) Nielsen	Jengkol	19	39
Arenga	Arenga pinnata (Wurmb) Merrill	BlackPalmSugar	1	12
Averrhoa	Averrhoa carambola L.	Star Fruit	1	4
	Averrhoa bilimbi L.	Bilimbi	1	
Dimocarpus	Dimocarpus longan Lour.	Longan	1	3
Diospyros	Diospyros discolor Willd.	Velvet apple	1	119
Durio	Durio zibethinus L.	Durian	16	21
Garcinia	Garcinia mangostana L.	Mangosteen	7	98
Gnetum	Gnetum gnemon L.	Gnetum	6	18
Lansium	Lansium domesticum Correa	Langsat	1	3
Metroxylon	Metroxylon sagu Rottboell	Sago	1	1
Momordica	Momordica charantia L.	Bitter Gourd	1	5

<i>Nephelium</i>	<i>Nephelium lappaceum</i> L.	Rambutans	1	12
<i>Ocimum</i>	<i>Ocimum americanum</i> L.	American Basil	1	3
<i>Parkia</i>	<i>Parkia speciosa</i> Hassk.	Bitter Bean	5	5
<i>Pometia</i>	<i>Pometia pinnata</i> Forst. &Forst.	Matoa	1	2
<i>Salacca</i>	<i>Salacca zalacca</i> (Gaertner) Voss	Snakefruit	1	7
<i>Syzygium</i>	<i>Syzygium aqueum</i> (Burm.f.) Alston	Water Apple	1	159
	<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry	Malay Apple	1	
	<i>Syzygium cumini</i> (L.) Skeels	Jambolan	1	
Subtotal			69	513
Third Priority (related to LP crops)				
<i>Cajanus</i>	<i>Cajanus cajan</i> (L.) Millsp.	Pigeon pea	3	6
<i>Dioscorea</i>	<i>Dioscorea alata</i> L.	Yams	23	33
<i>Ficus</i>	<i>Ficus carica</i> L.	Figs	31	279
<i>Lablab</i>	<i>Lablab purpureus</i> (L.) Sweet	Lablab Bean	1	1
<i>Rubus</i>	<i>Rubus idaeus</i> L.	Rapsberry	12	28
Subtotal			70	347
Total			234	1025

This paper also aims to raise the awareness of Indonesian stakeholders to include CWR as valuable assets for conservation and breeding programs. As indicated by Maxted and collaborators (2007), nature conservation and agricultural stakeholders in Indonesia still pay less attention to CWR due to different focused of object targets and responsibilities. For example, recent legal documents of national protected animals and plants by Indonesian ministry of environment and forestry only listed rare or threatened plant species (Ministry of Environment and Forestry, 2018). Only four taxa related to underutilized crops are included on the list and in this case only because they are threatened or rare and not because they are CWR. On the other hand, national gene banks managed by ministry of agriculture lack CWR accessions (Kurniawan *et al.*, 2004).

This is another case where countries with a rich flora has difficulty in prioritizing which plant taxa should have immediate conservation action due to the lack of information and proper evaluation (Barazani *et al.*, 2008). On the other hand, Indonesia is under the pressure to report on their achievements towards the GSPC targets. Targets 7 and 8 of the GSPC focus on threatened plants, while CWR conservation is referred in target 9 (Sharrock, 2012). However, the threat status of many plant taxa, including CWR, has not been determined at global or

national levels. Therefore, in conservation programs that focus only on already known threatened taxa, CWR does not get proper priority.

Another important issue on CWR conservation is endemism. In the prioritization process, Kell and collaborators (2016) and Labokas (2018) showed a variation in national CWR priorities among the European countries. Some of them only prioritize their national endemics. In this study, we show that the endemics were not always the priority for conservation, more depended on the level of relatedness of the taxa to crops (Maxted and Kell, 2009). For example, the highest numbers of national endemic CWR in Indonesia are related to blueberries, but none of those taxa are priorities for conservation as they belong to different subgenus to the crop (*Vaccinium myrtillus* L. and other North American blueberries). There are unique characteristics in some CWR; the closest related taxa are the common and/or widely distributed taxa. For example weedy types of *Sorghum bicolor* (L.) Moench in Africa (Maxted and Kell, 2009) or *Oryza rufipogon* Griffith in Indonesia (Soerjani *et al.*, 1987). Soerjani and collaborators (1987) stated that *O. rufipogon* is easy to intercross with the rice in cultivation. Londo and collaborators (2006) also stated that *O. rufipogon* is the wild ancestor of cultivated rice. Its wide distribution means that this species can be occupy various habitats. It can be implied that these widespread species have great genetic diversity and some of them probably contain rare and important traits. As they frequently occupy anthropogenic areas (roadside, farm, settlements, or irrigation channels), they are more vulnerable to land use changes or other anthropogenic disturbances. Therefore, they are also important to conserve.

In terms of endemism, the island of Sumatra and Indonesian Papua were the richest areas containing national endemic CWR. This finding was similar to Roos and collaborators (2004) who treated general higher plant species in five major islands (Borneo, Java, New Guinea, Sulawesi, and Sumatra). They found that New Guinea (the geographical entity) containing the highest endemic species, followed by the island of Borneo, then Sumatra, Sulawesi and Java. They conclude that the balance between speciation, migration and extinction means the larger island are richer than the smaller ones.

In this study, the first priority taxa, i.e. those related to NGI crops, and third priority taxa, i.e. those related to LP crops, show that Indonesian priority CWR are linked to global priority CWR conservation. That is because those related crops have a higher economic value, wider cultivation range, and has intensive breeding programs. For some crops, the origin of domestication or the centre of diversity area were different to that of their production area

(Khoury *et al.*, 2016). Hyten and collaborators (2006) found that the bottleneck effect syndrome (a syndrome where a crop becomes more genetically uniform leading to lowering of resilience capacity to environmental changes) mostly happened during the process of domestication. However, this syndrome is increasingly found in modern cultivars since only limited accessions were used in their development. Moreover, Khoury and collaborators (2016) also found that the cultivation of exotic crops in many countries has increased. Therefore, those countries depend on CWR resources from elsewhere for global crop breeding programs.

The wild relatives of minor crops were placed in the second priority group due to their significant cultivation area, economic role and other socio-cultural factors, although those are only limited to particular regions. Moreover, they are probably cultivated on their original area of distribution (domestication area). It means that these CWR can be their progenitors/ancestors. Conservation of those progenitors will keep the wild relatives available for breeders in *ex situ* collections and sustain their *in situ* evolution in the wild. These taxa could be a starting point to initiate regional CWR conservation programs, as global investors are less interested in investing in these crops for the research and development. For the Southeast Asia region, tropical fruits, such as *Averrhoa carambola* L. (star fruit), *Dimocarpus longan* Lour. (longan), *Durio zibethinus* L. (durian), *Garcinia mangostana* L. (mangosteen), *Nephelium lappaceum* L. (Rambutans), *Lansium domesticum* Corrêa (Langsat), and *Salacca zalacca* (Gaertner) Voss (Snakefruit) could be given priority as they have wild relatives and are mostly endemic to the region.

Underutilized crops (UC) are important to diversify our food sources as suggested by Massawe and collaborators (2016). FAO (1993) indicated that about 10,000-50,000 plant species are edible but only 150-200 of them are used globally as human foods. Those UC can potentially become important future food sources as for example what happened with quinoa (*Chenopodium quinoa* Willd.) that now has global recognition as an important food after promotion by FAO (Massawe *et al.*, 2016). However, in this study, the wild relatives of these crops not considered as priority taxa. This does not mean that these taxa have no need for any conservation action. Like any wild plants, these taxa could be threatened, as well. The reason is these crops are still under the domestication process (or need a pipelining process to become a crop) which means that they might not yet need their relatives to increase their genetic variability.

To define the degree of importance of CWR on crop improvement of their related crops, the gene pool (GP) and taxon group (TG) concepts were used. Based on the inventory of CWR, 1,338 taxa belonging to similar genera to the priority crops (NGI, MC, and LP). To further reduce the number of taxa to be prioritized, taxa belonging to GP1B, GP2, TG1B, TG2, TG3, and those known to contain important traits or that have already been used in crop breeding programs were selected as the priority taxa for conservation. These results showed that only 17.71% of those taxa included in NGI, MC and LP crops are priorities. Heywood (2008) noted that the TG concept is still the best proxy for practice to define the relationship of crops and their wild relatives when information of their gene pools is lacking. However, he also noted that this concept is less likely to be applied for those taxa that are taxonomically less studied or when the classification does not have general agreement. Moreover, many plant genera have no subdivisions. In this study, plants that are still poorly understood taxonomically in Indonesia are CWR belonging to genera *Diospyros* (Ebenaceae) (119 taxa) and *Syzygium* (Myrtaceae) (159 taxa). While, genera that have no subdivision are *Arenga*, *Averhoa*, *Nephelium*, and *Salacca*. Therefore, only TG1B were selected as priority taxa for those genera.

The Second Global Plan of Action of PGRFA (FAO, 2011) noted that the inventory of PGRFA is a critical initial step for their conservation. Based on Magos Brehm and collaborators (2017) and Bioversity International (2018), only 47 countries and five regions have published their CWR checklists and inventories. Most of these publications come from European countries (19 countries and two regions (Euro-Mediterranean and Nordic). In Asia, just 12 nations and one region (Fertile Crescent) published their CWR checklist. While, in the Americas (only 6 countries), Africa (nine countries and two regions (North Africa and SADC), and Australia and Oceania (only one country) have published their CWR checklist. This current inventory will add the number of Asian countries that published their CWR inventory.

2.6 Conclusion

One year left to 2020 as the GSPC second phase and the Strategic Plan for Biodiversity 2011–2020 (UNEP, 2010) will be asked for their targets. Effective CWR conservation addressed by the GSPC targets (target 9) and the Aichi targets (targets 13) are still challenging to reach. Until recently, only 47 countries and 5 regions have their own CWR checklist and inventories. This study will add to that number. About 1968 wild relatives to food crops are included in the current checklist. After prioritization, 234 taxa that belong to 26 families and

36 crop genera were established as priority for conservation in Indonesia. The first priority includes 95 CWR taxa that are important at the national and global levels, such as the wild relatives of rice, banana, mango, breadfruit, sugarcane, taro, coconut, sweet potato, melon, sorghum, citrus, and aubergines. The second priority includes 69 taxa that are related to the crops that important at the national and regional levels such as many tropical fruits (mangosteen, durian, star fruit, snake fruit, longan, langsat, Malay apple, or rambutans) and sugar crop (*Arenga* and Sago). The third priority consists of 70 taxa that are related to the crops that are important at the global level but less so at the national level, such as yam, figs, raspberry, and pigeon pea.

CHAPTER 3

GAP ANALYSES OF PRIORITY WILD RELATIVES OF FOOD CROP IN CURRENT EX SITU AND IN SITU CONSERVATION IN INDONESIA

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Critically reviewed the paper: W.R., J.M.B., N.M., J.P.

3.1 Abstract

Conservation programs are always limited by available resources. Careful planning is therefore required to increase the efficiency of conservation and gap analysis can be used for this purpose. This method was used to assess the representativeness of current *ex situ* and *in situ* conservation actions of 234 priority crop wild relatives (CWR) in Indonesia. This analysis also included species distribution modelling, creation of an ecogeographical land characterization (ELC) map, and complementarity analysis. The results show that both current *ex situ* and *in situ* conservation actions are insufficient. Sixty-six percent of priority CWR have no recorded *ex situ* collections. Eighty CWR with *ex situ* collections are still under-represented in the national genebanks and 65 CWR have no presence records within the existing protected area network although 60 are predicted to exist in several protected areas according to their potential distribution models. The complementarity analysis shows that a minimum of 61 complementary grids area are required to conserve all priority taxa and 40 complementary protected areas are required to conserve those with known populations within the existing *in situ* protected area network. The 40 complementary protected areas are proposed as the initial areas for the development of CWR genetic reserves network in Indonesia. It is recommended that support is given to enhanced coordination between *ex situ* and *in situ* conservation stakeholders for sustaining long term conservation of CWR in Indonesia. Implementation of the research recommendations will for the first time provide effective conservation of Indonesia's CWR diversity and will significantly enhance the country's food and nutritional security.

Keywords: Conservation, Complementarity analysis, Crop wild relatives, Ecogeographic land characterization, *ex situ*, *in situ*, Gap analysis, Indonesia.

3.2 Introduction

The Second Report of the State of the World's Plant Genetic Resources for Food and Agriculture stated that use of CWR in crop improvement programs was increasing (FAO, 2010). This increased level of use should continue as breeding techniques are improved, more published information on important traits in CWR becomes available, and the number of genebank accessions of CWR is increased (Hajjar and Hodgkin, 2007). Plant breeders are attracted to use CWR as they provide a wide range of traits including adaptive traits to increase crop resilience in changing environments and to improve the yield or quality of crops (Hajjar and Hodgkin, 2007; Maxted and Kell, 2009; Zhang *et al.*, 2017). About 970 CWR have been

used or recorded to have potential in crop improvement of 127 crops for specific traits such as: agronomic traits, abiotic and biotic stress, fertility, morphological, phenological and quality traits (Dempewolf *et al.*, 2017).

The problem that arises due to the increased demand on CWR is the inadequacy of the current conservation programs for CWR. In the past, CWR conservation programs were mostly focused on *ex situ* conservation. As a result, significant new accessions were added into *ex situ* collections, which now reach up to 7.4 million accessions of plant genetic resources, including CWR (FAO, 2010). Today, about 1,750 genebanks are available around the world (FAO, 2010). However, Castañeda-Álvarez and collaborators (2016) showed that 95% of global priority CWR are poorly represented in genebanks collections. On the other hand, *in situ* conservation programs are only just getting global attention as a useful method for conserving CWR (Maxted, 2003; Meilleur and Hodgkin, 2004; Maxted and Kell, 2009; Hunter and Heywood, 2010; Bellon and Burdon, 2017). This approach ensures the continued evolutionary adaptation of CWR to environmental changes and therefore continuing to shape their genetic diversity (Maxted *et al.*, 2008; Bellon and Burdon, 2017). However, Vincent and collaborators (2019) showed that most of globally priority CWR are underrepresented in the global protected area network.

The Convention on Biological Diversity (CBD) (1992) defines *in situ* conservation as the ideal method for protection of species, with *ex situ* being a complementary method of conservation. Some conservationist argued that the definition is putting those methods in unequal position (Pritchard *et al.*, 2012). Since 1990, the *in situ* conservation has become a globally leading approach on biodiversity conservation that brought the *ex situ* into less attention for funding (Pritchard *et al.*, 2012). In term of efficiency, Hajjar and Hodgkin (2007) stated that *in situ* conservation has a lower cost than *ex situ*, but Li and Pritchard (2009) stated the opposite. The cost of *ex situ* conservation in international genebanks ranges from \$5.15 per accession per year at ICARDA to \$22.52 per accession per year at CIAT (Schreinemachers, Ebert and Wu, 2014). In national genebanks, the cost of *ex situ* ranges from \$0.376 to \$454.87 per accession per year in India (Saxena *et al.*, 2003) and \$15.85 to \$80.57 per accession per year in Colombia (Moreno, 2003). While, Wainwright and collaborators (2019) estimate the cost for *in situ* conservation of CWR in Zambia around \$23 to \$91 per ha per year. This shows that the cost of *in situ* conservation is much less compared to *ex situ*. Therefore, conservation action needs an effective strategy that comes from a comprehensive planning process. A

methodology for CWR conservation planning has already been established (Maxted *et al.*, 1997; Magos Brehm *et al.*, 2017). It recognizes the *ex situ* and *in situ* conservation approaches as both part of an integrated system.

Gap analysis is one of the steps in CWR conservation planning (Magos Brehm *et al.*, 2017) and an effective method to determine the success of CWR conservation programs also providing guidance for further actions (Maxted *et al.*, 2008; Phillips *et al.*, 2016). In this method, all CWR *ex situ* collections are identified and compared to their natural habitat range within the country to evaluate the collections representativeness. In a similar way, *in situ* gap analysis evaluates the extent to which taxa distributions occur within existing protected areas and whether they are actively managed and monitored (Maxted *et al.*, 2008; Ramírez-Villegas *et al.*, 2010; Phillips *et al.*, 2016; Magos Brehm *et al.*, 2017). The accuracy of results depends on the availability of data, human resources, and funds.

Indonesia is frequently considered as one of the most important region for global and regional CWR (Vavilov, 1935; Vincent *et al.*, 2013, 2019; Castañeda-Álvarez *et al.*, 2016). Banana, coconut, sugarcane, taro, and many tropical fruits were domesticated in this region (Vavilov, 1935; van Steenis, 1949). Vavilov (1935) stated that South East Asia (including Indonesia) is the centre of origin for at least 55 cultivated plant species. Recently, Vincent *et al.* (2013) included 84 taxa from Indonesia in the list of globally important CWR. Moreover, FAO (2017) highlighted Indonesia as among the top five of global producers of banana, coconut, mango, mangosteen, rice, and sugarcane. National systematic conservation planning of those wild relatives as part of sustaining the long-term conservation and production systems is therefore needed.

This study aims to describe spatial distribution, evaluate the representativeness of current *ex situ* and *in situ* conservation programmes, and propose strategies for further conservation actions of priority CWR in Indonesia.

3.3 Methods

3.3.1 Priority CWR taxa for Indonesia

A recent inventory showed that 1,968 taxa of wild relatives of food crops are found in Indonesia (Rahman *et al.*, 2019). A prioritized subset of 234 taxa belong to 36 genera, 52 crops, and 219 species were selected as priority CWR taxa for Indonesia: 95 taxa related to nationally and globally important crops were set as primary priority taxa, 69 taxa related to nationally and regionally important crops were set as secondary priority taxa, and 70 taxa related to globally

important crops but have less significant value at national level were defined as tertiary priority taxa (Table 3.1).

Table 3.1 Priority crop wild relatives (CWR) in Indonesia grouped based on their priority rank (Rahman *et al.*, 2019)

Priority 1 (related to national and global important crops)		Priority 2 (related to national and regional important crops)		Priority 3 (related to global important crops but less popular at national level)	
Crop	Number priority CWR	Crop	Number priority CWR	Crop	Number priority CWR
Aubergine (<i>Solanum melongena</i> L.)	1	Amaranth (<i>Amaranthus tricolor</i> L.)	1	Figs (<i>Ficus carica</i> L.)	31
Banana & plantain (<i>Musa acuminata</i> Colla, <i>Musa balbisiana</i> Colla)	11	Basil (<i>Ocimum americanum</i> L.)	1	Lablab bean (<i>Lablab purpureus</i> (L.) Sweet)	1
Breadfruit & jackfruit (<i>Artocarpus altalis</i> (Parkinson) Fosberg)	20	BlackPalmSugar (<i>Arenga pinnata</i> (Wurmb) Merr.)	1	Pigeon pea (<i>Cajanus cajan</i> (L.) Millsp.)	3
Coconut (<i>Cocos nucifera</i> L.)	1	Bitter Bean (<i>Parkia speciosa</i> Hassk.)	5	Raspberry (<i>Rubus idaeus</i> L.)	12
Grapefruit (<i>Citrus maxima</i> (Burm.) Merr.)	1	Bitter Gourd (<i>Momordica charantia</i> L.)	1	Yams (<i>Dioscorea alata</i> L.)	23
Lime, lemon, & orange (<i>Citrus aurantiifolia</i> (Christm.) Swingle, <i>Citrus aurantium</i> L., <i>Citrus limon</i> (L.) Osbeck)	1	Durian (<i>Durio zibethinus</i> L.)	16		
Mango (<i>Mangifera indica</i> L.)	29	Gnetum (<i>Gnetum gnemon</i> L.)	6		
Melon (<i>Cucumis melo</i> L.)	1	Jengköl (<i>Archidendron jiringa</i> (Jack) Nielsen)	19		
Mungbean & Rice bean (<i>Vigna radiata</i> (L.) Wilczek, <i>Vigna umbellata</i> (Thunb.) Ohwi & Ohashi)	4	Langsat (<i>Lansium domesticatum</i> Corrêa)	1		
Rice (<i>Oryza sativa</i> L.)	7	Longan (<i>Dimocarpus longan</i> Lour.)	1		
Sorghum (<i>Sorghum bicolor</i> (L.) Moench)	4	Mangosteen (<i>Garcinia mangostana</i> L.)	7		
Sweet potato & water lettuce (<i>Ipomoea batatas</i> L., <i>Ipomoea aquatica</i>)	11	Matoa (<i>Pometia pinnata</i> Forst. & Forst.)	1		
Sugarcane (<i>Saccharum officinarum</i> L.)	3	Rambutans (<i>Nephelium lappaceum</i> L.)	1		
Taro (<i>Colocasia esculenta</i> (L.) Schott)	2	Sago (<i>Metroxylon sagu</i> Rottboell)	1		
		Snakefruit (<i>Salacca zalacca</i> (Gaertner)Voss)	1		
		Star fruit & Bilimbi	2		

		(<i>Averrhoa carambola</i> L., <i>Averrhoa bilimbi</i> L.)			
		Velvet apple (<i>Diospyros discolor</i> Willd.)	1		
		Water apple, Malay apple, & Jambolan (<i>Syzygium aqueum</i> (Burm.f.) Alston, <i>Syzygium malacense</i> (L.) Merr. & L.M.Perry, <i>Syzygium cumini</i> (L.) Skeels)	3		
Sub-total	95		69		70
Total					234

3.3.2 Data collection

Occurrence points for 234 priority CWR taxa were gathered from the Global Biodiversity Information Facility (GBIF) (www.gbif.org), herbarium specimens from herbarium Bogoriense (BO) (Bogor, Indonesia) and herbarium Naturalis Leiden (L) (Leiden, Netherlands), Genesys (<https://www.genesys-pgr.org/>), and literature (Appendix 5). Records that did not have geographic coordinates were georeferenced using the online resources such as Cartographic Info (<https://cartographic.info/names/place.php?state=id&f=id>), Mapcarta (<https://mapcarta.com>), and Papua Gazetteer (https://github.com/rdmpage/papua-gazetteer/blob/master/papua_gazetter.tsv). Old herbarium specimens were georeferenced with guidance from collector journey history which is available on cyclopaedia of Malesian collectors (<http://www.nationaalherbarium.nl/FMCollectors/>). In total, 8,226 unique presence points for 234 priority CWR were recorded and tabulated in MS Excel using the occurrence Data Collation Template (Magos Brehm *et al.*, 2017) which is freely to download and use. The number of presence records for each taxon ranged from 1 to 259. The accuracy of presence points of the present dataset was checked using the Geoqual tool in CAPFITOGEN (Parra-Quijano, 2016). Only those with Totalqual100 value equal to 70-100 were used for further analysis.

3.3.3 Predicted potential taxa distribution

Species distribution modelling or environmental niche modelling was used to identify potential areas of occurrence since the national collecting and surveying programs have not been systematically undertaken for all studied area. Initially, 103 variables separated into three components (67 bioclimatic, 31 edaphic, and five geophysics variables) at 30 arc-second grid resolution (~1 km in the equator) were provided as predictors (as seen in Appendix 6). SelectVar tool from CAPFITOGEN was then used to select the most important variables values

for each taxon. First, a stepwise collinearity test with variation inflation factors (VIF) <5 was used. When the collinearity test had no results to pass the minimum VIF, a Random Forest procedure followed by bivariate correlations were used to select uncorrelated variables. Only variables with Pearson's correlation $|r| < 0.7$ were used. In addition, to prevent over prediction of the models, particularly for endemic island species, biogeographic units were used as an additional variable predictor as suggested by Raes and collaborators (2013). Each biogeographic units has a unique value that was used as a dispersal limitation predictor (Raes *et al.*, 2013). The list of variables for each taxon to be used in the models can be seen in Appendix 7.

Maximum entropy algorithm (MaxEnt version 3.4.1k) (Phillips *et al.*, 2018) was used to build species distribution models (SDM) for each priority taxon. Maximum training sensitivity plus specificity was applied as threshold rule (Liu *et al.*, 2005) and crossvalidation was used for resampling methods. Four replications for taxa with 10 to 30 presence points was used, while 5 and 10 replicates were for taxa with 30 to 50 presence points and those with more than 50 presence points, respectively. To evaluate the accuracy and stability of the distribution models, three conditions were assessed: (i) average under the test receiver operating characteristics curve (AUC_{test}) > 0.7 ($ATAUC > 0.7$), (ii) standard deviation of the $ATAUC < 0.15$ ($STAUC < 0.15$), and (iii) the proportion of potential distribution area with $STAUC > 0.15$, being $< 10\%$ ($ASD15 < 10\%$) as suggested by Ramírez-Villegas *et al.* (2010). Only taxa that met these criteria were considered to have accurate and stable models. The potential distribution area for taxa with presence points < 10 or without accurate and stable models were estimated using a circular radius of 50 km around each presence point (CA_{50}) (Hijmans and Spooner, 2001). The list of taxa with valid SDM models and those estimated using CA_{50} are listed in Appendix 8.

3.3.4 Ecogeographic Land Characterization (ELC) map

There are two types of ELC maps, generalist and species-specific ELC maps. Generalist ELC maps are based on generalist ecogeographic variables thus representing different landscape scenarios in a given area, while species-specific ELC maps are based on variables that were selected as being relevant in determining specific adaptive ecogeographic scenarios for single taxon (Parra-Quijano, *et al.*, 2012; Magos Brehm *et al.*, 2016; Phillips *et al.*, 2016; Contreras-Toledo *et al.*, 2019) (Parra-Quijano *et al.*, 2012; Phillips *et al.*, 2016; Contreras-

Toledo *et al.*, 2019). To generate generalist ELC map, five variables per component (bioclimatic, geophysics, and edaphic component) of 103 environmental variables with 2.5 arc-minutes resolution (~5 km at equator) were selected using SelectVar tool in CAPFITOGEN. A Random Forest procedure followed by bivariate correlation test were used on the variables selection. Only variables with high importance rank of mean decrease accuracy and Pearson's correlation $|r| < 0.7$ were selected. The selected variables for the generalist ELC map are: temperature seasonality (bio_4), annual temperature range (bio_7), precipitation during the coldest quarter (bio_19), average precipitation for April (prec_4), maximum temperature for January (tmax_1), top soil organic carbon content (t_oc), top soil sodicity (t_esp), top soil saturation of bases (t_bs), gravel content in top soil (t_gravel), top soil clay cation exchange capacity (t_cec_clay), elevation (alt), eastness, northness, aspect, and slope. Besides these 15 variables, latitude and longitude were also used to reduce crosslinking among the ecogeographic units (Parra-Quijano, 2016). While for species-specific ELC map, the variables are the same as used in SDM. The list of variables for species-specific ELC maps can be seen in appendices (Appendix 7). The elbow method was then used for clustering the variables due to its ability to process large datasets for large countries without taking too long (Parra-Quijano *et al.*, 2012; Parra-Quijano, 2016).

3.3.5 *In situ* diversity analyses

A map of predicted taxa richness areas for priority CWR in Indonesia was created by ensemble the predicted potential distribution maps of all studied taxa in ArcGIS 10.4.1. Whilst, for the observed taxa richness, it was based in all presence records for all priority taxa. In addition, a map showing the number of records, thus showing areas with a high number of collections, was also created. Both maps of observed taxa richness and number of records were created in DIVA-GIS ver.7.5.0 using a 50x50 km grid cell size. Subsequently, the total number of population and the number of population within the existing protected area network were identified for each taxon. In this study, two presence points of the same taxon were defined as different populations when they were separated by at least 10 km.

The *in situ* ecogeographic diversity analysis was conducted based on the generalist and species-specific ELC map. The proportion of each ELC category within the existing PA network were compared to their total ELC category. Through the Representa tool in CAPFITOGEN, the frequency of each ELC categories were divided into four quartile class:

low (<0.25), mid-low (0.25-0.5), mid-high (0.5-0.75), and high (>0.75). The representation of ELC categories was also conducted for the complementary area based on the complementarity analysis.

The complementarity analysis used the Rebelo's iterative method (Rebelo and Siegfried, 1990) both on grid cells and on the existing PA network. Complementary analysis was conducted through Complementa tool in CAPFITOGEN. For complementarity based on grid cell, the grids used 50x50 km of cell size.

3.3.6 *Ex situ* diversity analysis

The *ex situ* accessions dataset was compiled from Genesys (<https://www.genesys-pgr.org/>), collections from four national botanic garden in Indonesia (Bogor, Cibodas, Purwodadi, and Bali botanic gardens), and the Bioversity Collecting Missions Database (1978-1996) (<http://bioversity.github.io/geosite/>). The *ex situ* representativeness was assessed at both taxon and ecogeographic levels, using the Representa tool from CAPFITOGEN. The frequency of each ELC categories were classified into quartile classes: low, mid-low, mid-high, and high. These frequencies were then used to defined the *ex situ* gap types of each ELC category ranging from 1–13, where 1 is the highest priority and 13 the lowest priority (Parra-Quijano, 2016). Chi-square test was used to assess whether the collecting efforts were biased or not at 0.05 significance level. Based on overlay the map of buffered 10 km of the *ex situ* accessions, biodiversity intactness map (Newbold *et al.*, 2016), and the predicted taxa richness map, a map for further collecting programs was produced (Parra-Quijano *et al.*, 2012).

3.3.7 *In situ* and *ex situ* conservation gap analyses

In situ and *ex situ* conservation gap analyses followed Magos Brehm and collaborators (2017). *In situ* conservation gaps correspond to CWR taxa and their (ecogeographic) diversity not actively conserved *in situ* as well as CWR taxa that occur within protected areas but lack active management. *Ex situ* conservation gap correspond to both CWR taxa and their (ecogeographic) diversity not adequately conserved *ex situ*.

Based on the above conservation gap categories (both *in situ* and *ex situ*), three different recommendations for future conservation actions were made: (i) further field surveys for those taxa with records occurring in less than five existing protected areas, (ii) priority for *in situ* conservation for taxa with no records within the existing protected area network, and (iii) collection for *ex situ* conservation for taxa without any existing *ex situ* collections, taxa with *ex situ* accession less than 5 different populations and with high priority gaps (1–8 gap type value).

3.4 Results

3.4.1 Ecogeographic Land Characterization (ELC) map

The ELC generalist map for priority CWR in Indonesia is shown in Fig. 3.1. The map contains 28 categories (from category 1 to 28). The category 1 means that at these areas, some of environmental variables have missing value. The most frequent category is category 2 that covers 22.71% of generalist ELC map for Indonesia. Whilst the lowest occurrence category is category 12 that only 0.04% of total ELC generalist category (Appendix 9). Based on the average value of environmental variables that used to created ELC generalist map, category 8 has the lowest annual temperature range (differences between the hottest month and the coldest month). Whilst the category 25 has the highest annual temperature range. The other average value for the variables can be seen in Appendix 10. Not all categories occurred in each of seven biogeographic units (major islands group). Java and Sulawesi contained the most diverse ELC generalist categories with 26 and 25 ELC category, respectively. Whilst Lesser Sunda Island only contained 12 ELC category. The detailed of distribution of ELC categories of ELC generalist map for each biogeographic units can be seen in Appendix 11-17. Besides the ELC generalist map, the species-specific ELC maps were also produced for taxa with at least 10 occurrence records.

3.4.2 *In situ* diversity

The highest taxa richness areas of priority CWR based on the predicted distribution (Fig. 3.2) and observed distribution (Appendix 18) were found in Java Island, with the highest concentration in around West Java and Banten provinces. Several areas that contained significant numbers of priority CWR were also spotted outside Java such as at North and West Sumatra province, East Kalimantan, North Sulawesi, and South Sulawesi. On the other hand, Papua region contains the lowest diversity of priority CWR.

Based on the number of observation from where collections and expeditions were conducted, the island of Java was also identified as the most frequently surveyed (as seen on number of observation map in Appendix 19), while large areas in Papua region were still under-surveyed. Even though the collecting effort was unequal across the country, predicted distribution models can be used to identify potential existing populations in those regions that are under-surveyed.

ELC category

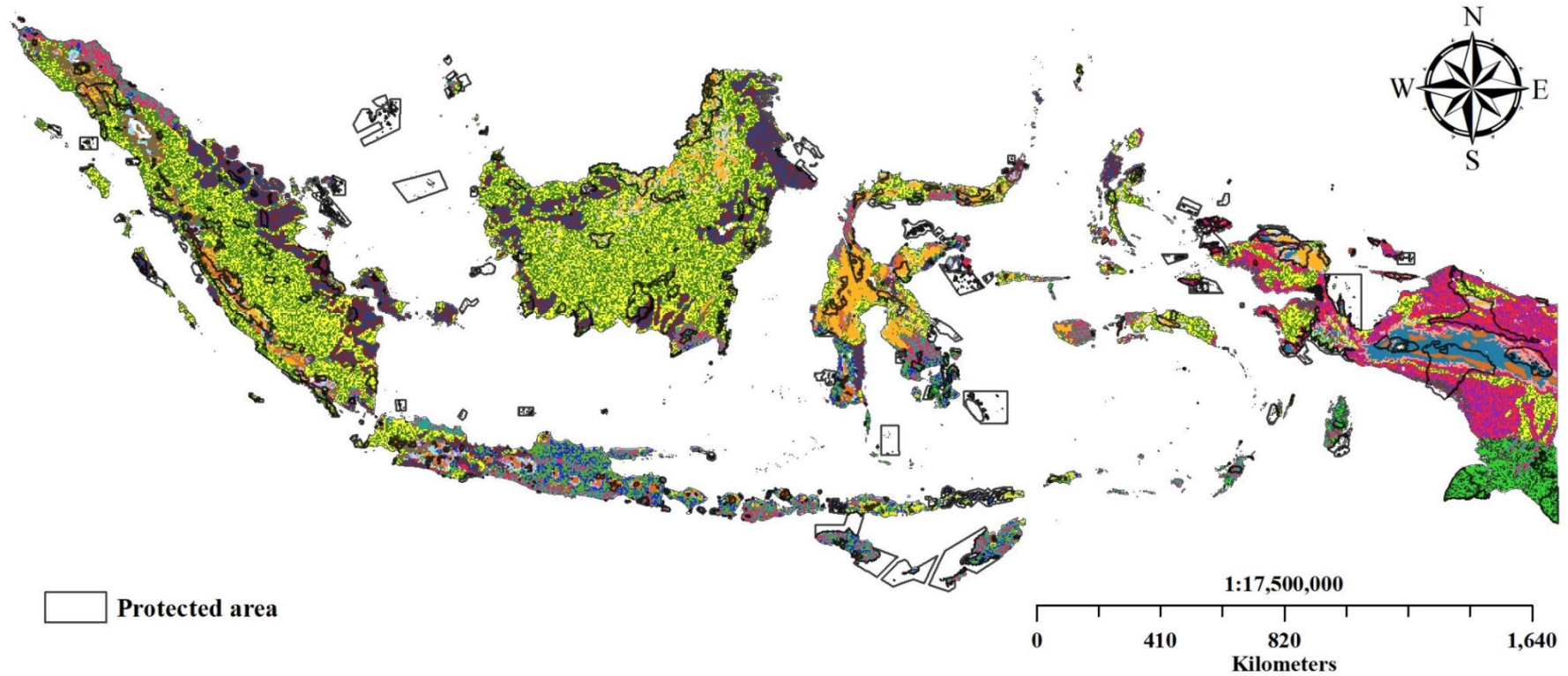
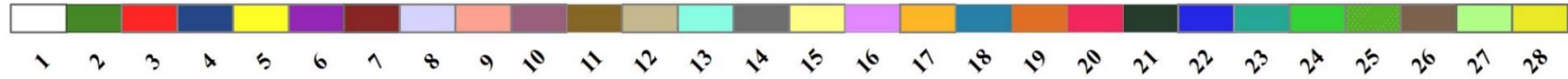


Fig. 3.1 Ecogeographic Land Characterization (ELC) generalist map of priority CWR in Indonesia.

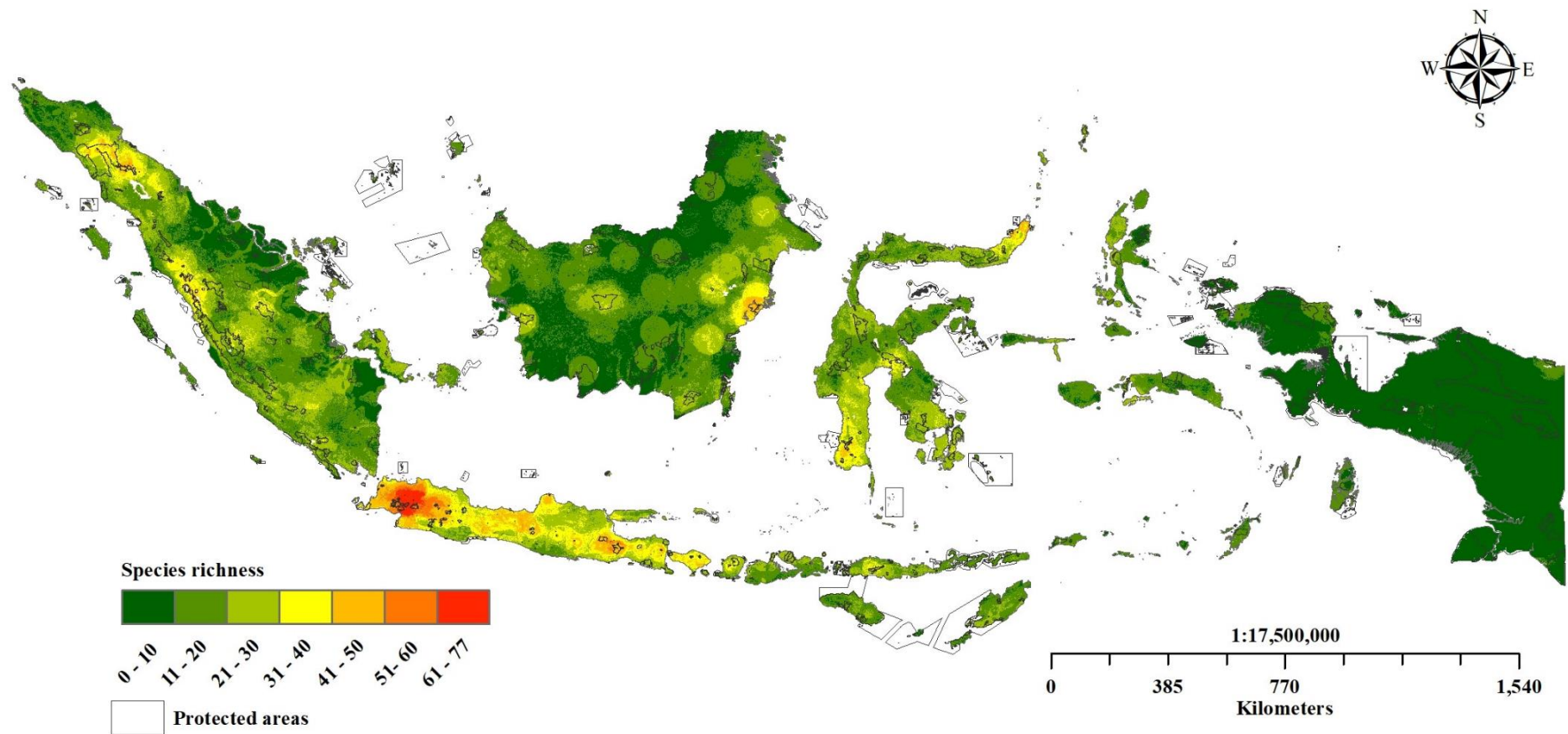


Fig. 3.2 Taxa richness map based on predicted distribution of priority CWR taxa in Indonesia

About 169 taxa have at least one known record within the existing PA network. Number of total priority CWR in protected area network in Indonesia as seen in Appendix 20. Further analysis based on the predicted potential distribution model, showed that 60 out of the 65 taxa that do not have known records within the PA network have potential to occur there (Appendix 21). While predicted distribution of five taxa such as *Dioscorea tenuifolia*, *Ficus auricoma*, *F. halmaherae*, *F. subglabripala*, and *Musa acuminata* subsp. *microcarpa* predicts no occurrence in the existing PA network.

At the ecogeographic level, all ELC categories in the generalist ELC map have representatives in the existing protected areas network. Three protected areas that contained the diverse ELC categories are Kerinci Seblat NP, Mt. Leuser NP, and Kaimana LMMA with 13 different ELC categories. Most of taxa do not have enough ecogeographic representativeness within the existing protected areas. Only 62 taxa that have more than 50% of their ecogeographic diversity within the existing protected areas. The *in situ* ecogeographic diversity of each taxon based on the generalist ELC map were range from 1 to 24 categories. *Colocasias esculenta* has the diverse *in situ* ecogeographic diversity with 24 ELC categories area. While, 30 taxa were recorded to have only one of ELC category (Appendix 22). Only 147 of 234 taxa have species-specific ELC map due to the limitation of their presence records. On average, all of ELC categories for each taxon are under-represented in the existing PA network based on species-specific ELC maps. The distribution of ELC categories of species-specific ELC map in the existing PAs can be seen in Appendix 23.

Table 3.2 The 11 complementary grids (50 x 50 km) needed to conserve in situ two-thirds of the priority CWR taxa in Indonesia

Complementary grid rank	Additional taxa	Total taxa	Cumulative unique taxa	Province
1	54	54	54	Banten, Jakarta Raya, West Java
2	30	46	84	East Kalimantan
3	17	31	101	North Sulawesi
4	12	46	113	West Java
5	11	27	124	Riau
6	8	25	132	West Kalimantan
7	7	30	139	Aceh
8	5	26	144	Riau, West Sumatra
9	5	22	149	South Sulawesi, South East Sulawesi
10	5	19	154	South Kalimantan
11	5	13	159	East Nusa Tenggara

Sixty one complementary grid cells (50 x 50 km) are required to conserve all priority CWR taxa (Fig. 3.3) and 11 are enough to cover $\frac{2}{3}$ of priority taxa (Table 3.2). Within the eleven complementary grids, two are located in both of Java and Sulawesi Island, three are in both of Sumatra and Kalimantan Island, and one in Timor Island. The full list of complementary grids can be seen in Appendix 24. *Artocarpus elasticus* is the most frequent taxon in the complementary grid network found in 22 grids. However, *Archidendron clypearia* is found in 18 grids with a higher number of recorded populations within the complementary grids. Whilst, 162 taxa were found in less than five complementary grids and 92 taxa were found in only one. At ecogeographic level, three ELC categories of ELC generalist map (11, 14, and 26) were absent in complementary grids (Appendix 9). Complementary grids ranked 33 which found in West Sumatra contained the highest diversity of ELC categories but only contained 11 priority taxa. Whilst, the number of ELC category in the top rank of complementary grids was only seven categories (Appendix 24).

Table 3.3 Top 10 complementary PA that proposed as genetic reserves for CWR in Indonesia

Complementary PA rank	Additional taxa	Total taxa	Cumulative unique taxa	Protected area*	Province
1	48	48	48	Mt. Leuser NP	Aceh, North Sumatra
2	19	30	67	Mt. Palung NP	West Kalimantan
3	13	27	80	Mt. Gede - Pangrango NP	West Java
4	8	17	88	Lore Lindu NP	Central Sulawesi
5	7	23	95	Kerinci Seblat NP	Bengkulu, Jambi, West Sumatra, South Sumatra
6	7	22	102	Bukit Baka - Bukit Raya NP	West Kalimantan, Central Kalimantan
7	6	12	108	Kutai NP	East Kalimantan
8	5	13	113	Memberamo Foja WR	Papua
9	5	10	118	Bantimurung NRP	South Sulawesi
10	4	12	122	P. Bawean WR	East Java

Notes: * NP=National Park, WR=Wildlife Reserve, NRP=National Recreation Park

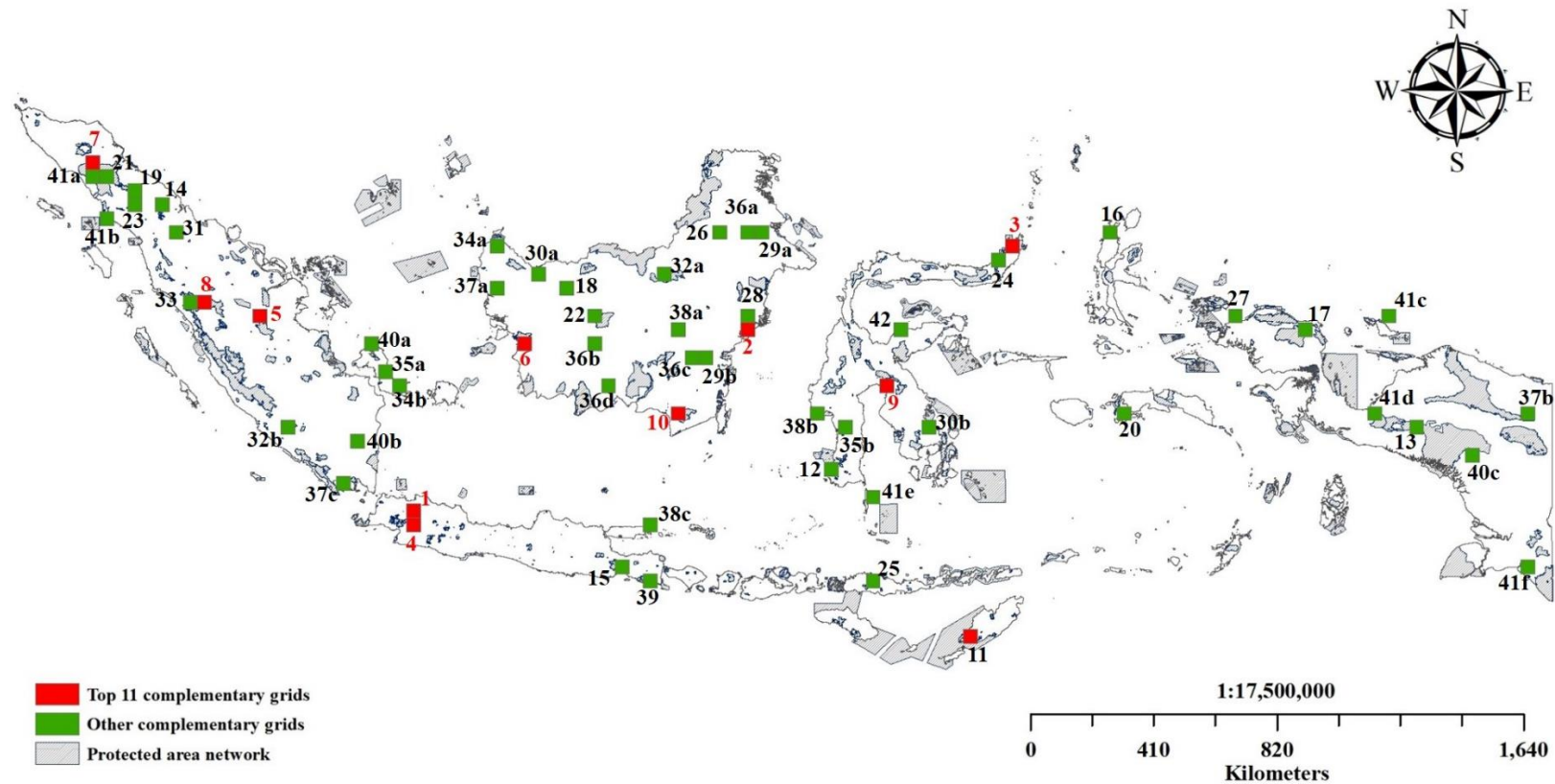


Fig. 3.3 Complementary area based on complementary grid cells (50x50 km) for 234 priority CWR taxa in Indonesia. The number indicates the rank of complementary grid. The first site has the highest number of taxa and the subsequent number has the highest additional taxa compared to the previous complementary grid. Letters following the number mean that those grids have the same total number of taxa and were ranked alphabetically.

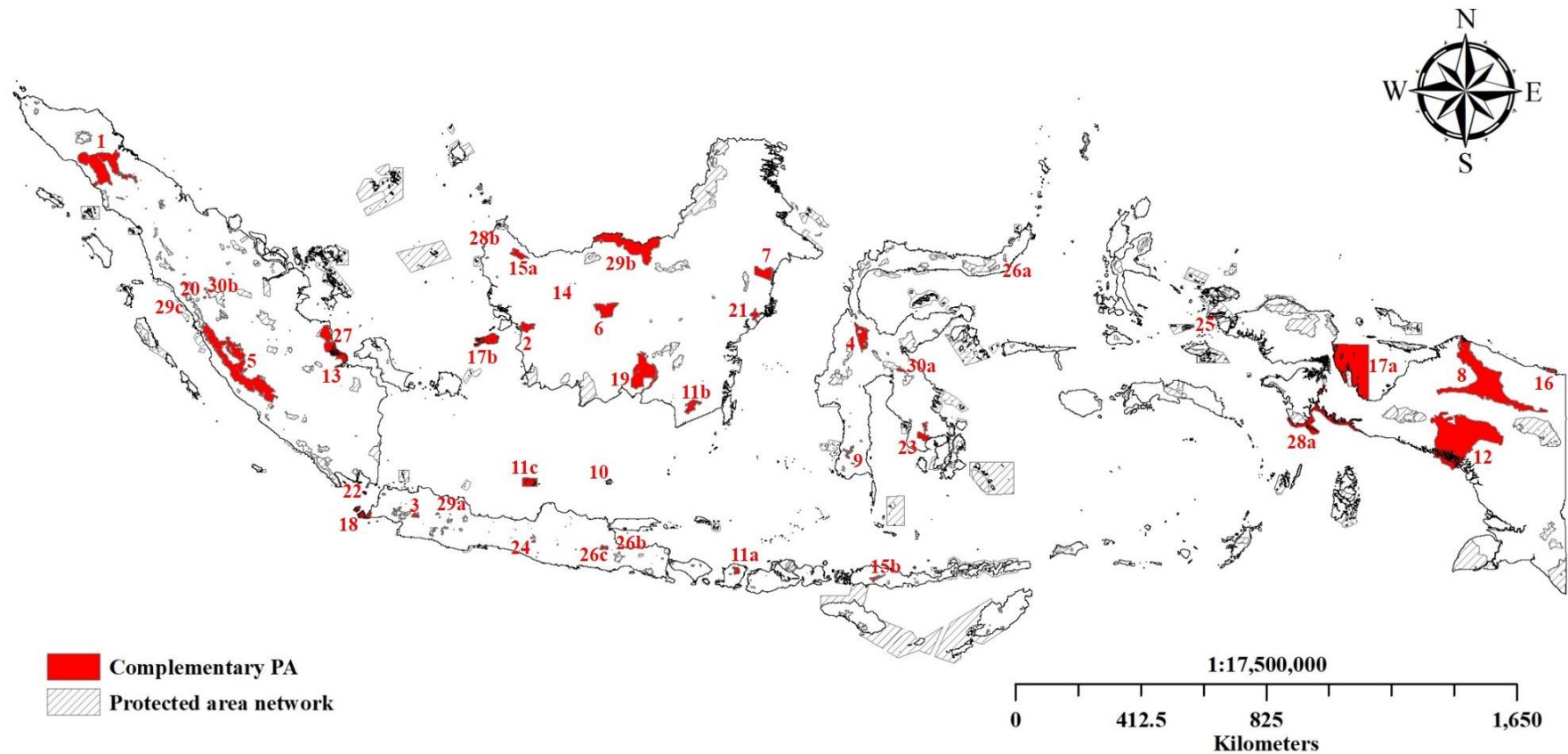


Fig. 3.4 Complementary protected area network for 169 priority CWR taxa that at least have one known population record within the protected area network in Indonesia. The number indicates the rank of the complementary area. The first area has the highest number of taxa and the subsequent number has the highest additional taxa compared to previous complementary area. Letters following the number mean that those grids have the same total number of taxa and were ranked alphabetically.

In addition, 40 complementary protected areas were identified to conserve the 169 priority CWR that have known records within the protected area (PA) network (Fig. 3.4). Mt. Leuser NP in Aceh and North Sumatra province was identified as the top complementary PA containing populations of 48 priority taxa (Table 3.3). Additionally, the complete list of the 40 complementary PA can be found in Appendix 25. *Pometia pinnata* is the most frequent taxon across the complementary PA network occurring in 14 complementary PA (Appendix 26). In terms of ecogeographic level, two ELC categories of ELC generalist map (12 and 15) were absent in complementary PA (Appendix 9).

3.4.3 *Ex situ* diversity

Around 34% of the 234 priority CWR (80 taxa) are represented in *ex situ* collections. Within the *ex situ* collections, only three taxa (*Durio zibethinus*, *Oryza officinalis*, and *Oryza rufipogon*) were collected from more than 50 different populations. *Oryza rufipogon*, the closest wild relative of rice, has the highest accessions number of *ex situ* accessions.

The ecogeographic representativeness of the accessions for most of those taxa with *ex situ* collections was low when compared to their distribution range. In similar way, the *ex situ* accessions were unevenly distributed within the ELC categories on both of ELC generalist map and ELC species-specific maps (ecogeographical gaps) (Appendix 27). For most taxa, collecting efforts were not biased due to the low numbers of collection. Collecting effort bias where found on the accessions of *Colocasia esculenta*, *Durio zibethinus*, *Garcinia celebica*, *Musa acuminata*, and *Saccharum spontaneum* based on the ELC generalist and ELC species-specific map. It means that most of *ex situ* collections of those taxa were came from the same ELC zone. Appendix 23 and 27 can be used as guidance for selecting PA as collecting sites target to enhance the *ex situ* collections.

3.4.4 *In situ* and *ex situ* gap analysis

In situ gap analysis identified 65 taxa occurring outside the existing protected area network exclusively (Appendix 28). Whilst 169 taxa have records within existing protected areas but lack conservation management, i.e. they are passively conserved. Based on ecogeographic diversity, most of taxa are not adequately represented in the existing protected areas. Only nine of 234 taxa have fully representation of their ecogeographic diversity within the existing protected areas.

On the other hand, *ex situ* gap analysis identified 154 (66%) taxa not adequately conserved *ex situ*. Moreover, most priority taxa do not have their ecogeographic diversity adequately conserved *ex situ*, except for *Durio macrantha* that has one single *ex situ* accession from the only one known location from where this species was described. However, its ecogeographic class was categorized as low representation and its mean required more *ex situ* accessions. Priority areas for further collection for *ex situ* conservation has similar pattern to the predicted distribution richness of priority taxa as shows in Fig. 3.5.

3.5 Discussion

Ex situ and *in situ* conservation gaps for priority CWR at global level have been identified by Castañeda-Álvarez and collaborators (2016) and Vincent and collaborators (2013, 2019). However, further analyses are required to identify the species or gaps for conservation programs at national level since the management of these resources and other natural resources is of national responsibility. Therefore, conservation of CWR should be in conjunction with other national's conservation programs and wealth development (Magos Brehm *et al.*, 2017). The results proposed here report on the representativeness of these national priority CWR in current *ex situ* and *in situ* conservation programs in Indonesia.

The distribution map of priority CWR in Indonesia revealed that the Java, Kalimantan, Sumatra, and Sulawesi Island contained the richest area for their diversity. Most area in Java were categorized as high degree of CWR diversity, particularly the western part. In Sumatra, the richest areas were identified in the northern and western part. In Kalimantan (Indonesian Borneo), the diversity concentrated in the eastern part, particularly in the mouth of Mahakam river area at around Samarinda. In Sulawesi, Northern and Southern part of Sulawesi were the richest area. It seems that the richest area of CWR in Indonesia were congruence with the global biodiversity hotspots. Sumatra, Java, and Kalimantan were laid in Sundaland and Sulawesi in Wallacea, two areas that were defined as the global biodiversity hotspots (Myers *et al.*, 2000; Mittermeier *et al.*, 2011). Therefore, those CWR richness area can be defined as CWR diversity hotspots in Indonesia.

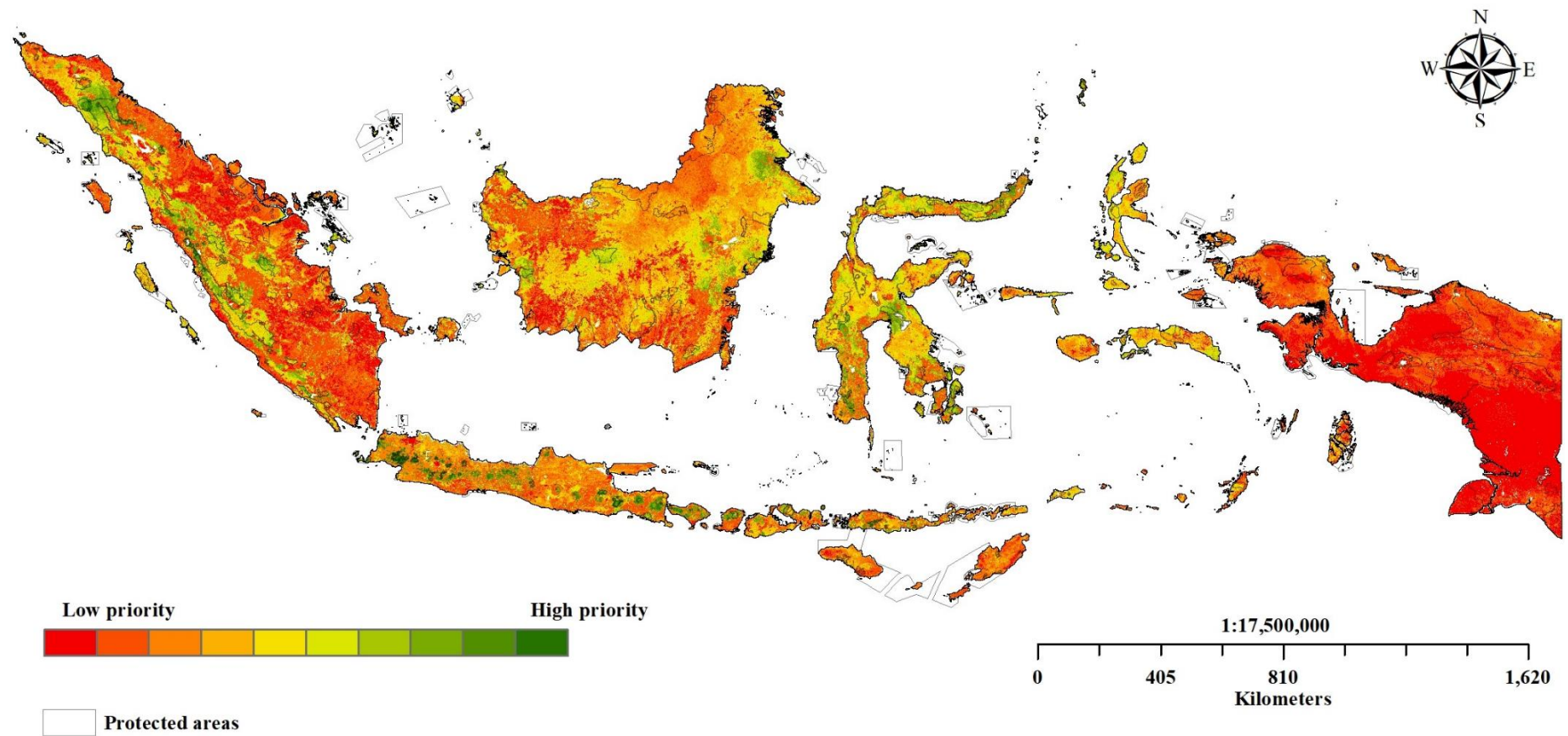


Fig. 3.5 Priority areas for further ex situ collecting programs of priority CWR in Indonesia

The results show that the Java Island is the richest area and contain the highest priority taxa densities for further collecting of *ex situ* conservation. However, Dsikowitzky and collabolators (2019) stated that the island is the most populous and natural ecosystem have been severely affected by land conversion compared to other islands in Indonesia. The question is why the Java Island contains more priority CWR taxa. Is it merely caused by the fact that it better surveyed than the other islands which can be seen in biased observation map (Fig S3.9 in appendices)? Van Welzen and collabolators (2011) found that based on floristic similarity, flora of Java is more related to Wallacea and Philippines flora than that of the Sumatra and Borneo. Further investigation showed that western part of Java is much related to Sundaland flora (Borneo, Sumatra, and Malay Peninsula), while eastern part of Java to Wallacean flora (Welzen and Raes, 2011). It seems that this evidence had caused the percentage of endemic flora in Java is the lowest in Malesia (floristic area that cover Indonesia, Malaysia, Brunei, Philippines, Singapore, and Papua New Guinea) (Welzen *et al.*, 2011). In consequence, many wide distributed or non-endemic taxa can be found in Java, including the priority CWR taxa. Moreover, the ELC generalist map shows that the ecogeographic diversity in Java is more diverse than the other area in Indonesia.

However, to propose priority areas for conservation of biodiversity, a strategy that merely focuses on species richness areas is not an effective approach since this approach is driven by widespread species and neglected those that urgently need conservation action (Brooks *et al.*, 2006). To cope with this insufficiency, complementarity analysis is frequently used (Fielder *et al.*, 2015; Phillips *et al.*, 2016; Contreras-Toledo *et al.*, 2019). The result of complementarity analysis of priority CWR in Indonesia shows that complementary grids or complementary PA are not only located in the CWR hotspots in Indonesia. Forty complementary grids are located in Sundaland, 13 in Wallacea, and eight in Papuasia. Whilst, 27 complementary PA were found in Sundaland, 7 in Wallacea, and 6 in Papuasia.

Based on the World Database for Protected Areas (PAs), about 733 protected areas are recorded in Indonesia (<https://protectedplanet.net>). Only 175 of these have records of priority CWR. 40 of those were identified as complementary sites for 169 priority taxa that have records within the existing PAs. Based on predicted distribution, 23 taxa were predicted to occur in more than 300 different existing protected areas in Indonesia, including those 175 PAs. One problem that still challenges within the existing PAs areas is the effectiveness of conservation management of this areas in terms of biodiversity conservation. In Indonesia, “paper parks”,

i.e. protected areas that are encroached by illegal logging or farm expansion activities, is a known problem (Curran, 2004; Gaveau *et al.*, 2007). However, there are increasing positive trends in the effectiveness of protected areas on biodiversity and ecosystems conservation in Indonesia, between 2015 and 2017, for the 398 existing PAs which have management effectiveness evaluation (Ariyanto *et al.*, 2017). While the other protected areas are not yet evaluated.

Since the aims of CWR conservation is capturing the maximum genetic diversity for crop improvement, proposed priority conservation areas should also consider their genetic diversity coverage. The genetic diversity can be predicted based on ecogeographic diversity (Korona, 1996). The ELC map developed by Parra-Quijano and collaborators (2012) aims at describing different potential plant adaptation scenarios based on ecogeographic diversity of CWR taxa. The results show that all ELC categories, based on the ELC generalist map, have a representation in the existing protected areas but some ELC categories were missing in the complementary sites in both of grid cells based (category 11, 14, and 26) or protected area based (category 11 and 14). In average, the ELC categories diversity for each taxon in complementary grid cells (53.29%) was higher compared to in all existing protected area (30.95%) or complementary PA (23.75%) (Table S9 in supplementary data). This evidence is consistent for the coverage of different populations for each taxon, where on average, the complementary grid cells (35.39%) covered more higher populations than the whole existing PA (16.26%) and complementary PA (11.32%) sites. It shows that not all of priority taxa have suitable environment inside the protected areas. Maxted and Kell (2009) stated that most protected areas tend to conserve the climax community while most CWR were found in pre-climax community. In fact, some wild relatives, particularly of non-tree species, such as wild relatives of amaranth, basil, melon, rice, sugarcane, sorghum, or taro, are found frequently in anthropogenic areas such as roads side, fields edge, or abandoned cultivated areas. Even though complementary protected areas may not conserve all genetic diversity of priority taxa, these results provide baseline information for a minimum set of priority conservation areas, extend the coverage of existing PA, and/or make an informal *in situ* conservation areas. Therefore, complementary PA can be set up as the initial priority areas for effective conservation of CWR in Indonesia since they have formal legal recognition for long-term conservation.

Aichi targets 11 recognizes the important value of conservation areas outside the protected areas (UNEP, 2010). Other Effective Area-Based Conservation Measures (OECMs),

i.e. geographical areas other than protected areas for long term *in situ* conservation of biodiversity and related ecosystem services, are a good option (CBD, 2018b). Therefore, for those 65 taxa without known records within existing protected areas, complementary grids could be nominated as OECMs, after further field surveys are conducted. Even though OECMs can provide positive outcomes for CWR conservation, their implementation, like other conservation efforts, are challenged by limited resources (Jonas *et al.*, 2018). With massive problems faced by the existing PAs in Indonesia, the development of OECMs for CWR will require a lot of efforts from all related stakeholders. However, there are examples of sites managed by local traditional tribes in Indonesia which could be defined as OECMs, for examples: sacred forest of dayak Iban in West Kalimantan (Wadley and Colfer, 2004), tana' ulen or restricted forested land of Dayak Kenyah in North Kalimantan (Eghenter, 2018) and sacred forest of Naga community in West Java (Irawan *et al.*, 2019). OECMs can also be developed by private sectors or organizations (Jonas *et al.*, 2018). The Harapan rainforest in Sumatra is probably an example of OECMs that was established by a consortium of conservation organisations in Indonesia (Utomo and Walsh, 2018). Fourteen tree taxa of priority CWR were recorded from the Harapan rainforest. Utomo and Walsh (2018) noted that at least 820 tree species occurred in this forest. These mean that the development of OECMs for priority CWR in Indonesia have potential prospect.

As part of comprehensive CWR conservation planning, the *ex situ* plays an important and complementary role to *in situ* conservation. *Ex situ* conservation techniques include seed storage, field genebank, *in vitro* storage, cryopreservation, botanic garden and arboreta, pollen storage, or DNA storage (Maxted *et al.*, 1997; Engels *et al.*, 2008). Based on the catalogue of national crop genebanks in Indonesia (BB-Biogen, 2019), most of priority CWR taxa do not have any accessions in the national agricultural genebanks. Most of their collections are primarily landraces. This evidence was highlighted by Hawkes and collaborators (2000) that landraces are easier to collect as they have cultivated population within farms. *Ex situ* collections of Indonesia priority CWR were mostly deposited and recorded at international institutions such as IRRI, Bioversity international, AVRDC, or CIAT (<https://www.genesys-pgr.org/>). Those *ex situ* collections mainly conserved plants with orthodox seeds. While the *ex situ* collections of perennials, particularly trees, mostly found in botanic gardens. O'Donnell and Sharrock (2018) stated the importance of botanic gardens in conjunction with agricultural genebanks in conservation of CWR. About 2,700 botanic garden around the world conserve up

to 30% of known plants and about six thousands of those were identified as wild relatives of 68 crop genera (O'Donnell and Sharrock, 2018).

A combination of different techniques should be used to get an adequate *ex situ* conservation of priority CWR taxa in Indonesia. Taxa with orthodox seeds type such as grass taxa (*Oryza* spp., *Saccharum* spp., and *Sorghum* spp.), pulses (*Cajanus* spp., *Lablab* spp. and *Vigna* spp.), *Amaranthus* spp. and *Ocimum* spp., should be prioritized for institutions with seedbank. *In vitro* techniques can be applied for wild relatives of banana and taro, since these techniques have been successfully used for these taxa (MusaNet, 2016; Ebert and Waqainabete, 2018). Perennials with recalcitrant seeds, particularly trees, are recommended to be conserved in field genebanks or botanic gardens. Eleven Indonesian institutions maintain field genebanks for plant genetic resources for food and agriculture (PGRFA), among which, five are already conserved of some priority CWR in Indonesia (Indonesian authorities for the second report of the state of PGRFA, 2010). There are also 31 botanic gardens designed for specific themes of collections and related to conserve CWR (Widyatmoko and Risna, 2017). Indonesian authorities for the second report of the state of PGRFA (2010) highlighted the differences between field genebank and botanic garden lies on the number of maintained taxa in field genebanks are limited but their genetic diversity is high while botanic gardens maintain many taxa but their genetic diversity is generally low since their number of accessions are relatively small compared to field genebanks.

Brown and Briggs (1991) developed a rule of minimum sample requirement for adequate *ex situ* plant genetic diversity. The rule was designed for endangered species but the concept of multiple taxa and equal efforts of sampling will prevent unequal attention to some rare taxa by over collecting efforts for the highly collected taxa. They recommended to conserve at least five known populations with ten individuals for each population of each different taxon as a minimum sample to capture their genetic diversity. From this viewpoint, 31 priority CWR with *ex situ* collections reach their minimum sample of *ex situ* accessions. In this circumstances, the other 49 taxa with *ex situ* collection and 154 other taxa without any *ex situ* collections are the priority for further collecting programs. Parra-Quijano and collaborators (2012) introduced a new approach based on the ecogeographic representativeness to evaluate the adequacy the *ex situ* collections. They stated that collections that cover all ecogeographic diversity of taxa will maximize the range of variation traits from environmental adaptation in the collections (Parra-Quijano *et al.*, 2012). Looking at this angle, all taxa with *ex situ* collections of priority CWR

have both spatial and ecogeographical gaps. Therefore, all priority CWR taxa in Indonesia require further collecting missions to properly cover their ecogeographic diversity. However, the priority for immediate collecting missions are for the 154 taxa without any *ex situ* collections.

Based on the results of this paper, seven recommendations to strengthen the conservation programs of priority CWR taxa in Indonesia are proposed:

1. For *in situ* programs, complementary PA should be a priority to establish a network of genetic reserves for CWR populations in Indonesia. By linking conservation of CWR diversity and general biodiversity within the complementary PA, active conservation management of priority CWR will have equal attention. The top ten of complementary PA (Mt. Leuser NP, Mt. Palung NP, Mt. Gede-Pangrango NP, Lore Lindu NP, Kerinci Seblat NP, Bukit Baka-Bukit Raya NP, Kutai NP, Mamberamo Foja WR, Bantimurung NRP, and P. Bawean WR) can be prioritized for the genetic reserves of CWR in Indonesia.
2. Further field surveys for the 65 taxa without any records within the existing protected area network are strongly proposed. The highest priority are the five taxa that are not predicted to be found within the existing PA network. Priority protected areas for future field surveys are those in the surroundings of presence records or those for which CWR presence has been predicted but not confirmed. The priority PA for further field surveys are Mt. Mangkol GFP (Bangka Island), Kayan Mentarang NP (North Kalimantan), Lati Petangis GFP (East Kalimantan), Sungai Kapuas and Tanjung Malatayur (Central Kalimantan), and Aketajawe Lolobata NP (North Moluccas).
3. It is suggested that Other Effective Area-Based Conservation Measures (OECMs) are used for taxa that are not found within the PA network and for non-forest taxa (pre-climax community species). The locations for potential OECMs of priority CWR taxa are the complementary grids where these taxa are found. For example, the OECMs can be established in Berau and Malinau area of East Kalimantan, Labuhan Batu-Tapanuli Selatan of North Sumatra, or Bangka Selatan in Bangka Island. Coordination within the stakeholders and relevant local communities where the OECMs will be established is strongly advised to get the appropriate applied management.
4. For *ex situ* programs, the priority for further collecting missions are the 154 taxa without any *ex situ* collections. The priority areas for this action are Mt. Leuser NP (Aceh), Arau

Hilir and Air Terusan WR (West Sumatra), Mt. Halimun-Salak NP (West Java), Mt. Palung NP (West Kalimantan), and Faruhumpenai NR (South Sulawesi).

5. To increase the current accession number of taxa with *ex situ* collections, the ecogeographic diversity representativeness is suggested as a guide. The area with high gap types can be used as the guidance as in Table S10 and S14. The priority area will be specific for each taxa. For example, *Archidendron clypearia*, the highest gap type was found in Memberamo Foja WR, Pulau Kobror WR, Pulau Dolok WR, Karimata NR, Lorentz NP, Muara Kaman Sedulang NR, Tasik Belat WR and Wasur NP.
6. Enhance the diversity of *ex situ* techniques (arboreta and botanic gardens, cryopreservation, field genebank, *in vitro* culture, pollen storage, and seed bank) to optimize the safety of long-term *ex situ* conservation. The institutions with specialized *ex situ* techniques should be in coordination for an efficient conservation efforts.
7. The *in situ* and *ex situ* conservation achievement progress should be communicated between the stakeholders periodically to evaluate the effectiveness and efficiency of the CWR conservation programs. In this context, the national agricultural genebanks can be the major player.

3.6 Conclusion

The diversity and *in situ* and *ex situ* conservation gaps for 234 priority CWR in Indonesia were identified in this paper. 169 priority taxa at least have one population record within the existing protected area network. The other 60 taxa were predicted to occur in several existing PAs, while the existence of five other taxa (*Dioscorea tenuifolia*, *Ficus auricoma*, *Ficus halmaherae*, *Ficus subglabripetala*, and *Musa acuminata* subsp. *microcarpa*) should get the most attention by undertaking immediate field surveys. Complementary analysis identified at least 61 complementary grids are required to conserve all priority CWR and 40 complementary PA to conserve 169 priority taxa, those with records within the PA network. Complementary PA should be prioritized to initiate the development of a genetic reserve network of priority CWR in Indonesia. OECMs for priority CWR taxa should also be considered to complement the CWR PA network. Only 80 taxa have records within the current *ex situ* collections. Only three of those taxa have *ex situ* accessions from 50 or more different populations. Since all taxa with *ex situ* collection have spatial and ecogeographical gaps, all

priority CWR taxa are required for further collecting programs. However, those 154 taxa without any *ex situ* collections are priority for future collecting missions.

CHAPTER 4

CLIMATE CHANGES IMPACT ON THE DISTRIBUTION RANGE SHIFTS OF PRIORITY CROP WILD RELATIVES IN INDONESIA

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Wrote the paper: W.R.

Critically reviewed the paper: W.R., J.M.B., N.M.

4.1 Abstract

The analysis of climate change impact is important to include in conservation planning of crop wild relatives (CWR) to provide the guideline for effective long term protection under unpredictable future environmental condition. These resources play an important role to sustain the future of food security but the evidences showed that they are threatened by climate change. However, the climate change impact analysis shows that priority CWR in Indonesia are not always impacted negatively. One to seven CWR (*Archidendron clypearia*, *Artocarpus lanceifolius*, *A. sepicanus*, *Dioscorea pyrifolia*, *Durio zibethinus*, *Ficus padana* and *Oryza meyeriana*) are predicted to have a significant benefit from changes in climate as their distribution range is predicted to expand more than 30% depend on the scenario. The results also show that only one to six CWR (*Artocarpus sepicanus*, *Averrhoa bilimbi*, *Cocos nucifera*, *Dioscorea alata*, *Ficus chartacea* and *F. oleifolia*) are predicted to obtain more than 30% contraction of their current distribution range by the climate change. The ability to migrate seems to be key for their persistence in the future as the results show that without migration all the distribution ranges of priority taxa will be declining. One factor that is fundamental to support their migration are the availability of climate refugia. Based on the existing protected areas network, the climate refugia of priority CWR in Indonesia were identified. The hotspots of climate refugia for the 56 priority CWR were located in South-Western Part of Java, whilst climate refugia with high possibility containing non-analogue community assemblages were identified in Central-North Kalimantan and Central-South Papua. The significant holdouts populations for multiple species were also identified in Sumatra and Sulawesi and should be the target for *ex situ* collections and sources for assisted migration. Therefore, by considering their climate refugia, migration capacity, and holdouts populations, the goals to keep high genetic variations for long term conservation of CWR in Indonesia can be achieved.

Keywords: Climate change, climate refugia, crop wild relatives (CWR), distribution range shift, holdouts, protected areas.

4.2 Introduction

Incorporating the impact of climate change on conservation planning is increasingly a routine activity in adjusting the conservation goals in the future (Prober *et al.*, 2019). By anticipating the future distribution range shifts of species due to climate change, their extinction risk can be minimized (Thomas *et al.*, 2004; Wiens *et al.*, 2010; Morecroft *et al.*, 2019). In this

term, climate refugia, the extant or new colonized natural areas where species will exist under climate change (Keppel *et al.*, 2015), and holdout populations, i.e. populations that persist in a microclimate for a limited period and that is likely to disappear in the near future due to adverse climatic conditions (Hannah *et al.*, 2014), should be identified and prioritized for the conservation of species. Thus, by including those objects in conservation planning, effective long term protection as the goal of biodiversity conservation will be achieved.

Crop wild relatives (CWR), like all wild taxa are threatened by climate changes (Maxted *et al.*, 1997; Jarvis *et al.*, 2008; Aguirre-Gutiérrez *et al.*, 2017; Phillips *et al.*, 2017; Vincent *et al.*, 2019). Some wild relatives of cultivated peanut, potato, maize, and broad-bean are predicted to go extinct in the next 50 years (Jarvis *et al.*, 2008; Vincent *et al.*, 2019). Whilst, Jablonski *et al.* (2002) reported that elevating concentration of CO₂ had negative effect on CWR reproduction system which will lead to disrupt their regenerating process. On the other hand, CWR are keys for broadening genetic diversity of related crops to be more adaptive in changing climates. Therefore, the initiative to established a global *in situ* network of CWR sites (Maxted and Kell, 2009; FAO, 2013, 2014) and increase *ex situ* collections (Jarvis *et al.*, 2010; Castañeda-Álvarez *et al.*, 2016) are developed to reduce the extinction risk of CWR by climate changes.

Based on niche conservatism theory, each species has their own niche and the population will be maintained under this niche (Wiens and Graham, 2005; Wiens *et al.*, 2010). In this context, their future existence will depend on how large their niche exists or expands in the future. In terms of climatic niche, it means how large the analogue climate condition will be available in the future. However, based on niche construction theory (Odling-Smee *et al.*, 1996, 2013), the niche can also shift (Ackerly, 2003; Pearman *et al.*, 2008) and evolve (Smith and Beaulieu, 2009; Wake *et al.*, 2009). Recent finding showed that the climatic niche of plants mostly shifted when they introduced to another continent from their native ranges (Atwater *et al.*, 2018).

The world, and particularly Indonesia, is experiencing anthropogenic climate changes (IPCC, 2014). As one of the global biodiversity hotspot' and mega-diverse countries (Mittermeier *et al.*, 2011), Indonesia is vulnerable to the negative impact of climate changes (The Ministry of Environment and Forestry of the Republic of Indonesia, 2018). Herawati and Santoso (2011) predicted that climate change will disrupt annual temperatures and rainfall patterns, with Northern part of Indonesia experiencing more rainy days than the Southern part.

Further extreme weather conditions such as El-Niño and wildfires are likely to become more frequent and worst in Indonesia.

Protected areas (PAs) are important to support the dynamic of species range shifts under climate changes (Thomas *et al.*, 2012; Haight and Hammill, 2020). However, there are pessimistic predictions that the current existing PAs in Indonesia might fail to support these shifts (Proctor *et al.*, 2011; Scriven *et al.*, 2015). Proctor and collaborators (2011) and Scriven and collaborators (2015) stated that land use fragmentation had promoted the isolation and lack of inter-connectivity among PAs. This means that species with less capacity for long-distance dispersal will have a higher risk of extinction.

The availability of CWR diversity for crop improvement and climate change mitigation is a growing priority in Indonesia in part because of the threat to their diversity posed by climate change but also because of the need to sustainably increase food production in a country with a fast growing human population. Utilisation of CWR in climate smart crop variety requires that the necessary CWR diversity is actively conservation and so available for use (Maxted *et al.* 2020). The aims of this research are therefore (a) to determine the predicted changes of distribution range shift of priority CWR in Indonesia led by climate change, (b) to identify the capacity of the existing PAs as climate refugia, and (c) to identify the suggest ways to mitigate the impact of climate change on Indonesian CWR diversity through adapted conservation planning and management.

4.3 Methods

4.3.1 Priority CWR of food crops in Indonesia and occurrence data collection

Based on an Indonesian checklist of 1,968 CWR taxa were prioritised on relative threat levels and potential use in breeding and an inventory of 234 taxa was used as the basis for this research (Rahman *et al.*, 2019). Occurrence points for each priority taxa were collected and compiled from Global Biodiversity Information Facility (GBIF), herbarium specimens deposited in Herbarium Bogoriense and Naturalis Leiden, and various publications. In total, 8,226 unique occurrence points were recorded and where necessary georeferenced.

4.3.2 Species distribution modelling

Maxent version 3.4.1k (Phillips *et al.*, 2018) was used to develop the current and future species distribution models for the priority taxa. Cross-validation was used as a resampling method with different replications depending on the number of occurrence points for each taxa

(4 replicates = 10–30 presence points, 5 replicates = 30–50 presence points, 10 replicates $\geq$ 50 presence points). Maximum training sensitivity plus specificity was chosen as threshold rule as it gives good results when transforming the probabilities value into presence/absence data (Liu *et al.* 2005).

The produced models for the current climatic condition were validated through three criteria developed by Ramírez-Villegas and collaborators (2010). In order for a model to be accurate and stable, it should meet the three following criteria: (i) the average AUC test should be higher than 0.7 (ATAUC > 0.7), (ii) the standard deviation of ATAUC should be less than 0.15 (STAUC < 0.15), and (iii) the proportion of potential distribution area with STAUC > 0.15 should be less than 10%. Only species with valid models were used to develop the distribution models under future climatic conditions. Validation results for current distribution range models can be found in Appendix 8.

4.3.3 Environmental variables selection

Initially, 103 variables (67 climatic, 31 edaphic, and 5 geophysics variables) with 30 arc-second resolution were provided as environmental background (Appendix 6). Those variables were extracted for every occurrence points for each priority taxa. Then, a stepwise collinearity test was used to select uncorrelated variables with variation inflation factors (VIF) < 5 as the threshold value. Some taxa which did not surpass the threshold value were further analysed through Random Forest procedure followed by bivariate correlation. Only variables with Pearson's correlation < 0.7 were selected. One additional variable, the biogeographic unit, was added for all taxa as dispersal limitation predictor to prevent over prediction of taxa distribution range to other islands where they have never been recorded (Raes *et al.*, 2013). The list of used variables for each priority taxa can be found in Appendix 7.

4.3.4 Future species distribution models

Future climate conditions were downscaled from the Global Circulation Model (GCM) and compiled from CCAFS (available at <http://www.ccafs-climate.org/>) (Navarro-Racines *et al.*, 2020). Five climates models were used as seen in Table 4.1. Based on IPCC report ARS 5 (Settele *et al.*, 2014), each climate models given different response value of the impact climate change to the global terrestrial systems. Those five selected climate models are representative of the highest, the upper middle, the middle, the lower middle, and the lowest climate models to the projection simulation of the future extent of Northern Permafrost as one of key ecosystem

for the global climate change mitigation. Two Representative Concentration Pathways (RCP) of greenhouse gases (GHG) emission scenarios (RCP 4.5 and RCP 8.5) were selected for two different periods (year 2050 and 2080), as those two RCP scenarios provided moderate optimistic and very pessimistic scenarios for the future GHG emission for the near and long term climate projections (Moss *et al.*, 2010). All of the global future climatic variables from five climate models were clipped to the Indonesia territory as the study area. The ensemble of each variables from five climate models was created by their median value in Arcmap and used for further analysis.

Table 4.1 Selected climate models

Climate Model	Model code	Developer
Beijing Climate Centre Climate System Models	bcc_csm1_1	Beijing Climate Centre (BCC), China Meteorological Administration (CMA), China.
Goddard Institute for Space Studies GISS-E2-R model	giss_e2_r	NASA Goddard Institute for Space Studies, USA.
Institute Pierre-Simon Laplace (IPSL_CM5a_LR)	ipsl_cm5a_lr	Institute Pierre-Simon Laplace, France.
The Model for Interdisciplinary Research on Climate (MIROC 5 model)	miroc5	Atmosphere and Ocean Research Institute; Centre for Climate System Research-National Institute for Environmental Studies; and Japan Agency for Marine-Earth Science and Technology, Japan
Met Office Hadley Centre Hadley Global Environment Model 2-Earth System	mohc_hadgem2_es	Met Office, UK.

To develop the future distribution models, the same environmental variables were used as those used in current climatic models, except for the climate variables. The ensemble value of climatic variables for each scenarios was used as the climatic predictors. Whilst the edaphic, geophytic, and biogeographic unit variables were same for all scenarios. Validation of the future distribution models were based on three criteria used by Ramírez-Villegas and collaborators (2010) as mentioned before. Only species with valid models for all scenarios were used for climate change impact analysis. Validation results for the future distribution range models in all scenarios can be seen in Appendix 29-32.

4.3.5 Climate change impact analysis

Two migration scenarios were used to analyse the impact of climate change to the priority taxa, i.e. unlimited migration and no migration. Unlimited migration means the species are able to colonize the new areas with analogous climate conditions in the future. Whilst no migration scenario means the species are unable to migrate to new areas in the future and are restricted to the current distribution range. By considering RCP scenarios, time projections, and migration scenarios, eight future distribution models were therefore created for each priority taxa.

Distribution range shifts for each taxon were predicted by comparing the future distribution to the current distribution. The winners (species that have benefitted from climate change by increasing their distribution range) and losers (species that have negative impacts from climate change by contraction in their distribution range) were determined by calculating the gain and loss areas for each priority taxa based on the grid cells occupancy. Species richness was identified and mapped for the current and future distribution range by overlapping the models in order to determine the species hotspots. Species turnover rates were also calculated and mapped to determine the future community assemblages. The turnover rates for the unlimited migration scenario is calculated as $(100 \times (\Sigma\text{loss} + \Sigma\text{gain}) / (\text{current species richness} + \Sigma\text{gain}))$, while for the no migration scenario is $(100 \times \Sigma\text{loss} / \text{current species richness})$ (Thuiller *et al.*, 2005). The hotspot maps of species distribution changes, gains and losses were also produced.

4.3.6 Protected areas (PAs) network capacity analysis for future conservation

The capacity of the existing PAs to conserve future distribution of priority CWR taxa was measured by their potential to become climatic refugia (Haight and Hammill, 2020). In this context, species distribution models for all scenarios were over-layed with the national network of PAs. PAs that were occupied by the target taxa were considered as climate refugia. Besides refugia, holdouts population were also identified by comparing the future and current distribution inside the PAs for each taxon based on grid cells. PAs were considered containing significant holdouts when their future occupancy are deficit compared to the current distribution range. The average number of PAs as climate refugia and those with significant holdouts population were tabulated based on their crop gene pool.

Representa tool in Capfitogen (Parra-Quijano, 2016) was used to prioritize the PAs for further collecting sites to enhance the *ex situ* collections based on their ecogeographic

representation. Therefore, species specific Ecogeographic Land Characterization (ELC) maps were produced for each of the 56 taxa. The same environmental variables for the development of species distribution modelling were used to create the ELC maps. Whilst, the information of *ex situ* accessions were compiled from the global database, such as in Genesys (<https://www.genesys-pgr.org/>) and the Bioversity Collecting Mission Database (1978-1996) (<https://bioversity.github.io/geosite/>), and from national botanic garden in Indonesia (Bogor, Cibodas, Purwodadi, and Bali botanic garden). The output table of Representa tool that contain gap type classes was used to select the priority ELC zone. The class 1 to 6 of 13 classes of gap type were considered as the higher priority (Parra-Quijano, 2016). Then, PAs which contain those ELC zone were identified. Those PAs were matched with those containing significant holdouts population. The PAs which containing the highest diversity of priority ELC zone and having the highest average of holdouts population in across all of the scenarios were selected as the priority.

4.4 Results

Among the 234 taxa of priority CWR in Indonesia, only 58 taxa have valid distribution models for the current climate (Table S3.4). The other 176 taxa either had < 10 occurrence points (83 taxa) or did not pass the validation threshold values (93 taxa). Out of the 58 taxa for which future distribution models were created, only 56 taxa have valid models in all scenarios and these were then used for climate change impact analysis (Appendix 29-32). Those 56 taxa are related to 24 crops gene pools.

The impact of climate change on the species distribution range varies among the taxa and between the RCP scenarios, migration scenarios, and the year of projections. On average, the worst scenario is RCP 8.5 without migration ability for year 2050. However, not all of priority taxa will experience a negative impact by the future climate change. Positive impacts were found in taxa which have ability to migrate and colonize new areas without any restriction (unlimited migration).

By 2050, the average of distribution changes ranges from -16.2% (in RCP 8.5 with no migration) to 1.6% (in RCP 8.5 with unlimited migration) (Fig. 4.1A and B). One fig wild relative (*Ficus chartacea* (Wall. ex Kurz) Wall. ex King) is predicted to get the worst negative impact by decreasing the distribution range for more than half of the current range. *Artocarpus sepicanus* Diels (breadfruit wild relative) is also predicted to have a significant decreasing its

distribution range by 2050. On the other hand, one wild relative of rice (*Oryza meyeriana* (Zoll. & Mor.) Baillon) is predicted to enlarge its distribution range by more than 80% of its current range. Some species, such as *Archidendron fagifolium* (Blume ex Miq.) Nielsen, *Archidendron jiringa* (Jack) Nielsen, *Artocarpus lanceifolius* Roxb., *Durio zibethinus* L., *Dimocarpus longan* Lour. and *Rubus rosifolius* J.E.Smith, are predicted to have non-significant distribution changes by climate change in year 2050.

By the year 2080, the average of distribution changes will be projected at around -14.79% (in RCP 8.5 with no migration scenario) to -0.76% % (in RCP 8.5 with unlimited migration scenario) (Fig. 4.2A and 4.2B). *Ficus oleifolia* King, wild relative of figs, will be experiencing the highest reduction to close to 70% of its current distribution based on the RCP 4.5 scenario without migration. Whilst one of the yams wild relative (*Dioscorea pyriformis* Kunth.) will have more favourable areas up to 70% of the current distribution based on RCP 8.5 scenario with unlimited migration.

Table 4.2 and 4.3 show that, out of the 24 crop gene pools, only 12 have consistent increasing distribution area in both 2050 and 2080 based on RCP 4.5 scenario and only 8 on RCP 8.5 scenario. In simultaneously comparison between the year 2050 and 2080, fifteen crop gene pool will continue to lose their current distribution range based on RCP 4.5 scenario, while only 10 crop gene pool will be experiencing the same situation based on RCP 8.5. The number of crop gene pools which is expected to experience continuous reduction in distribution ranges between 2050 and 2080, is higher in the RCP 4.5 than in the RCP 8.5 scenario. Some crops gene pools have non-significant losses or gain as the losses or gain areas are only less than 1% of their current distribution range. Changes on gains and losses of distribution area for each priority taxon can be seen in Appendix 33.

Fig. 4.3, 4.4, and 4.5 show that the island of Java is the richest area of priority CWR for both the current and future climates in all scenarios. However, a decrease pattern of the richest area (in term of number of the richest grid cells) within this Island can be observed when comparing the future distribution to the current, particularly based on the RCP 8.5 scenarios in year 2080. The second richest island is Sulawesi. In this island the relatively richest areas were identified in the southern peninsula of the Island. In Sumatra, the west coast is richer than the east coast. Whilst, in Kalimantan, the eastern part is richer than the western part. Moreover, based on the species changes map (Appendix 34), the hotspot of gains area (Appendix 35) and the hotspots of losses area (Appendix 36), the future richness area in Sumatra tends to shift

from the western to the eastern coast. While in Kalimantan and Sulawesi, it tends to expand to the centre of the islands. In all cases, the eastern part on Indonesia, particularly the Papua region show the lowest area on the diversity of priority CWR taxa.

Fig. 4.6 and 4.7 shows turnover rates of priority CWR future distribution based on the no migration and unlimited migration scenario, respectively. Areas with highest turnover rates are identified in Central-Southern part of Papua and in Central-Northern part and Southern part of Kalimantan. Whilst the lowest turnover rates are mostly found in Java, Lesser Sunda Islands, Moluccas, and Sulawesi. Many areas will be experiencing to have higher turnover rates based on RCP 8.5 scenario than the RCP 4.5. Based on the RCP 8.5 scenario, number of areas (grid cells) which will be experiencing the highest turnover rates in 2050 is expected higher than in 2080. Whilst, based on RCP 4.5 scenario, it is likely in contrast.

The average number of PAs with persistent population is expected to decline in most crop gene pools in all scenarios (Table 4.4). Based on no migration scenario, the area occupied by all the target taxa within the existing PA is expected to decrease. Whilst, based on unlimited migration, the average numbers of future refugia within the existing PAs varies among the taxa and between RCP scenarios. Some of crop gene pools will be declining in both of 2050 and 2080 (e.g. black palm sugar, starfruit, figs, mangosteen, and sorghum). Some others will increase both in 2050 and 2080 (e.g. archidendron, mungbean), decreasing in 2050 then increasing in 2080 (e.g. aubergine, mangoes, rambutans, rubus, yam) and increasing in 2050 then decreasing in 2080 (e.g. Gnetum, pigeon pea). Full list of the number of PAs as climate refugia for each CWR taxa can be seen in Appendix 37.

On average, the numbers of PAs that contain holdouts based on RCP 8.5 scenario is higher than RCP 4.5 (Table 4.5). Numbers of holdouts based on no migration scenario are always higher than the unlimited migration for all taxa. Number of PAs containing significant holdouts will increase from year 2050 to 2080 based on RCP 4.5 scenario. In contrast, number of PAs containing significant holdouts will decrease from year 2050 to 2080 based on RCP 8.5.

Only 36 of 56 taxa that currently have accessions in the *ex situ* collection. However, the accession number of all those taxa were insufficient to represent their potential genetic variation based on their ecogeographic distribution range. The number of priority PAs for further collecting site were identified for each taxa (Appendix 38). For those taxa without current *ex situ* collection, most of PAs that contains the holdouts population were also contained the priority ELC zone. For *Ficus chartacea* and *F. oleifolia* two of figs wild relatives that predicted

to have the greatest contraction, the priority PA is the Kerinci Seblat NP, where three of five and four of 12 priority ELC zones occurred with holdouts population reached up to 4,085 km² in 2050 based on RCP 8.5 and 6,373 km² in 2080 based on RCP 4.5, respectively. Whilst, for *Artocarpus sepicanus*, wild relative of breadfruit, the priority PA is Waigeo Barat Timur NR in West Papua where it holds three of four priority ELC zone with holdouts population up to 306 km² in 2080 based on RCP 8.5

4.5 Discussion

The current climate changes impact analyses results are necessarily based on only 56 of 234 priority CWR taxa in Indonesia because of lack of basic biodiversity data for the majority of the species, however, for these taxa valid distribution models can be produced and generate useful information. Most of the 56 national priority taxa are wide spread distributed species. Whilst, many national endemics are not included in distribution models, since their record numbers are limited. Thus, further field surveys is required for most priority CWR in Indonesia to improve the baseline assessment. The other possible reason why so many taxa, particularly the narrow regional endemics, do not have valid models is because these were restricted to the country boundaries and not created for their entire natural range distribution, which means that they may not cover their full environmental variations. Raes (2012) stated that partial species distribution models could lead to over or under prediction and suggested to run the species distribution model for the full range of their natural distribution.

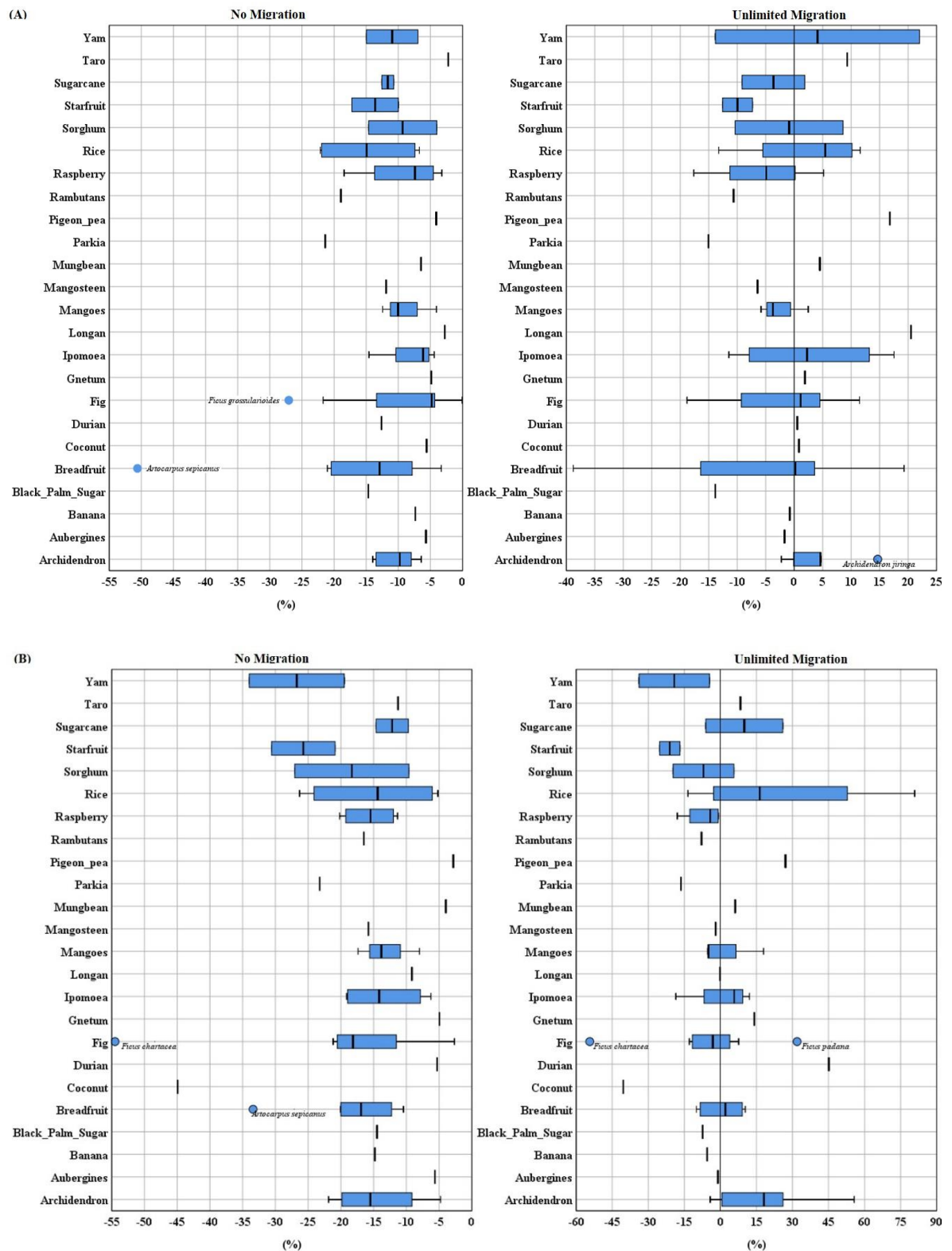


Fig. 4.1 Distribution range changes (%) of priority CWR for year 2050 based on (A) RCP 4.5 and (B) RCP 8.5.

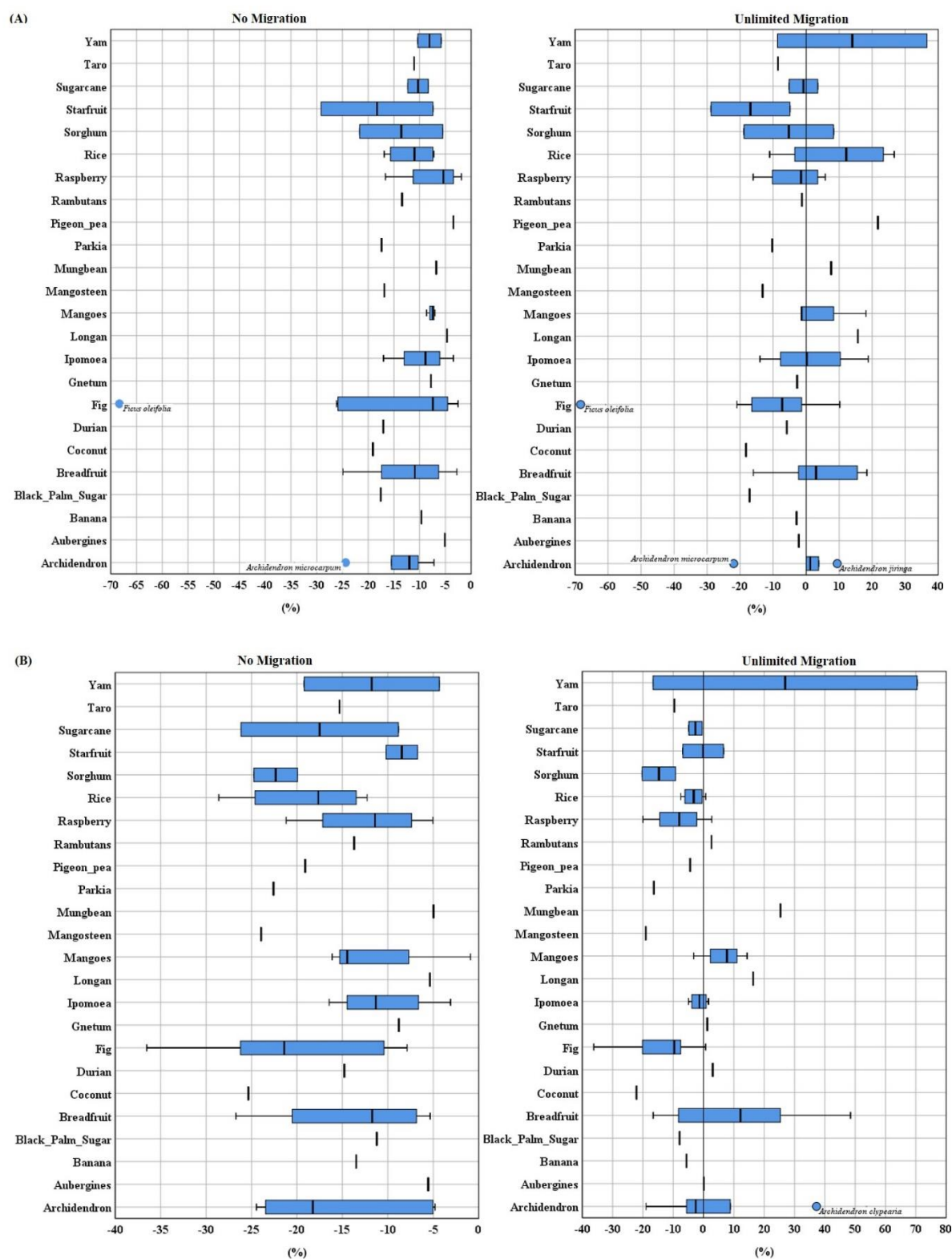


Fig. 4.2 Distribution range changes (%) of priority CWR for year 2080 based on (A) RCP 4.5 and (B) RCP 8.5.

Table 4.2 Average gains and losses area of future distribution of priority crop genepool in Indonesia based on RCP 4.5 scenario for 2050 and 2080.

Crop Genepool	No CWR	Current area (km ²)	RCP 4.5							
			2050				2080			
			Gain (km ²)	% Gain	Loss (km ²)	% Loss	Gain (km ²)	% Gain	Loss (km ²)	% Loss
Archidendron	5	738,546 (±124,027)	113,661 (±83,812)	14.65 (±8.74)	78758 (±34,655)	10.32 (±3.32)	93,442 (±67,584)	12.38 (±7.57)	106,393 (±61,003)	13.87 (±6.59)
Aubergine	1	500,316	20,106	4.02	28,522	5.70	14,510	2.90	25,552	5.11
Banana	1	609,984	40,166	6.58	44,838	7.35	41,428	6.79	59,056	9.68
BlackPalmSugar	1	805,872	6,726	0.83	118,252	14.67	3,456	0.43	141,474	17.56
Breadfruit	8	881,473 (±398,767)	97,784 (±77,309)	11.46 (±6.27)	115437 (±90,632)	17.04 (±15.05)	111,323 (±62,991)	16.48 (±10.81)	96,558 (±79,259)	12.12 (±7.61)
Coconut	1	625,082	40,220	6.43	34,982	5.60	5,530	0.88	119,268	19.08
Durian	1	747,320	98,516	13.18	94,406	12.63	83,972	11.24	127,562	17.07
Fig	7	645,071 (±324,040)	53,688 (±37,071)	7.39 (±3.41)	63,476 (±81,910)	9.63 (±10.34)	34,012 (±29,566)	5.43 (±5.69)	118,976 (±130,769)	19.88 (±23.61)
Gnetum	1	963,088	65,094	6.76	46,776	4.86	48,680	5.05	75,090	7.80
Ipomoea	4	707,404 (±225,396)	70,762 (±60,547)	10.46 (±9.71)	62,164 (±57,572)	7.81 (±4.57)	72,159 (±72,290)	10.87 (±11.94)	76,864 (±67,078)	9.55 (±5.6)
Longan	1	1,130,878	263,354	23.29	31,302	2.77	230,386	20.37	53,080	4.69
Mangoes	3	831,454 (±267,731)	50,069 (±7,524)	6.49 (±2.24)	69,845 (±35,038)	8.85 (±4.32)	86,843 (±43,560)	12.76 (±11.11)	64,047 (±20,989)	7.71 (±0.84)
Mangosteen	1	874,000	47,792	5.47	103,958	11.89	32,386	3.71	147,558	16.88
Mungbean	1	433,194	47,528	10.97	28,004	6.46	62,190	14.36	29,348	6.77
Parkia	1	1,079,894	68,564	6.35	230,932	21.38	76,948	7.13	187,924	17.40
Pigeon_pea	1	235,964	49,300	20.89	9,668	4.10	59,450	25.19	8,150	3.45
Rambutan	1	1,483,344	123,186	8.30	280,954	18.94	180,098	12.14	199,110	13.42
Raspberry	4	243,708 (±189,124)	7,404.5 (±6,967)	3.56 (±3.54)	29,525 (±34,356)	9.12 (±6.64)	10,064 (±12,887)	4.01 (±3.94)	24,083 (±31,078)	7.34 (±6.43)
Rice	4	511,611 (±129,602)	83,123 (±53,546)	16.99 (±11.24)	78,544 (±51,784)	14.68 (±8.4)	113,378 (±89,746)	21.53 (±15.05)	61,046 (±33,465)	11.55 (±4.87)
Sorghum	2	784,722 (±142,626)	70,336 (±58,138)	8.43 (±5.88)	67,759 (±45,652)	9.32 (±7.51)	71,104 (±73,038)	8.35 (±7.79)	98,451 (±70,129)	13.58 (±11.41)
Starfruit	2	766,262 (±775)	28,144 (±10,745)	3.67 (±1.4)	104,306 (±39,284)	13.61 (±5.11)	10,900 (±11,729)	1.42 (±1.53)	140,150 (±117,787)	18.28 (±15.35)
Sugarcane	2	689,188 (±41,173)	53,851 (±41,325)	8.01 (±6.47)	80,506 (±13,845)	11.64 (±1.31)	63,721 (±57,625)	9.51 (±8.93)	70,524 (±15,061)	10.32 (±2.8)
Taro	1	782,306	90,286	11.54	17,408	2.23	20,122	2.57	86,772	11.09
Yam	2	509,709 (±98,634)	67,027 (±85,479)	15.05 (±19.68)	58,622 (±39,663)	10.95 (±5.66)	98,385 (±125,026)	22.09 (±28.8)	42,886 (±24,305)	8.1 (±3.2)

Table 4.3 Average gains and losses area of future distribution of priority crop genepool in Indonesia based on RCP 8.5 scenario for 2050 and 2080.

Crop Genepool	No CWR	Current area (km ²)	RCP 8.5							
			2050				2080			
			Gain (km ²)	% Gain	Loss (km ²)	% Loss	Gain (km ²)	% Gain	Loss (km ²)	% Loss
Archidendron	5	738,546 (±124,027)	233,560 (±100,183)	33.48 (±18.77)	111,764 (±68,573)	14.22 (±7.19)	133,210 (±84,654)	18.99 (±13.95)	121,682 (±88,388)	15.2 (±9.67)
Aubergine	1	500,316	23,184	4.63	28,226	5.64	28,300	5.66	27,824	5.56
Banana	1	609,984	56,758	9.30	90,332	14.81	47,812	7.84	82,236	13.48
BlackPalm Sugar	1	805,872	57,096	7.08	116,714	14.48	26,654	3.31	90,396	11.22
Breadfruit	8	881,473 (±398,767)	130,338 (±69,938)	18.54 (±11.44)	134,989 (±61,821)	17.77 (±7.42)	140,046 (±81,396)	25.07 (±23.65)	112,794 (±90,592)	13.78 (±7.97)
Coconut	1	625,082	28,614	4.58	280,942	44.94	20,186	3.23	158,420	25.34
Durian	1	747,320	376,736	50.41	39,510	5.29	133,240	17.83	110,550	14.79
Fig	7	645,071 (±324,040)	72,814 (±55,851)	14.06 (±11.25)	162,102 (±192,860)	19.92 (±16.73)	35,749 (34,926)	5.52 (±5.18)	143,638 (±124,116)	19.87 (±10.72)
Gnetum	1	963,088	183,702	19.07	47,674	4.95	96,366	10.01	84,656	8.79
Ipomoea	4	707,404 (±225,396)	110,900 (±74,155)	14.68 (±10.15)	87,490 (±31,042)	13.41 (±6.55)	66,663 (±33,059)	9.04 (±2.96)	77,184 (±41,973)	10.55 (±5.61)
Longan	1	1,130,878	101,808	9.00	103,440	9.15	245,832	21.74	60,684	5.37
Mangoes	3	831,454 (±267,731)	113,637 (±24,819)	15.63 (±9.17)	115,132 (±62,778)	13.06 (±4.74)	127,947 (±93,15)	16.77 (±6.44)	82,628 (±72,578)	10.5 (±8.35)
Mangosteen	1	874,000	120,898	13.83	138,094	15.80	43,024	4.92	209,264	23.94
Mungbean	1	433,194	44,018	10.16	17,188	3.97	131,458	30.35	21,550	4.97
Parkia	1	1,079,894	74,096	6.86	250,908	23.23	67,008	6.21	243,860	22.58
Pigeon_pea	1	235,964	70,570	29.91	6,682	2.83	34,638	14.68	45,048	19.09
Rambutan	1	1,483,344	128,156	8.64	244,796	16.50	242,296	16.33	203,370	13.71
Raspberry	4	243,708 (±189,124)	18,464 (±17,409)	8.81 (±6.6)	38,862 (±33,471)	15.62 (±4.3)	9,527 (±10,162)	3.93 (±3.45)	37,509 (±39,767)	12.26 (±6.81)
Rice	4	511,611 (±129,602)	175,305 (±98,072)	40.09 (±32.76)	80,541 (±59,679)	15.06 (±10.6)	80,418 (±46,338)	15.73 (±9.15)	97,636 (±42,776)	19.05 (±7.27)
Sorghum	2	784,722 (±142,626)	92,645 (±60,122)	11.3 (±5.61)	135,011 (±70,551)	18.32 (±12.32)	62,935 (±45,296)	7.62 (±4.39)	172,871 (±5,274)	22.34 (±3.39)
Starfruit	2	766,262 (±775)	35,866 (±6,672)	4.68 (±0.87)	197,213 (±52,743)	25.73 (±6.86)	63,868 (±54,040)	8.33 (±7.04)	64,873 (±18,734)	8.47 (±2.45)
Sugarcane	2	689,188 (±41,173)	148,507 (±122,922)	22.12 (±19.16)	84,524 (±28,969)	12.16 (±3.48)	100,212 (±57,083)	14.81 (±9.17)	118,060 (±77,208)	17.5 (±12.25)
Taro	1	782,306	153,492	19.62	88,124	11.26	44,504	5.69	119,864	15.32
Yam	2	509,709 (±98,634)	33,382 (±46,024)	7.56 (±10.49)	141,328 (±78,642)	26.73 (±10.26)	171,929 (±221,982)	38.67 (±51.03)	65,183 (±65,211)	11.77 (±10.52)

The climate change impacts on CWR extinction risk in the literature remains uncertain. Jarvis and collaborators (2008) predicted that 16-22% of 207 CWR belong to three crop genera will be extinct by the 2055. While recent analysis by Vincent and collaborators (2019) found only two of 724 CWR are predicted to go extinct by the year 2070. In this current analysis, none of 56 priority CWR in Indonesia are predicted to go extinct by either 2050 or 2080, in terms of their distribution ranges contraction. Moreover, the taxa most likely to be at extinction risks, the rare or lesser known taxa were excluded from the analysis because of insufficient baseline data. In Vincent and collaborators (2019) 44% of globally CWR have occurrence records less than 10, while there are 35% of the total priority CWR for the current analysis. Most of these CWR have limited distribution range and not included in the analysis. On the other hand, Pimm and collaborators (2014) highlighted that the narrow-ranged species has high probability to be the threatened species. They also stated that the current extinction rates is a thousand times faster than the background benchmark (0.1 extinction per million years species) based on the available fossil records and molecular dating phylogenies. Whilst, Urban (2015) conclude that the biodiversity extinction risks by the climate change are relatively smaller compared to the total impact that the species obtain. Scheffers and collaborators (2016) showed that the recent climate change has changing species genetic, physiology, morphology, phenology, and distribution characteristics. Therefore, the result of the climate change analysis is applicable in conservation planning.

The current results show that without migration ability to expand their ranges to new areas in the future, the distribution range of all the priority taxa will be declining. Wild relatives of breadfruit, coconut, fig, starfruit, and yam are predicted to suffer significant reduction of their distribution ranges. The ability of plant species to migrate depends on their dispersal mechanism (Levin *et al.*, 2003) and the connectivity of their habitats (McConkey *et al.*, 2012). It means that unlimited migration scenario are almost impossible where many habitats become fragmented and isolated. Some species, such as those with seeds dispersal by wind (wild relatives of rice, sugarcane, or sorghum), may be able to disperse long distances beyond their habitat barriers without stepping stone population (Pearson and Dawson, 2005). Therefore, the future distribution range of the priority taxa studied is likely to be in between of no migration and unlimited migration scenario (Urban, 2015). However, the unlimited scenario is important as guidance to identify the suitable habitats in the future and no migration scenario allows us to anticipate the worst scenario.

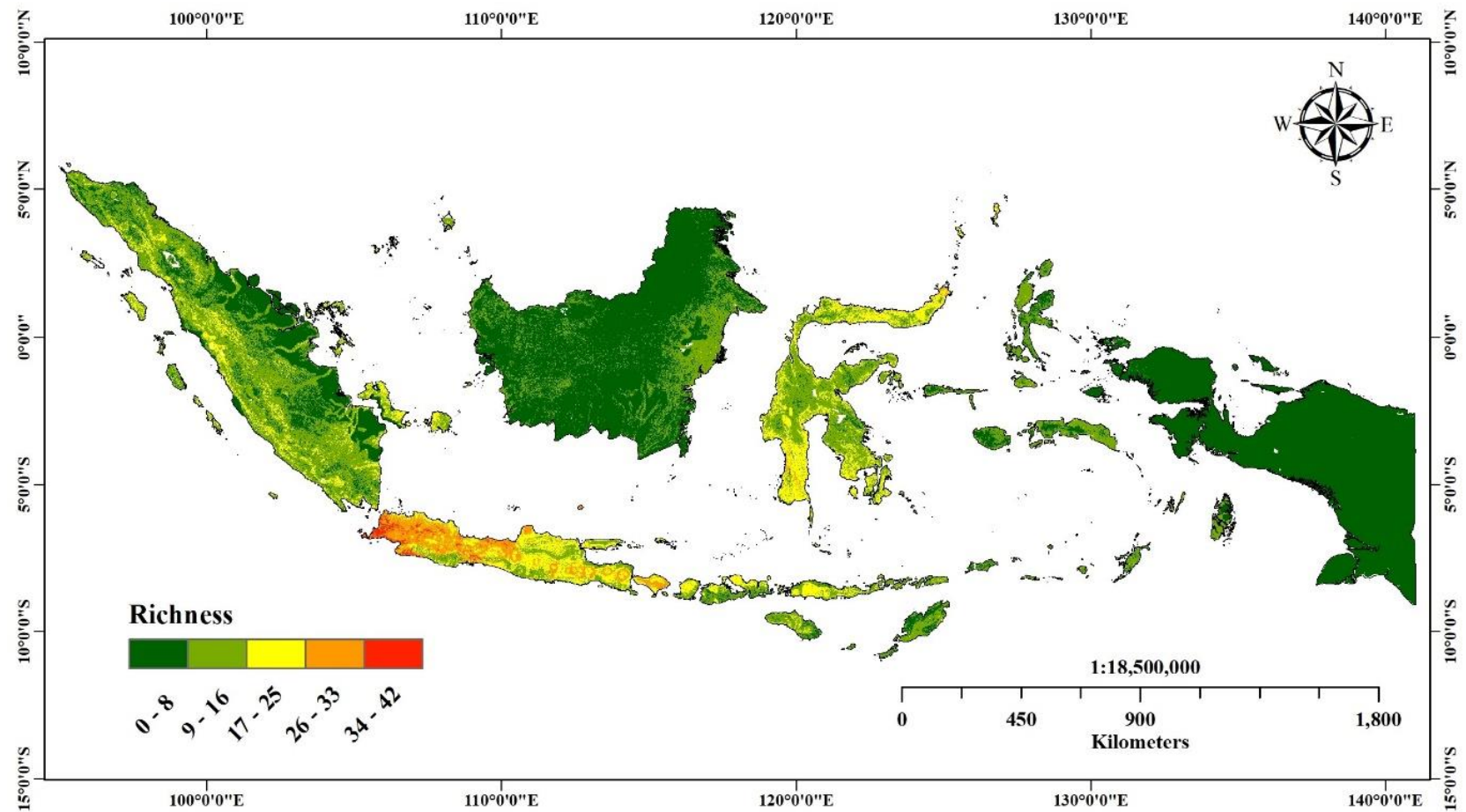


Fig. 4.3 Current species richness of 56 priority CWR taxa in Indonesia.

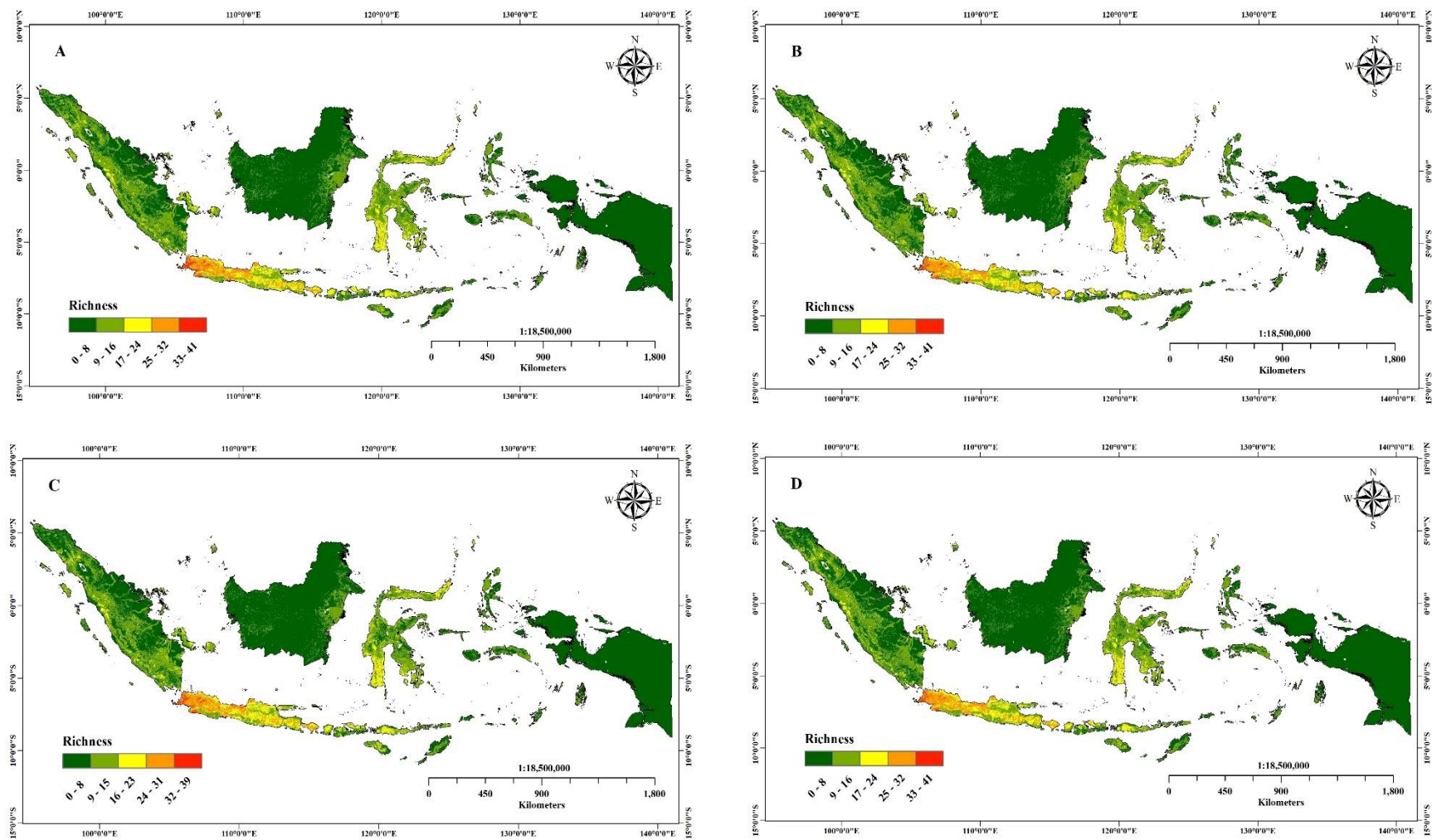


Fig. 4.4 Future species richness of 56 priority CWR taxa based on no migration scenario. A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080

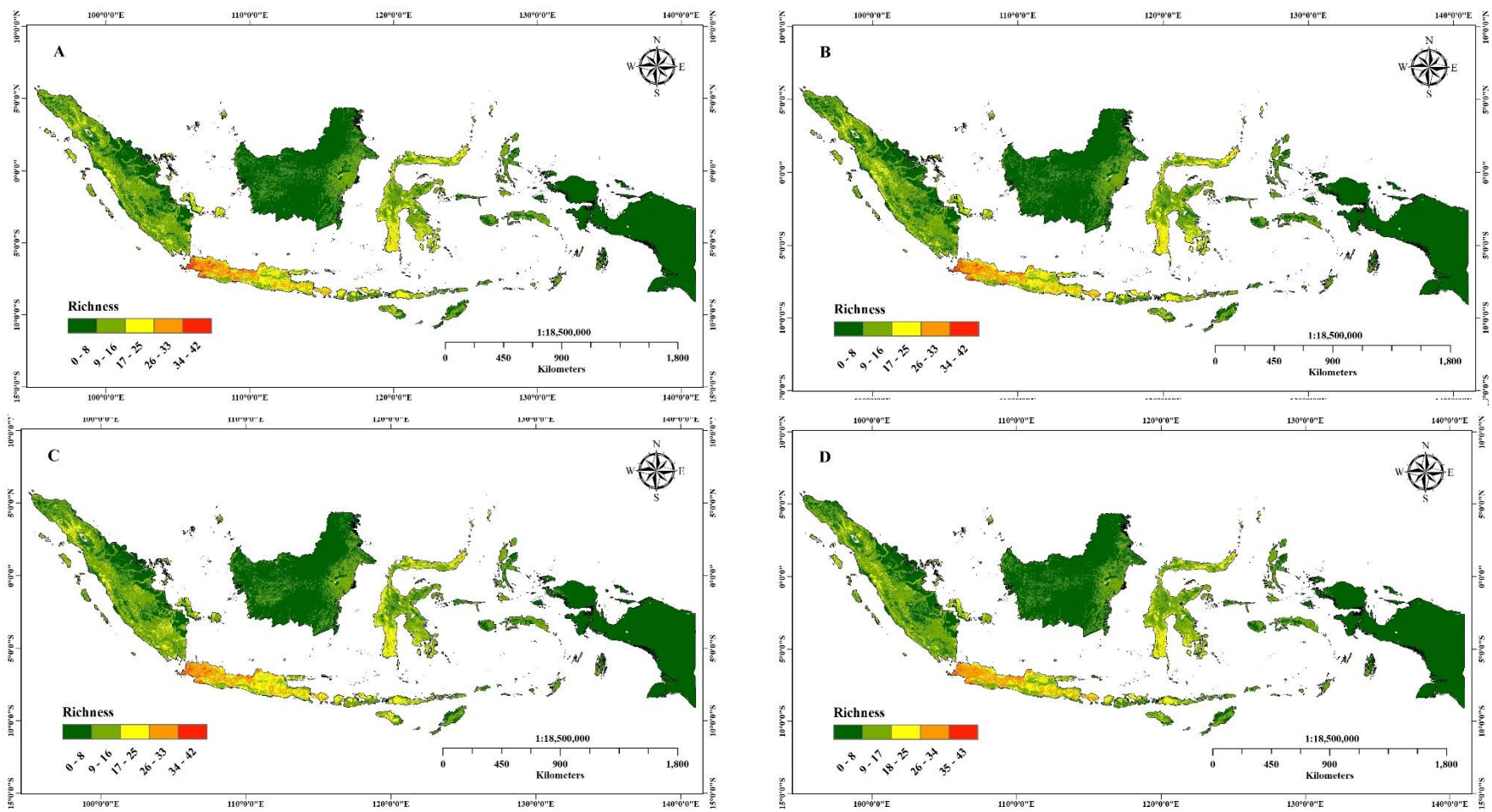


Fig. 4.5 Future species richness of 56 priority CWR taxa based on unlimited migration scenario. A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080

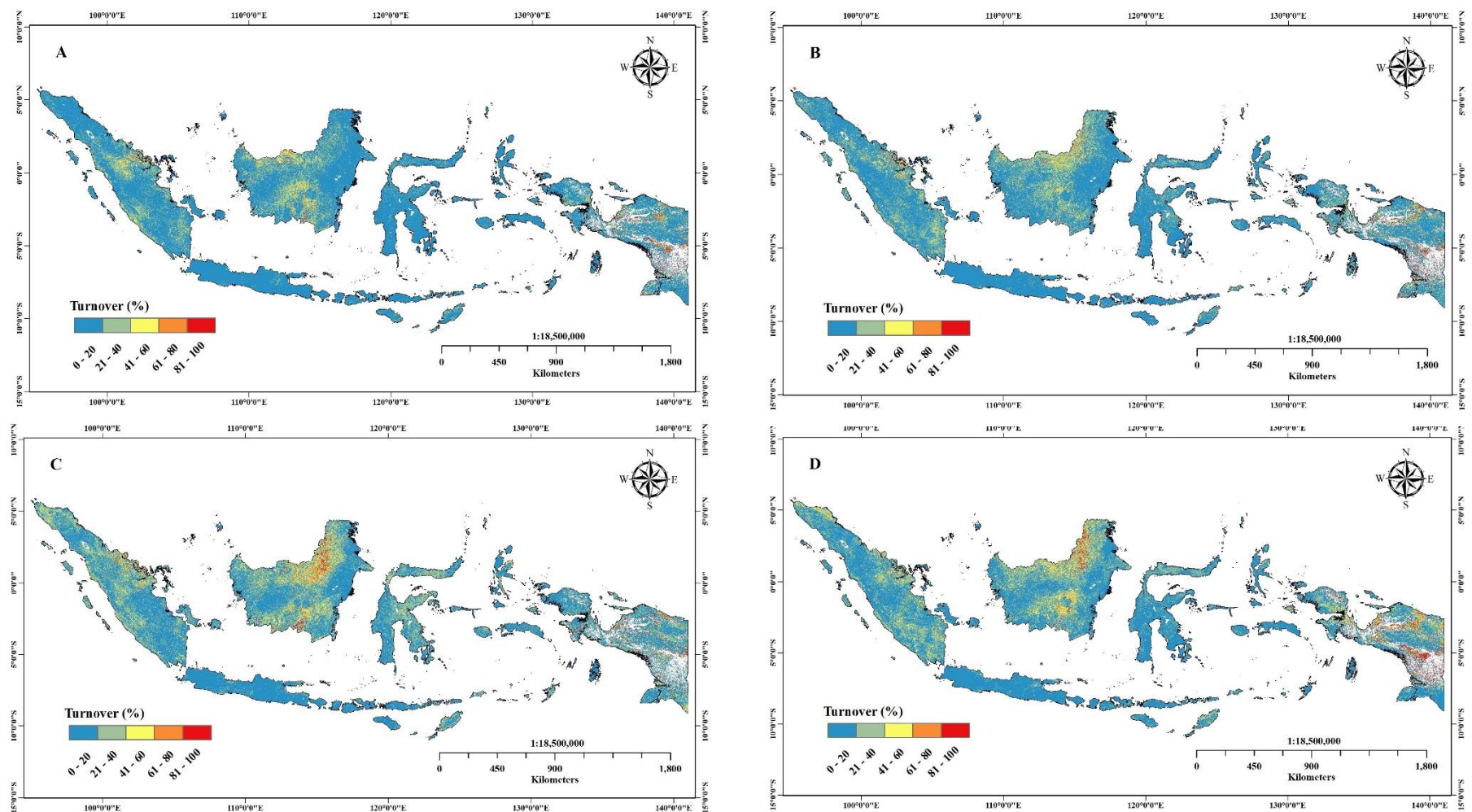


Fig. 4.6 Species turnover rates (%) based on no migration scenario of 56 priority CWR taxa A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080.

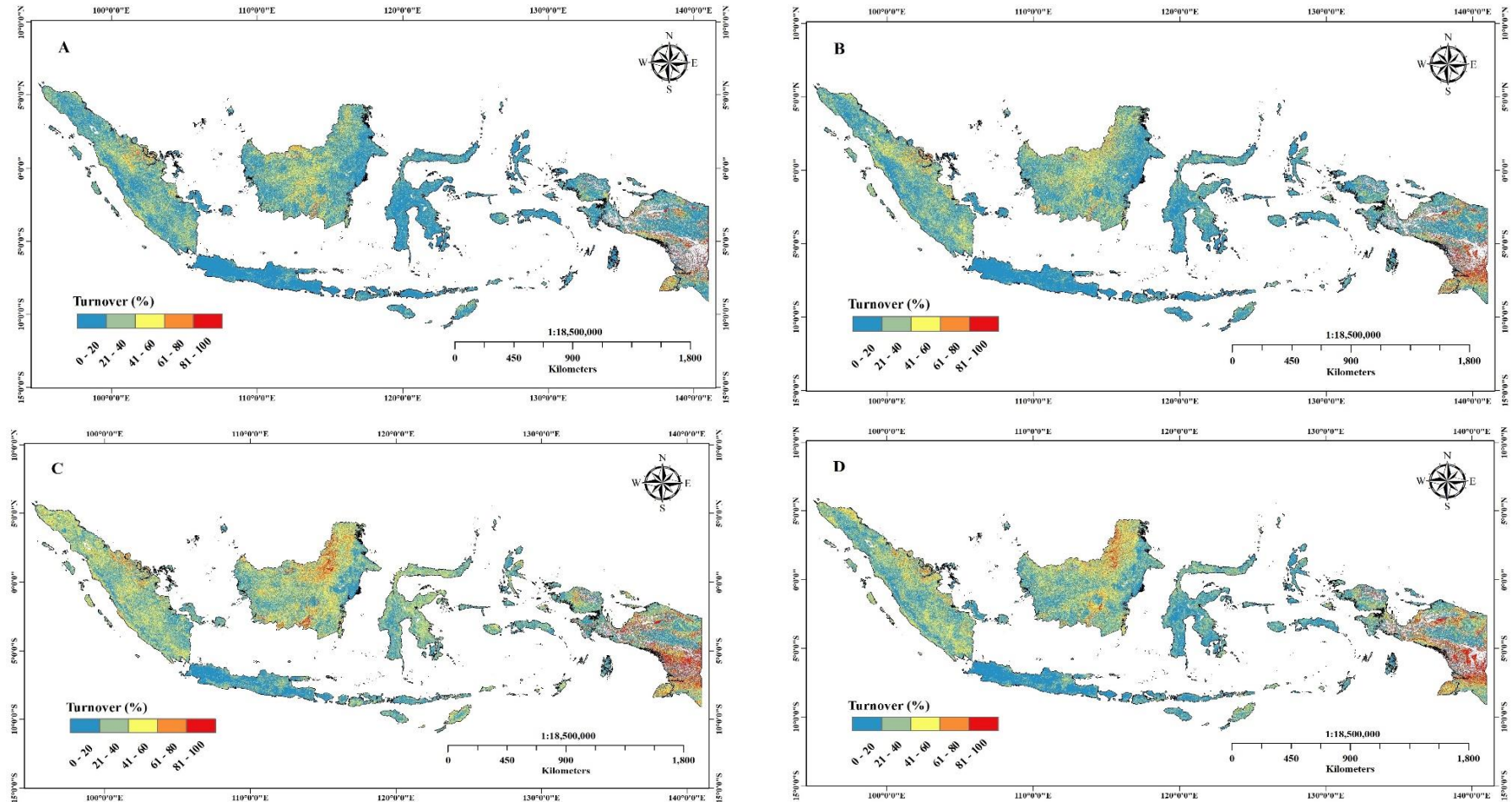


Fig. 4.7 Species turnover rates (%) based on unlimited migration scenario of 56 priority CWR taxa A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080.

In general, Urban (2015) predicted that in the more pessimistic scenario of GHG emission, the more the extinction rate of species is increase. However, the results from this study show that for the same RCP scenario, the studied taxa responded differently. Some species will be negatively impacted (loser species), while others are expected to benefit (winner species) in terms of their distribution range. There is no clear pattern of traits associated to differentiate the winners from the losers. Poorter and Navas (2003) observed that the fast growing herbaceous C3 species, such as wild relatives of aubergine, rice and mungbean, are more responsive to elevated CO₂ than woody plants (such as wild relatives of breadfruit, durian, mangoes, and mangosteen) or C4 species (such as wild relatives of sorghum and sugarcane). In terms of migration capacity, plants should move at corresponding velocity of climate change in order to not be negatively affected (Corlett and Westcott, 2013). Still, there is evidence that the distribution shifting capacity of some species lag behind the local impact of climate change (Ash *et al.*, 2017), plants with abiotic pollination and long distance dispersal, such as in wild relatives of rice, sorghum, and sugarcane, are likely to be winners in opposite to animals obligate, such as in wild relatives of figs (Wiegmann and Waller, 2006). Besides the long distance dispersal ability, Corlett and Westcott (2013) stated the availability of climate refugia could lowering their extinction risk by the climate change.

Identifying climate refugia is important in conservation planning (Keppel *et al.*, 2012, 2015; Beaumont *et al.*, 2019) as they can be identified as priority sites for active *in situ* conservation (Keppel *et al.*, 2015). As climate change is species specific, selecting priority sites based on multiple species refugia is recommended (Keppel *et al.*, 2015; Beaumont *et al.*, 2019) but then the classical SLOSS (single large or several small) debate will arise when prioritizing it. Does the single large area has better refugia capacity than the several small? Therefore, identification multiple refugia based on the existing protected areas is more reliable since they are already established and managed (Haight and Hammill, 2020). For the 56 priority CWR in Indonesia analysed, protected areas in the western part of Java have been identified as the best potential refugia with the highest diversity: Ujung Kulon National Park (NP), Halimun Salak NP, and Gede Pangrango NP. In Sulawesi, the second richest island for the priority taxa, Bantimurung bulursaraung NP is identified as the potential for future refugia.

In terms of CWR conservation, the goal is to keep the broadest genetic variation possible in both of *in situ* and *ex situ* conservation. As the refugia populations tend to have less genetic variation, holdout populations are important to consider in CWR conservation planning.

Holdout populations should be targeted for the *ex situ* collections and/or be used as source for assisted migration, as they tend to deteriorate or, ultimately, go extinct, and may have relevant adaptive diversity that needs to be conserved. The result shows that for multiple taxa, two PAs: Kerinci Seblat NP in Sumatra and Bogani Nani Wartabone NP in North Sulawesi, were identified to contain the highest number of holdouts population for all the 56 taxa. At least nine to twelve taxa have holdouts population in those two PAs. At single taxon, the priority PAs can be identified more details by including their ecogeographic representation. For example, Kerinci Seblat NP is the highest priority PA for *Ficus chartacea* and *F. oleifolia*. Whilst, Waigeo Barat Timur NR in West Papua and Morowali NR in Central Sulawesi are the highest priority for *Artocarpus sepicanus* and *Averrhoa bilimbi*, respectively. Those PAs were selected since they contain the highest diversity of priority ecogeographic zones and have significant area size of holdouts population. Since the future source-sink populations in refugia based on PAs are more easily to identify, the holdouts population could potentially be trans-located.

The future climate refugia with non-analogue community assemblages can be identify from the species turnover rates map (Thuiller *et al.*, 2005). For the current CWR priority taxa, some refugia with highest turnover rates in the Central-North and the Southern part of Kalimantan were identified. In Central-North Kalimantan, Kayan Mentarang NP and Bukit Sapat Hawung Nature Reserve will be the future refugia with non-analogue assemblages, while Tanjung Puting NP and Sebangau NP in the Southern Kalimantan. In Central-Southern Papua only lowland of Southern part of Lorentz NP will cover small part of novel distribution shifts of the priority CWR. On the other hand, a large area in the lowland plain of Boven-Digul and Mappi district does not have any protected areas that could be identified as climatic refugia. These areas are also threatened by the expansion of new large scale plantations and timber logging concessions (CIFOR, 2019). In total, forest loss in these two districts reach up to more than 111,373 ha since 2000. Therefore, it is important to establish new protected areas in these areas, as well as establishing less formal conservation agreement with local communities or land owners to manage their marginal areas (i.e. field margins or roadsides) to promote CWR population sustainability (Maxted *et al.*, 2020).

Table 4.4 The average number of PAs as climate refugia for priority crops genepool for all scenarios.

Crop Genepool	No CWR	The average number of PAs as refugia								
		Current	RCP 4.5 - 2050		RCP 4.5 - 2080		RCP 8.5 - 2050		RCP 8.5 - 2080	
			Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
Archidendron	5	262	267	248	264	248	264	234	269	246
Aubergine	1	304	302	295	306	299	302	292	309	296
Banana	1	267	265	259	263	256	241	230	274	260
BlackPalmSugar	1	325	305	305	310	309	319	304	321	311
Breadfruit	8	222	243	208	222	210	220	198	220	204
Coconut	1	300	304	290	271	268	256	238	267	254
Durian	1	304	309	269	300	283	347	292	302	278
Fig	7	200	197	190	192	183	192	175	188	181
Gnetum	1	312	316	302	307	299	330	301	317	300
Ipomoea	4	339	334	325	333	322	323	308	336	322
Longan	1	198	213	175	206	183	168	156	208	177
Mangoes	3	263	259	253	262	253	251	238	262	248
Mangosteen	1	371	369	359	364	357	370	346	370	348
Mungbean	1	250	258	238	271	243	252	238	293	245
Parkia	1	237	231	215	232	218	201	195	228	218
Pigeon_pea	1	173	192	168	189	169	198	171	158	139
Rambutans	1	334	308	305	333	320	318	310	330	319
Raspberry	4	144	138	134	140	136	130	122	135	131
Rice	4	239	232	217	238	219	263	213	227	209
Sorghum	2	331	326	318	325	314	322	300	302	296
Starfruit	2	326	317	309	306	301	270	267	325	310
Sugarcane	2	176	168	164	173	168	177	162	172	163
Taro	1	337	343	330	325	322	327	311	327	318
Yam	2	288	279	258	285	257	223	214	292	253

Table 4.5 The average number of PAs containing significant holdouts for priority crops gene pool for all scenarios.

Crop Gene pool	No CWR	The average number of PAs contain significant holdouts							
		RCP 4.5 - 2050		RCP 4.5 - 2080		RCP 8.5 - 2050		RCP 8.5 - 2080	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
Archidendron	5	59	79	71	85	84	114	74	92
Aubergine	1	55	65	46	50	65	72	44	55
Banana	1	69	86	66	79	111	131	72	86
BlackPalmSugar	1	142	149	157	163	127	152	99	122
Breadfruit	8	65	84	64	81	89	116	71	86
Coconut	1	78	85	148	152	171	196	146	153
Durian	1	84	122	111	129	29	68	103	125
Fig	7	56	64	71	78	82	98	83	90
Gnetum	1	68	85	99	113	62	131	84	104
Ipomoea	4	81	95	89	103	124	161	81	99
Longan	1	34	65	44	63	111	133	57	86
Mangoes	3	69	79	59	71	85	118	57	70
Mangosteen	1	122	149	138	169	138	188	166	187
Mungbean	1	42	65	34	55	49	77	20	40
Parkia	1	83	99	86	95	130	142	80	89
Pigeon_pea	1	11	17	7	14	5	8	65	80
Rambutans	1	146	167	101	126	135	155	105	134
Raspberry	4	49	54	43	51	63	78	60	64
Rice	4	69	85	67	84	72	102	83	98
Sorghum	2	78	98	98	115	146	175	157	169
Starfruit	2	110	117	132	137	180	198	90	103
Sugarcane	2	62	76	55	65	71	88	59	72
Taro	1	23	61	131	140	86	135	118	133
Yam	2	86	95	83	90	168	178	90	97

Conservation planning should consider how to facilitate migration of species to their predicted future refugia. Increasing habitat connectivity and assisted migration are suggested as potential tools (Morelli *et al.*, 2017). Assisted migration allows the persistence of the species in the future when natural migration is unlikely (Vitt *et al.*, 2010). However there are continuing debates about the ecological and socio-economic consequences of this strategy as an effective conservation tool against climate change (McLachlan *et al.*, 2007; Ricciardi and Simberloff, 2009; Vitt *et al.*, 2009; McCormack, 2018; Cannon and Petit, 2019). This is important to address, particularly for species which are predicted to become new comers in non-analogous assemblages. Despite the uncertainty of the risk, assisted migration has high potential as conservation tool to mitigate the species in human dominated landscapes for critically important taxa (Maxted *et al.*, 2020). For example, two large size protected areas in the southern part of Kalimantan (Tanjung Puting NP and Sebangau NP) that have been identified as potential climate refugia of the priority CWR, are surrounded by oil palm and pulp wood plantations, and logging concessions and they are frequently affected by wildfires (CIFOR, 2019). Without assisted migration their biodiversity will decline until it disappears. The implementation of this approach should consider the risk of negative effect of the species introduction to the existing community such as invasiveness or genetic contamination and the fact that it is experimental in that moving a single species will break obligate association with other taxa. Therefore, the decision to run this practice should be taken with caution (Hoegh-Guldberg *et al.*, 2008; Maxted *et al.*, 2020).

Since the flora of Indonesia related to the flora of the neighbour countries, particularly taxa that distributed in the same island such as Borneo or New Guinea, it is important to strengthen a cooperation among those countries to mitigate the impact of climate change on the distribution of native CWR. At the South East Asian region, the ASEAN Working Group on Climate Change (AWGCC) is a joint partnership among the countries to coordinate and communicate the climate change issue to the global and regional community. Based on the statement in the last working group meeting, the ASEAN parties agree to include the protection and restoration of degraded habitat and ecosystem as nature based solution to mitigate global climate change (Civil Society Constituencies in ASEAN member states, 2020). Another example of such cooperation is the heart of Borneo initiative that declared by three countries, Brunei Darussalam, Indonesia and Malaysia which shared their territory in the island of Borneo, to conserve the forest in the centre of the island (Persoon and Osseweijer, 2008). Such

transnational cooperation should also be initiated between Indonesia and Papua New Guinea that shared their territory in the island of new guinea that known as the richest island for the plants diversity in the world (Cámara-Leret *et al.*, 2020). In the context of distribution range shift of CWR, this trans-boundary cooperation will provide a legal framework for protected areas manager to be part of the regional PAs networks to share information and monitor the population status of CWR in their managed area.

4.6 Conclusion

The predicted impact of climate change on the distribution of priority CWR in Indonesia is species specific, some benefit, but some are negatively impacted. One to seven CWR (*Archidendron clypearia*, *Artocarpus lanceifolius*, *A. sepicanus*, *Dioscorea pyrifolia*, *Durio zibethinus*, *Ficus padana* and *Oryza meyeriana*), depend on the scenario, are expected to expand more than 30% of their current distribution range. On the other hand, only one to six CWR (*Artocarpus sepicanus*, *Averrhoa bilimbi*, *Cocos nucifera*, *Dioscorea alata*, *Ficus chartacea* and *F. oleifolia*) are predicted to obtain significant contraction (more than 30%) of their current range by the climate change. RCP and migration scenarios influence the future predicted distribution of priority taxa, but it is thought that actual future distribution falls in between of those scenarios. However, those scenarios could guide the identification of future climate refugia for priority CWR. Climate refugia for the 56 priority taxa within the existing network of PAs were identified in the South-Western part of Java: the Ujung Kulon NP, Halimun Salak NP, and Gede Pangrango NP. The climate refugia with potential to have non-analogue community assemblages were also identified in the island of Kalimantan and Papua. These require further attention as habitat connectivity in Kalimantan is becoming low and there are very few PAs, to serve as refugia, to be found in the Central-South Papua, particularly in Boven-Digul and Mappi district. Holdout populations in the Kerinci Seblat NP (Central Sumatra) and Bogani nani Wartabone NP (North Sulawesi) should be the target for further collecting sites to enhance the *ex situ* collection and to provide as source for assisted migration.

CHAPTER 5

NOVEL THREAT ASSESSMENTS OF PRIORITY CROP WILD RELATIVES IN INDONESIA

5.1 Abstract

Threat assessment aims to evaluate the species' extinction risk. The results have an important role in species conservation planning as they can be used as one component to prioritize species for conservation. Crop wild relatives (CWR) is one functional group of plants that is still under-assessment. This plant group has important values in sustaining the future of food security. However, many of them, particularly in the tropical region, have less conservation attention. About 127 priority CWR taxa in Indonesia were globally assessed for their threat status using the current version of IUCN Red List criteria and category (version 3.1). 114 taxa have novel global assessments while 13 taxa were updated from previous assessments. The results show that 40 taxa are threatened, 32 taxa are Near Threatened, 31 taxa are Least Concern, and 24 taxa are Data Deficient. 29 of the threatened taxa are large tree species and those belongs to important crops genepool such as *Archidendron*, breadfruit, durian, mangoes, mangosteen, and parkia. About 62% of the threatened taxa inhabit the lowland of tropical forest of Sundaland (including Java, Sumatra and Kalimantan). This habitat has been rapidly lost and severely fragmented during the last recent decades by the expansion of agricultural land and urban development. Based on predicted distribution maps, priority sites for active *in situ* conservation and *ex situ* collecting sites of threatened and near threatened taxa, and further surveys for Data Deficient taxa were identified. By including the current assessment results, the total number of globally threatened CWR taxa of food crops in Indonesia significantly increased from only 32 to 146 taxa. Thus, by incorporating the current threat assessments in conservation planning, conservation actions of CWR in Indonesia is expected to become more efficient.

Keywords: Crop Wild Relatives (CWR), threat assessment, IUCN Red List, threatened, near threatened, data deficient.

5.2 Introduction

About twenty two percent of total global plants were estimated to be threatened based on the sample red list index (Brummitt *et al.*, 2015). If this value is solely applied to vascular plants, at least 83,910 species are threatened based on a recent inventory (Willis, 2017). However, the actual numbers of the total threatened plants are still unknown (Brummitt *et al.*, 2015; Corlett, 2016). Costello and collabolators (2013), Pimm and collabolators (2014) and Willis (2017) predicted that some plant species were already extinct before they are known to

the current science since the total number of global plants are still uncertain while the extinction rates increases in the recent century. Efforts have been made to accelerate the numbers of conservation status of all known plants but some areas were still under assessment such as in the tropical regions (Callmander *et al.*, 2005).

One functional groups of plants that still lacks attention regarding its conservation status are the crop wild relatives (CWR) (Kell *et al.*, 2012). Defined as wild plants closely related to crops (Maxted *et al.*, 2006), they are important to broadening our future crops genetic variations to be more resilient to environmental changes. However, they are threatened by anthropogenic disturbances (Maxted and Kell, 2009). At national and regional level, their conservation was neglected because it lacks coordination between the agencies of agricultural sector and environmental protection. They tend to have different focused targets but both of their capacities are required for effective long term conservation and use of these genetic resources (Maxted, 2003; Maxted *et al.*, 2007).

In some regions where floras are well documented, the numbers of CWR that have been assessed has much increased (Kell *et al.*, 2012; Khoury *et al.*, 2013). In Europe where 80% of the flora is considered wild relatives of crops, 591 species of CWR have been assessed for its Red List status (Kell *et al.*, 2012). In USA, the threat status of 76% of the flora has been recorded, including CWR (Khoury *et al.*, 2013). Whilst in regions where documented flora still remains incomplete, such as in Indonesia, threat status of most of the plants are still unknown. To date, only four percent of known native plants in Indonesia have been published in IUCN Red List and one percent of those are listed as threatened species.

Until March 2020, up to 40,468 of global plant species have been assessed for their threat status (IUCN, 2020). The numbers significantly increased almost three times compared to 2010. Even though, it is only 10% of the total estimated described plants species, the progress shows that many stakeholders gave more attention to plant conservation. Callmander and collaborators (2005) stated that target 2 of the Global Strategy of Plant Conservation (GSPC) can be achieved when the preliminary assessments were done for all known plants. This target was not achieved by the year of 2010 (Miller *et al.*, 2012). However, what kind of preliminary assessments to state that the target 2 of the GSPC has been achieved? Has the 10% of the total estimated flora been assessed (IUCN, 2020) or the 22% estimated from SRLI (Brummitt *et al.*, 2015) enough to state as preliminary assessments? Miller and collaborators (2012) and Murray and collaborators (2014) suggested methods for rapid threat assessments for the global

biodiversity but none of full assessment for all organisms or all plants was done using those methods have been published. Despite taking slow process, red listing provide rigorous information for species conservation management and practice (Willis, 2017).

Based on the latest species list of the IUCN Red list (IUCN, 2020), about 3,119 species of plants in Indonesia have been assessed formally for the global level. About 689 of them are categorized as threatened. The top three plants families that contain the most threatened category are Dipterocarpaceae (179 species), Zingiberaceae (105 species), and Myristicaceae (50 species). Most of those threatened species were mainly distributed in the Sundaland and Wallacea. Thus, this research aims to conduct novel threat assessment for the priority CWR in Indonesia based on the IUCN red list criteria and category.

5.3 Methods

5.3.1 Priority CWR taxa used for the novel threat assessment

About 1968 CWR taxa related to food crops have been inventoried for Indonesia and 234 taxa were selected as priority for conservation (Rahman *et al.*, 2019). 127 belong to 17 genera, out of a total of 234 priority taxa were further analysed for current novel threats assessments. These taxa are national endemics and narrow regional endemics. Callmander and collabolators (2005) and Miller and collabolators (2012) stated that narrow endemics taxa should be prioritized for the threats assessments to a rapid overview of the drivers of global biodiversity loss.

5.3.2 Assessments process

Priority CWR were assessed at global level, meaning that the whole native range of the assessed taxa and not only within the Indonesian territory were considered, particularly for the narrow regional endemics which also included countries close to Indonesia. Information, such as taxonomy, distribution range and occurrence, population, habitat and ecology, use and trade, threats, and current conservation actions related to the 127 taxa were collated as the source of information for the assessments. This information was collected from various resources such as herbarium specimens, monographs, published papers, online database (such as Global Biodiversity International Facility (GBIF) (<https://www.gbif.org/>) for the taxa occurrences, International Plant Names Index (IPNI) (<https://www.ipni.org/>), Plants of the World Online (POWO) (<http://www.plantsoftheworldonline.org/>), and GRIN Taxonomy for taxonomy

(<https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomyquery.aspx>), Genesys for genebank collections (<https://www.genesys-pgr.org/>), BGCI plant search for ex situ collection within the botanic gardens worldwide) (https://tools.bgci.org/plant_search.php), Website (Atlas CIFOR) (<https://atlas.cifor.org/>), and grey literature. Additionally, taxonomic information, their synonyms, common names and other taxonomic notes were also compiled. Distribution information included their geographic range, mostly collected from monographs and from online databases. The occurrence records were collated mainly from GBIF and herbarium specimens. These records were corrected and cleaned by removing those records from cultivated origin and those from outside of its natural range distribution. Area of occupancy (AOO) with grid size 2x2 km and extent of occurrences (EOO) were calculated based on compiled occurrences records throughout their distribution range using GeoCAT (Bachman *et al.*, 2011). In addition, when GeoCAT failed to calculate the EOO and AOO because of the large number of occurrence records, such as in *Sorghum plumosum*, rCAT package of R statistic was used. Elevation range, biogeographic realm and hotspots information for each taxon were also compiled as the distribution information. Occurrence record information included the countries where the taxa recorded and their presence and origin status. In addition to EOO and AOO, area of habitat (AOH) that equivalent to extent of suitable habitat (ESH) was calculated for each assessed taxa based on the method described by Brooks and collaborators (2019). To calculate AOH, EOO based on the occurrence records was mapped then the suitable land cover that related to the habitat of assessed taxa were extracted from the global land cover 2000 (GLC 2000) within the EOO. In a similar way, elevation range of the assessed taxa was extracted from digital elevation model (DEM) within the EOO. By overlaying the extracted land cover and the elevation range, the AOH was calculated. Population information was mostly about the population size records based on their abundance or other index related to their density. This information was compiled for each assessed taxa based on the available vegetation analysis from published literature that usually expressed the species abundance as the number of individual/ha or based on the density index such as relative frequency or important value index (IVI), a total value of relative density, relative frequency and relative dominance of species in a community. Habitat and ecology information included the habitat types, generation length based on available information of related species or its congeneric in the literature, CWR identity, and growth forms. Use and trade information compiled description of kind of use, parts of plant to be used and commercialization information. As CWR, all assessed taxa are stated as

potentially used as genetic donors for crop improvement of related crops based on the genepool concept or the taxon group concept. The potential uses as genetic donor information can be searched at the Harlan and de Wet inventory (<https://www.cwrdiversity.org/checklist/>) and GRIN Taxonomy websites (<https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearchcwr.aspx>). Threat information of both anthropogenic and natural disturbance were compiled based on available evidence or prediction throughout the distribution range area of the assessed taxa. Whilst conservation action information contains evidences for their occurrences inside the protected areas (*in situ*) and in genebanks or botanic garden collection (*ex situ*). All those information were stored in the online IUCN Species Information System (SIS).

Based on the compiled information, the threat status of each taxon was evaluated using the IUCN Red List Categories and Criteria version 3.1 (IUCN, 2012), namely against five criteria: population reduction (criterion A), geographic range in terms of AOO and EOO (criterion B), number of mature individuals and declining information for small populations (criterion C), the number of mature individuals for the very small and restricted populations (criterion D), and quantitative analysis (criterion E). There are nine Red List categories: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), and Not Evaluated (NE). The rationale justification and threat category for each assessed taxon were determined. All taxa that assessed as in category CR, EN, and VU were stated as threatened taxa.

For the purpose of conservation planning at national level, threatened taxa, NT taxa, and DD taxa were mapped based on the known occurrences within the Indonesian boundary. The hotspots for threatened taxa, NT and DD taxa were determined based on circular area within radius 50 km around the occurrence records (CA50) (Hijmans and Spooner, 2001) and species distribution modelling (SDM). The procedures to conduct CA50 and SDM can be seen in Chapter 3. Then, Protected areas (PAs) that are predicted to contain the hotspots for those three groups were finally identified.

5.4 Results

Amongst the 127 taxa that have been assessed, 40 taxa are threatened, 32 taxa Near Threatened (NT), 31 taxa Least Concern (LC), and 24 taxa are Data Deficient (DD) (Fig. 5.1). Within the threatened taxa, 31 are categorized as Vulnerable (VU), 6 taxa are Endangered (EN)

and three taxa are categorized as Critically Endangered (CR). The genus *Mangifera* contains the most threatened taxa with 14 (10 Vulnerable and 4 Endangered) (Fig. 5.1B). Whilst the genus *Dioscorea* contains the most Data Deficient taxa with 9.

The range of extent of occurrences (EOO) for all assessed taxa is between 0 (18 taxa) to more than 6 million km² (3 taxa) (Fig. 5.2A). The three taxa with EOO larger than 6 million km² are *Dioscorea pyrifolia*, *Sorghum plumosum*, and *S. timorensis*. Taxa for which EOO was not estimated due to the fact that are only known from one or two localities are *Archidendron crateradenum*, *A. minahassae*, *Dioscorea bancana*, *D. elegans*, *D. niewenhuissii*, *D. platycarpa*, *D. sexrimata*, *D. vanvuurenii*, *D. warburgiana*, *Durio macrantha*, *Ficus auricoma*, *F. glabristipulata*, *F. halmaherae*, *F. kofmaniae*, *Gnetum gnemon* var. *gracile*, *Ipomoea stibaropoda*, and *Musa balbisiana* var. *brachycarpa*. The area of habitat (AOH) for all the assessed taxa is between 0 (18 taxa) to more than 3 million km² (2 taxa) (Fig. 5.2B). Two wild relatives of *Sorghum* (*S. plumosum* and *S. timorensis*) which have the largest AOH among the assessed taxa were mostly distributed in Northern Australia and Eastern part of Indonesia. The area of occupancy (AOO) for the assessed taxa is between four (9 taxa) to more than 4 thousand km² (2 taxa) (Fig. 5.2C). About 125 of the assessed taxa have AOO less than 2,000 km², except for the two *Sorghum* wild relatives (*Sorghum plumosum* and *S. timorensis*) have AOO more than 4 thousand km².

Ninety two of the assessed taxa are tree species (Fig. 5.3). Five taxa have two growth forms since their growth is between two forms, such as shrubs and small tree. As an exception, *Ficus deltoidea* is the only taxon with three possible growth forms: epiphyte, lithophyte, and small shrub. The other growth forms with significant number of taxa being assessed is vine, since all of *Dioscorea* and *Ipomoea* have this habit. Only four taxa are graminoid.

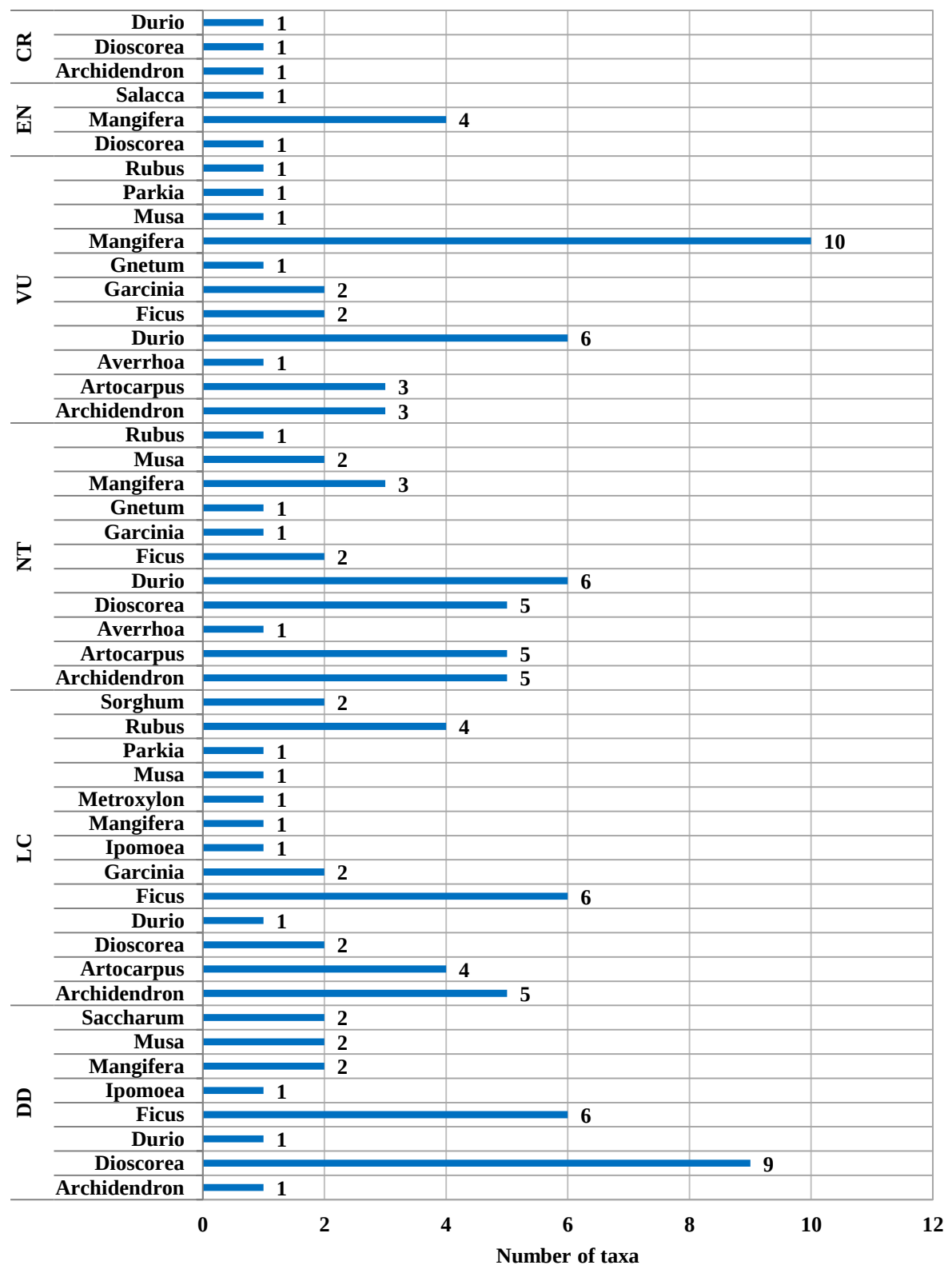


Fig. 5.1 Number of CWR within each IUCN Red List category and genera of the 127 that were assessed.

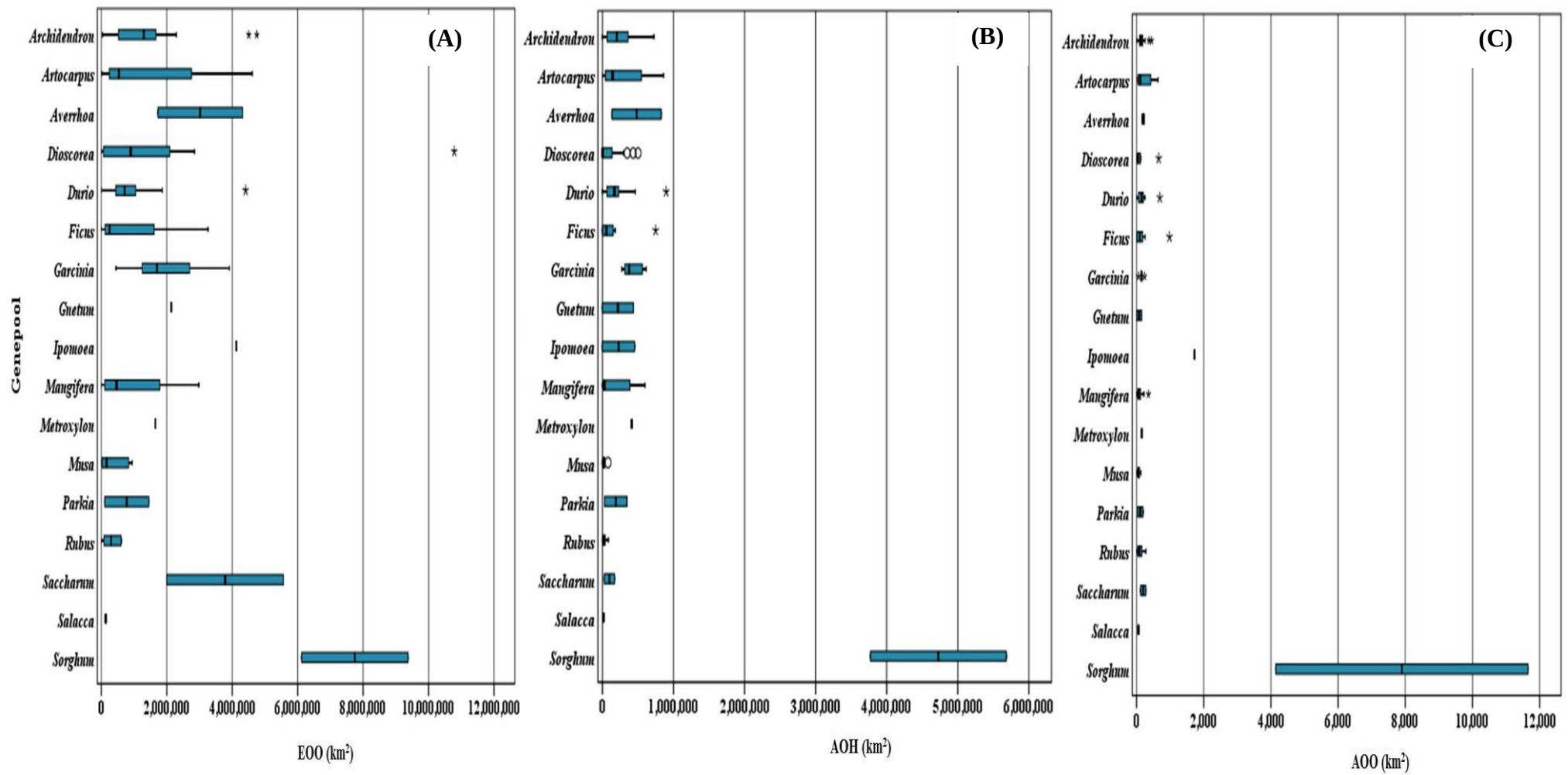


Fig. 5.2 The ranges value of extent of occurrence (EOO) (A), area of habitat (AOH) (B) and area of occupancy (AOO) (C) of the assessed CWR taxa based on their genepool.

In terms of habitat, most of the assessed taxa are forest species (Fig. 5.4). About 38 taxa occur in more than one type of habitat. For example, those forest species can also occur in tropical lowland forest and montane tropical forest (such as *Archidendron contortum*, *A. havilandii*, *A. pauciflorum*, *Ficus androchaete*, *F. brunneoaurata*, *F. deltoidea*, *F. tricolor*, *Mangifera magnifica*, *M. orophila*) or in tropical lowland forest and tropical swamp forest (such as *Archidendron kunstleri*, *Mangifera gracilipes*, *M. longipetiolata*, *M. parvifolia*, *M. swintonioides*, and *Parkia versteeghii*). Some shrubland species can also occur in other habitats such as in grassland in high altitude as for *Rubus lorentzianus* and *Rubus papuanus*.

About 25-36 of threatened taxa are threatened by the expansion of agricultural area both of small and industrial scale (Fig. 5.5). The other significant factor is the expansion of urbanized area. All threatened taxa are experiencing multiple threats. *Durio dulcis*, wild relative of durian, is the one with the highest number of multiple threats, while *Musa acuminata* subsp. *halabanensis* and *Rubus banghamii* are those threatened by only two threat factors (small holder farming and agro-industry scale farming of annual and perennial non-timber crops).

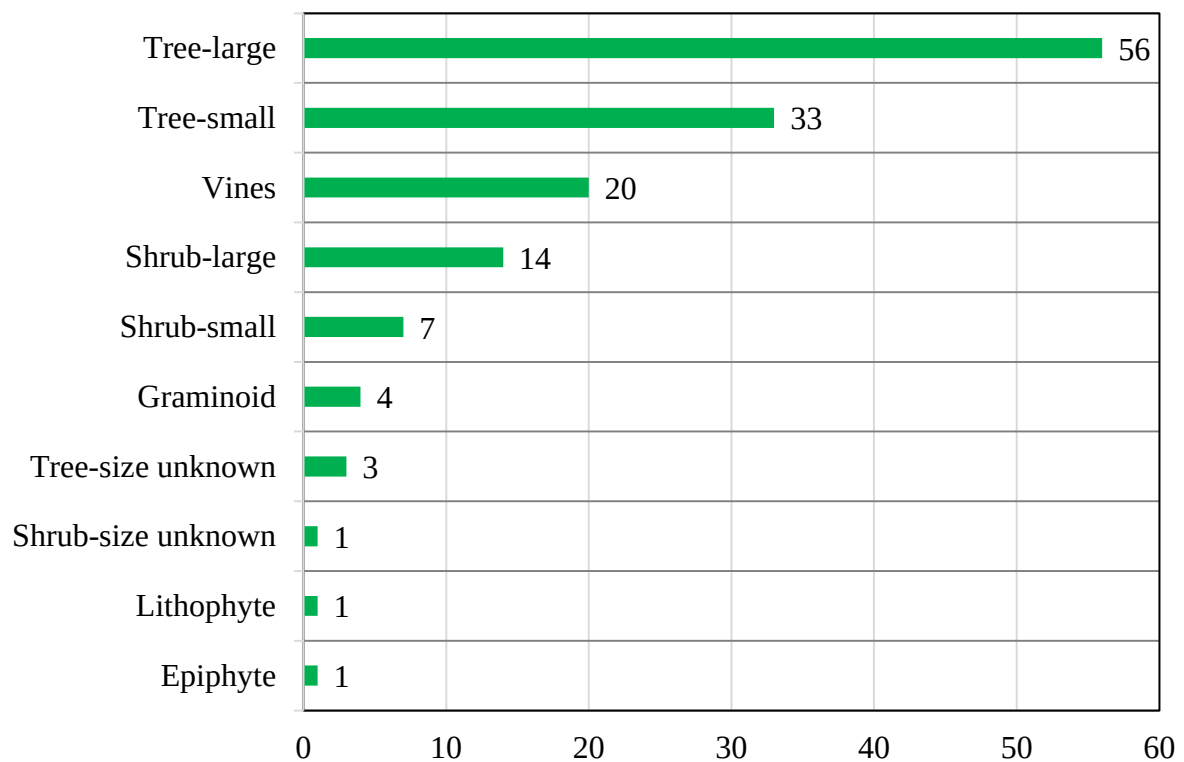


Fig. 5.3 Numbers of assessed CWR taxa based on their growth forms

Fig. 5.6 shows that the highest species richness area of threatened taxa are located in East Kalimantan and Riau province. When the NT taxa were added to the threatened taxa map, the hotspots were identified in East Kalimantan, West Kalimantan, and Riau province (Fig. 5.7). Whilst, the highest species richness for the DD taxa are located in North of Papua (Fig.5.8). Based on the existing protected areas network in Indonesia, Bukit Tiga Puluh NP (in Riau), Padang Luway NR and Bukit Soeharto GFP (in East Kalimantan) were predicted to contain the highest numbers of threatened taxa. Bukit Tiga Puluh NP, Bukit Soeharto GFP, and Gunung Palung NP were predicted to contain the highest number of threatened and NT taxa. Whilst, the protected area that is predicted to contain the highest number of DD is located at the Tanjung Wiay NR in Papua.

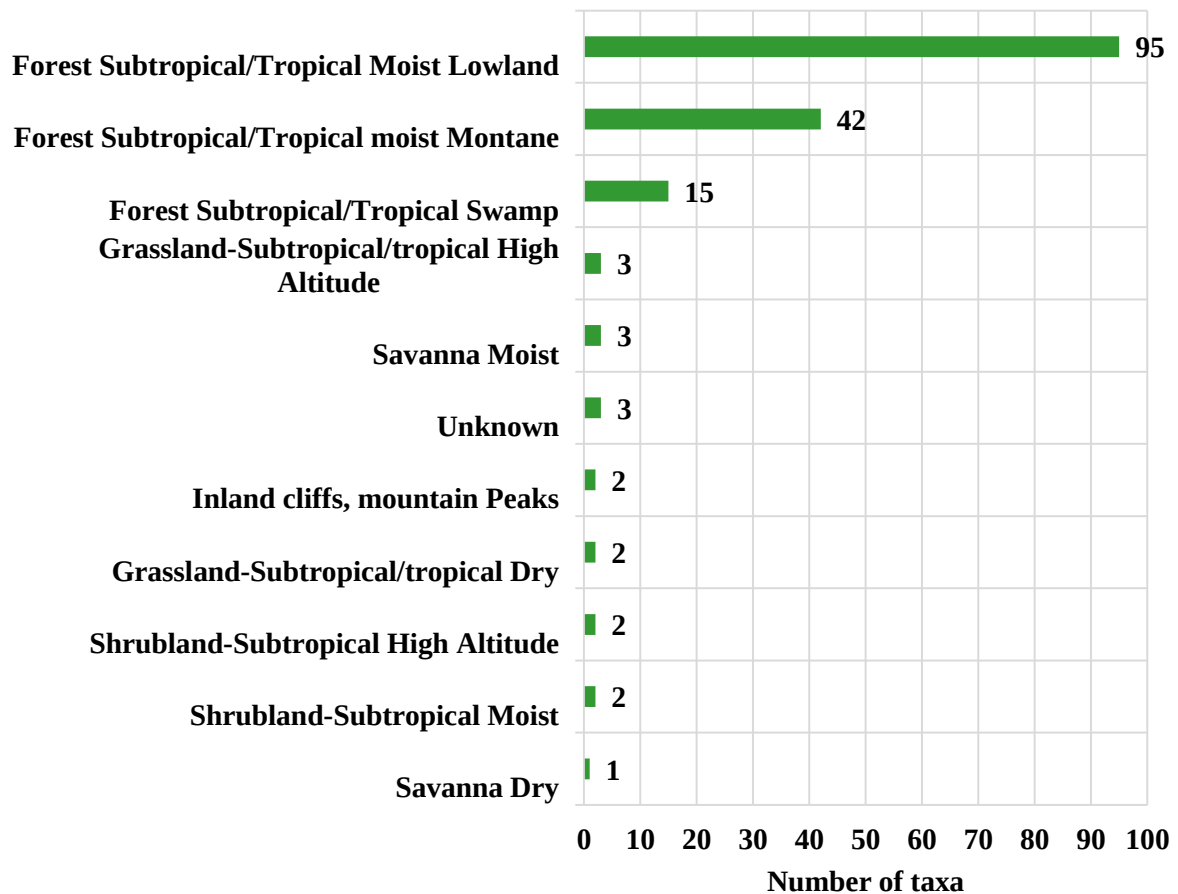


Fig. 5.4 Habitat types of the assessed CWR taxa.

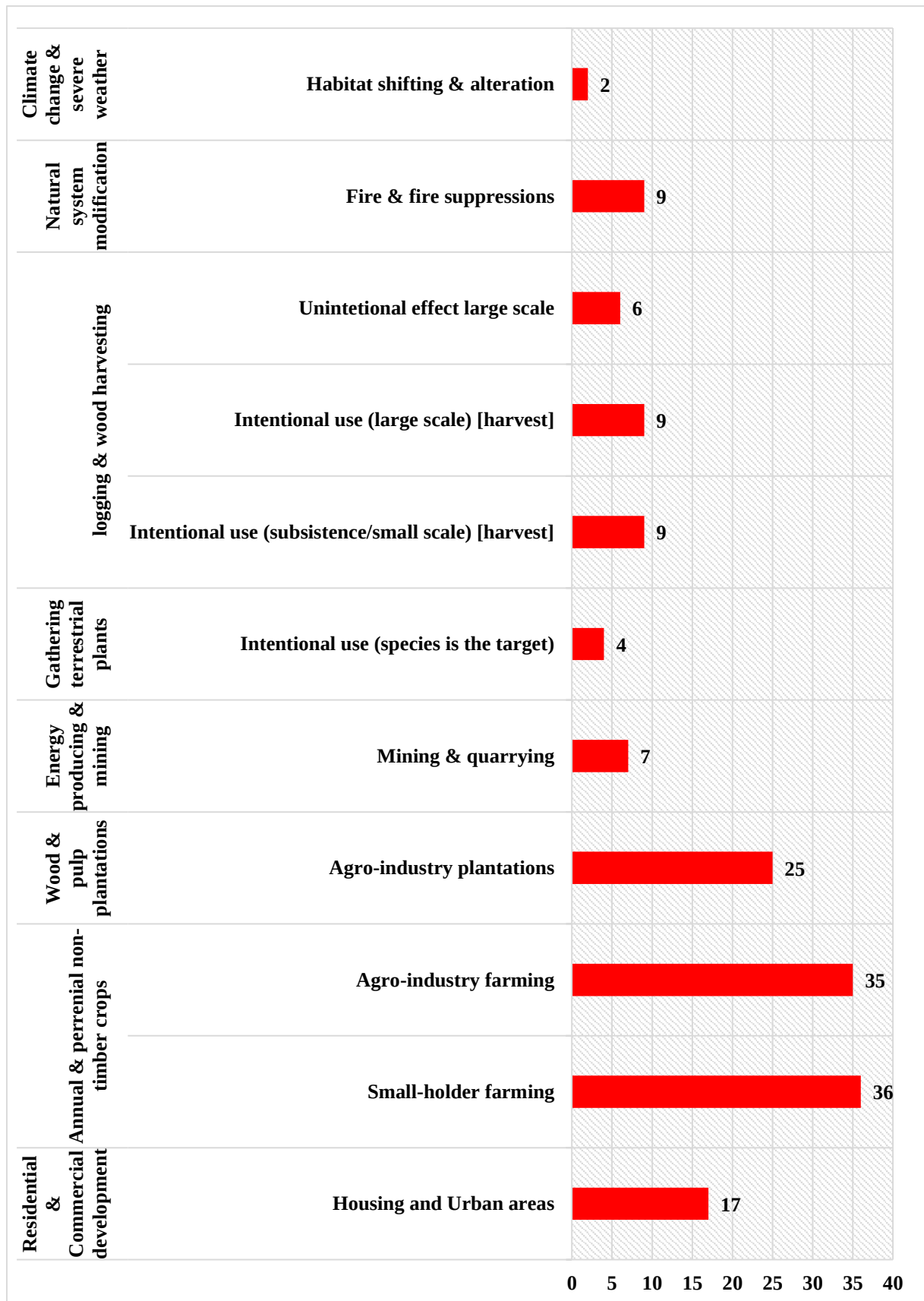


Fig. 5.5 Threatening factors of the threatened CWR taxa

5.5 Discussion

Since 2016, IUCN Species Survival Commission Indonesia Plant Red List Authority has been established (IUCN, 2018). This authority aims at accelerating the production of the national red list book. Starting with the assessment of 100 commercial timber species in 2016, it is now broadening to the other 250 of trees and non-trees species, including CWR (IUCN, 2018). Thirty two of the 1968 inventoried CWR taxa in Indonesia (Rahman *et al.*, 2019) have been assessed previously (IUCN, 2020). Twenty two of them were required to be updated since they were assessed more than two decades ago using Red List Categories and Criteria version 2.3. Therefore, by adding the current novel assessments, the total number of CWR taxa that were assessed will significantly increase up to 146 taxa or 7.42% of the total CWR in Indonesia.

The current assessments were dominated by the wild relatives of mangoes (20 taxa), yams (18 taxa), figs (14 taxa), durian (15 taxa), archidendron (15 taxa) and breadfruit (10 taxa). Eleven taxa of wild relatives of mangoes and two taxa of wild relatives of durian were updated from previous assessments, while the remaining taxa were genuine new assessments. Threat category of five of 13 updated assessment taxa were changed into higher level of extinction risk due to more information available to undertake the assessment, seven taxa kept the same category, and one taxa was moved to DD category. Those taxa that increased their extinction risk are *Mangifera dewildei*, *M. gracilipes*, *M. lalijiwa*, *M. magnifica*, and *M. sumbawaensis*. Whilst, *Mangifera altissima* that was previously categorized as threatened taxa was dropped to DD due to the uncertainty of its distribution range (Kostermans and Bompard, 1993; Litz, 2009; POWO, 2019).

The application of threat status on conservation of biodiversity can have different responses when it put into two opposite perspective scheme; reactive approach and proactive/precautionary approach (Brooks *et al.*, 2006; Le Breton *et al.*, 2019). In reactive approach, the resources for conservation will be prioritized to conserve the higher risk extinction taxa such as CR or EN taxa rather than the VU. In contrast, precautionary approach will prioritized the VU taxa or even accommodating the NT taxa to prevent their further increasing extinction risks. These two approach options become problematic for the conservation managers in making decision as their decisions will shape the future of conservation actions but, at the same time, contain high risk when the future of conservation resources, mostly the budget, are still uncertain to maintenance the previous allocation efforts. This dilemma is getting global attention in biodiversity conservation (Walls, 2018; Le Breton

et al., 2019). This is probably an example of what Drechsler and Wätzold (2020) explained in terms of “path dependence” (condition when the present decisions are influenced by the earlier decisions) and “lock-in effect” (condition when new better alternative decisions cannot be taken since the conservation path was already established by the previous decisions) to cope inefficiencies in conservation actions. Therefore, conservation planning is a critical point on long-term biodiversity conservation, including CWR conservation. However, to minimize those effects in prioritizing target species, it is better to put all threatened categorized (CR, EN, and VU) in equal level of necessity to conserve. In spatial distribution context, identifying locations with multiple target taxa has higher chances to success and at the same time minimize the cost of conservation. In relation to the current results, instead to allocate resources to conserve CR and EN taxa in distance locations (such as *Archidendron minahassae* in North Sulawesi, *Durio bukitrayaensis* in Central Kalimantan, *Mangifera dewildei* in North Sumatra, *M. sumbawaensis* in Sumbawa, *Dioscorea sarasinii* in Sulawesi, and *Salacca zalacca* in Java) with probability to fail to find the target taxa, it is much better to allocated the resources into three predicted sites of the highest species richness area of all threatened priority CWR taxa in Bukit Dua Belas NP, Padang Luway NR and Bukit Soeharto GFP that have higher probability to conserve higher number of threatened taxa.

Geographic range is one key component used in the IUCN red list criteria (IUCN, 2012). This component is frequently used as an indicator for rapid analysis to assess species at risk (Miller *et al.*, 2012; Syfert *et al.*, 2014; Le Breton *et al.*, 2019; Lughadha *et al.*, 2019). Within the geographic range component, threshold values for EOO and AOO are used to separate the extinction risk category of species. Even though those two measurements are widely accepted, Syfert and collabolators (2014) stated that those only best work for particular species with well-known sampled population. They also stated that for most species, their EOO are only described a part of their real distributions. Moreover, Lughadha and collabolators (2019) showed that calculation of AOO based on sample records of herbarium specimens will be underestimated and lead to overestimate to justify the extinction risk. The current result of assessments shows that most of AOO for the assessed taxa are lower than the threshold value for threatened category, 2000 km². This means that if this AOO value is used as the only criteria for the assessment, then most of the taxa will be categorized as CR which is very unreliable. However, those measurements are still useful as Le Breton and collabolators (2019) showed that there is good correlation between the EOO and the extinction risk of the species. Brooks and

collaborators (2019) are suggesting to use another metrics, area of habitat (AOH), to predict more precise of the available habitats for assessed taxa within their distribution range. They stated that AOH is the maximum value for EOO and AOO of the species and its important to monitor the habitat loss. However, the AOH can not be used directly in the process of threat assessment as this metric do not have a treshold value and cannot be compared to the threshold value of EOO and AOO (Brooks *et al.*, 2019).

The results show that 73% (27 of 37) of threatened taxa are large tree species and 62% (23 of 37) were found in lowland tropical forest. Most of them were distributed in Sumatra and Borneo where one taxa is endemic to Sumatra (*Mangifera dewildei*) and five are endemic to Borneo (*Archidendron cockburnii*, *Durio dulcis*, *D. kutejesis*, *D. testudinarum* and *Garcinia nitida*). Lowland tropical moist forest is rapidly losing habitat in Indonesia and in Southeast Asia, in general (FWI/GFW, 2002; Curran, 2004; Wilcove *et al.*, 2013; Margono *et al.*, 2014). Wilcove and collabolators (2013) stated that the lowland forest of Sundaland (an area that covered Malay Peninsula, Sumatra, Java, Borneo, and the small islands within) have lost 70% of its original size in 2010. The rate loss of this forest type in Sumatra reaches up to 21.3% between 2000–2012, while in Borneo it reaches up to 8.4% in the same period (Margono *et al.*, 2014). The proportion of this forest type to exist within the existing protected areas (PAs) network were very low (The Ministry of Forestry and The Ministry of Maritime and Fisheries of The Republic of Indonesia, 2010). In Sumatra, the existing PAs only covered 7.13% of the total lowland forest, while in Kalimantan (Indonesian Borneo), it was only 2.46% of the total forest type. The other forest types that were lost with worsening rates than the lowland forest is the peat swamp forest. Miettinen and collabolators (2012) showed that this type of forest has declined more than 40% within the period 1990–2020. Wilcove and collabolators (2013) also reported that in Sumatra the loss rate reached up to 5.2% per year during 2000–2010, while in Borneo it reached 2.8% per year. Within this forest type in Sumatra and Borneo, six large tree species were considered threatened: *Durio lissocarpus*, *Mangifera gracilipes*, *M. griffithii*, *M. longipetiolata*, *M. paludosa*, and *M. swintonioides*.

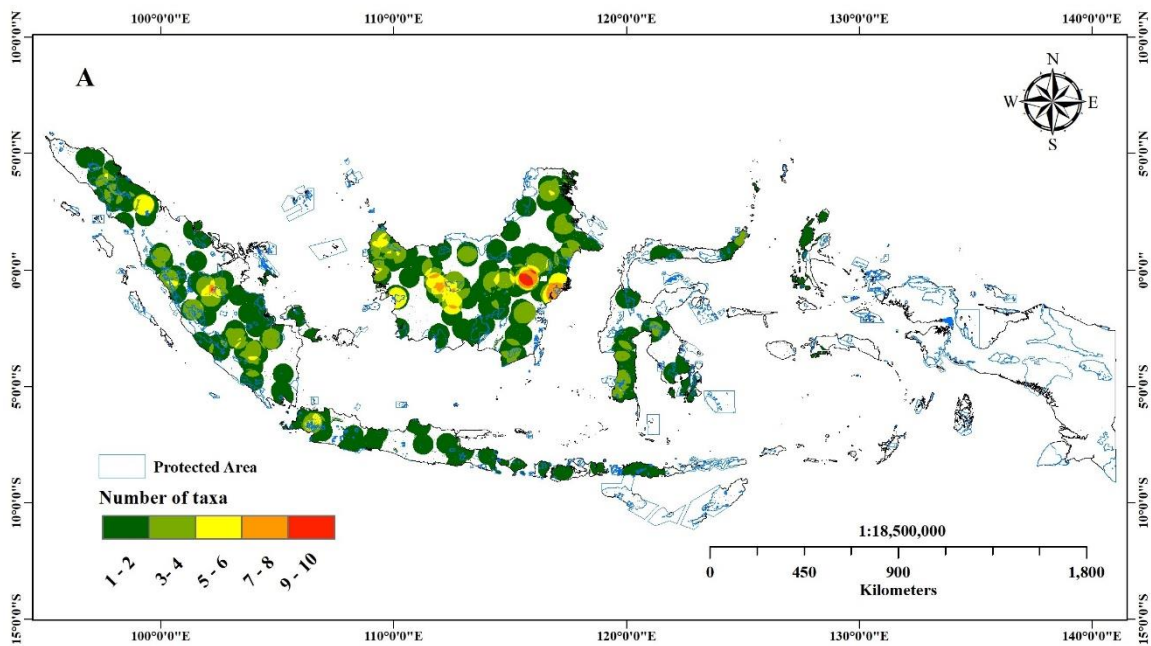


Fig. 5.6 Species richness of threatened priority CWR taxa in Indonesia.

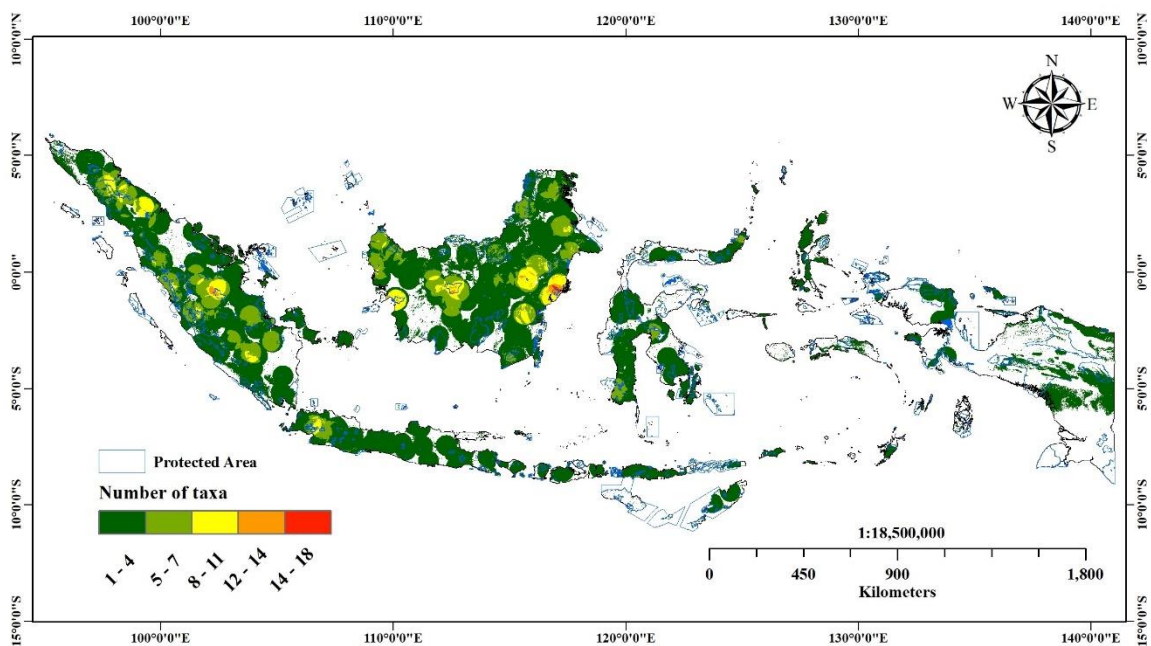


Fig. 5.7 Species richness of threatened and NT priority CWR in Indonesia.

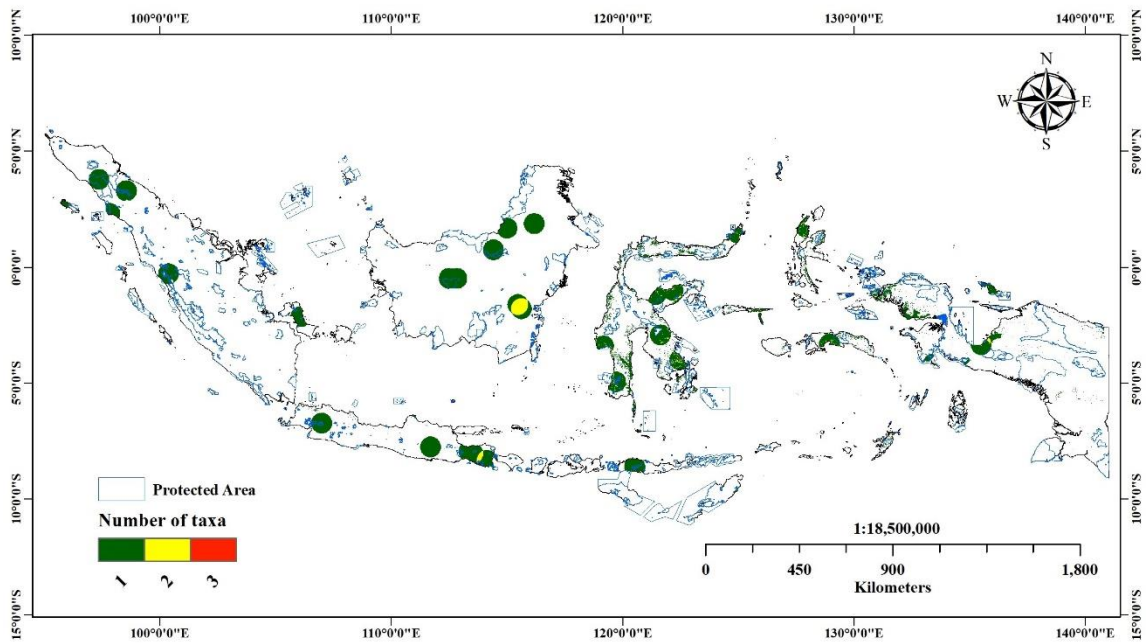


Fig. 5.8 Species richness of DD priority CWR taxa in Indonesia.

Agricultural expansion (including small scale and industrial scale of non-timber farming and timber plantations) and urban development are the most threatening factors for all the threatened taxa assessed in this study. These results are consistent to what Budiharta and collaborators (2011) reported previously. They found that the treats from agricultural expansion and urban development are closely related to the increase of extinction risk of Indonesian plants than the other threatening factors. At the global scale, the human population is reported to continuously increase in biodiversity hotspots (Williams, 2011). The growth rates of human population in two global biodiversity hotspots region, including Indonesia, *i.e.* Sundaland and Wallacea, reached 1.2 % per year between the years 2000–2010, resulting in population density of 167.6 and 95 per km², respectively. Based on the recent report by the United Nations Department of Economic and Social Affairs Population Division (2019), the current population in Indonesia is more than 273 million people with density of 151 km per km². This population is predicted to increase to more than 330 million in 2050 but then decline to about 320 million by the end of the century (United Nations Department of Economic and Social Affairs Population Division, 2019). It is implied that the urban development will expand and, since the most peoples are farmers, the needs for agricultural area will increase as well. As a

consequence, many plants species are at high extinct risk in this region by the end of this century due to habitat loss.

Then, how to conserve those priority threatened CWR in Indonesia effectively? To conserve the tropical forest and at the same time also support national human development program, the socio-economic of land use is important to understand besides ecological factor (Sodhi *et al.*, 2010; Clough *et al.*, 2016). About 93% of farmer in Indonesia were categorized as smallholder farmer with an average of farm size less than 0.6 ha (FAO, 2018b). Whilst in industrial scale plantation, the crop land size for one company can reach up to more than 500,000 ha, such as in oil palm company (Casson *et al.*, 2014). Most of smallholder farmer cultivated food crops, while the other in cooperation with agricultural plantation company cultivated exported crops. Instead of giving more space for further expansion of large scale agricultural plantation, increasing the number of economic investment for the smallholder agricultural sector and establishing new protected areas should be priority for Indonesia. The local smallholder farmer can be the best agent to protect and restore the protected areas. A project run by Alam Sehat Lestari Foundation which based in Gunung Palung NP in West Kalimantan is the example (<https://www.alamsehatlestari.org>). The project is try to increase the quality of public health service for people around the national park by increase the participation of the people on restoration project within and surround the national park. By restoring the degraded areas with native CWR such as *Archidendron* and *Parkia* and other native trees, the people have benefit in both of economic and health services. In the decade of ecosystem restoration 2012-2030, this project should be amplified to all PAs in Indonesia. This strategy will also reduce the number of wildfires from land clearing since the farmers have transferred knowledge by training to clearing their land without fires (Cahyaningtyas, 2018).

Establishing new PAs will increase the proportion of existing of natural forest types within the protected areas. In context of climate change, establishing new areas will also increase the number of climatic refugia sites for priority CWR and facilitate their migration in the future. However, for immediate conservation actions, some program to strengthen the capacity of the existing PAs on CWR conservation should be addressed. The maps of predicted distribution of the threatened, near threatened and data deficient CWR in the current assessment can be used to identify priority sites for immediate conservation actions. At least, three immediate actions can be suggested: (i) active *in situ* conservation, such as periodically monitoring of population trend, in the existing PAs in the highest species richness of threatened

CWR sites, (ii) increase *ex situ* collections from the highest species richness of threatened CWR sites, and (iii) further field surveys on the predicted of highest species richness area of DD taxa. Once these steps are achieved, the actions should be expanded to other areas which are highly affected by threats but with less CWR diversity. The first three priority PAs for active *in situ* conservation and *ex situ* collecting sites of the threatened and NT priority CWR are Bukit Tiga Puluh NP (Riau province), Bukit Soeharto GFP (East Kalimantan province), and Gunung Palung NP (West Kalimantan province). For DD taxa, the priority area for further field surveys are located at the Northern part of Papua, particularly around the Cendrawasih bay. One PA is found within this priority area in Northern Papua (Tanjung Wiay NR) can be set up as target location.

5.6 Conclusion

Among the 1968 CWR that related to food crops in Indonesia, only 32 taxa have been assessed and published for their threats status. The current analysis will increase those assessed taxa up to 146 CWR taxa. 114 taxa were assessed for the first time while 13 taxa were updated from previous assessment using the current version of IUCN Red List criteria and category (Version 3.1). Within the 127 taxa assessed currently, 40 are assessed as threatened, 32 as NT, 31 as LC, and 24 as DD. 73% of those threatened taxa are large trees species which are mostly distributed in the lowland of tropical forests. This habitats is severely threatened by the expansion of agricultural area and urban development. The habitat loss is predicted to increase due to the increasing needs for settlement and agricultural land as the human population in this region is predicted to rise. Increasing the investment of smallholder agricultural land and establishing new PAs are suggested to reduce the frequency of threatening factors. For immediate conservation actions, the maps of predicted distribution of the threatened, NT, and DD taxa were suggested to be used as one of criteria for prioritizing the areas. Three protected areas (Bukit Tiga Puluh NP, Bukit Soeharto GFP, and Gunung Palung NP) were identified as priorities for active *in situ* conservation and further *ex situ* collecting sites. On the other hand, Tanjung Wiay NR was prioritized for further field surveys of DD taxa.

CHAPTER 6

GENERAL DISCUSSION

6.1 Mainstreaming crop wild relatives on plant conservation and food systems in Indonesia

Mainstreaming biodiversity conservation into the development sectors requires at least four components, i.e. prerequisites, stimuli, mechanism and outcomes (Cowling *et al.*, 2002). To mainstream the CWR at national level, those four component are acceptably illustrated in the model of national strategic plan for conservation and use of CWR (Magos Brehm *et al.*, 2017). The component of prerequisites is analogue to the conservation planning step in the strategic model. This component is fundamental and without this the mainstreaming process is unlikely to happen. The stimuli component is similar to incorporating the policy environment and utilization potential to the conservation planning. The mechanism component is included in all the processes of the implementation of the strategy. Whilst, the outcomes can be assessed through the utilization step where public awareness and education, local communities as user and (pre-) breeding programs are deliberately identified.

The initiative on mainstreaming biodiversity conservation for all life wellbeing has been adopted and integrated in the CBD policies since the Cancun declaration 2016 (UNEP, 2016). Recently, FAO (2020) and WHO (2020) developed a strategy on mainstreaming this for agricultural and public nutrition and health sectors, respectively. In practice, the efforts to mainstream biodiversity in national development have been settled long before the declaration (Pagiola *et al.*, 1997; Huntley and Redford, 2014). The programs, such as environmental offsetting, natural capital, green economy, green accounting, green development, or the environmental valuation approaches, such as payment for ecosystem services, reduced emissions from deforestation and forest degradation (REDD+), environmental certification and climate change adaptation, are essentially coherent with the mainstreaming biodiversity terminology (Huntley and Redford, 2014).

The Cancun declaration provide a framework for integrating the biodiversity and all the services provided into all national development programs both in actions and policies (UNEP, 2016). This means that the tangible and intangible of socio-economic and historic-cultural aspects of biodiversity should be considered in pre- and post-programs of any public and private sectors development. For this, the CBD suggested to use the National Biodiversity Strategies and Action Plans (NBSAPs) as the instrument to guide and monitor the implementation progress of this mainstreaming actions for all the parties. As one of the parties, Indonesia has been reporting this current progress on the 6th national report for the CBD (UN, 2019a). Based on the Indonesian Biodiversity Strategy and Action Plan (IBSAP) 2015–2020, about 22

national targets have been assembled by following the framework of the Aichi Targets (The Ministry of National Development Planning, 2016). All of the targets were reported to be on track to achieve the goals with positive progression (UN, 2019a).

In terms of target 13 of the Aichi target that relates to the conservation of genetic diversity of crops and their wild relatives, all the target indicators, such as strengthening the institution capacity, number of policies related to plant genetic resources and number of documented characterized, and evaluated germplasm showed much improvements in Indonesia (UN, 2019a). For example, the establishment of the sub-national commission on genetic resources in 26 provinces has minimized the information gaps among the stakeholders in local governments and therefore increase the awareness and protection of their crop genetic resources (UN, 2019a). The number of *ex situ* accessions of crops genetic resources, including wild relatives, have increased and the on-farm genetic diversity has been monitored and protected in some areas, particularly the local rice varieties. However, the achievement of the GSPC target 9, where “70% of genetic diversity of crops and their wild relatives should be preserved and maintained” (Sharrock, 2012), is still challenging with an insufficient rate, particularly for the wild relatives of tropical tree crops such as of many regionally important fruit crops (UN, 2019a). Moreover, there is no information that these wild relatives are actively maintained and monitored in the existing protected areas (UN, 2019a).

Based on the recent national report to the CBD (UN, 2019a) and the previous country report for the state of plant genetic resources for food and agriculture (Indonesian authorities for the second report of the state of PGRFA, 2010), the successful mainstream of biodiversity rely on the involvements of many stakeholders. Whitehorn and collaborators (2019) who elaborated the 144 NBSAPs across the globe found that the range of involvement of multiple stakeholders in mainstreaming the biodiversity is wider in the developing countries. Thus, to increase the mainstreaming process for the conservation and use of CWR in Indonesia, the main stakeholders should embrace the values of CWR to increase the awareness and engagement of the public and private sectors. At least, eight stakeholders as the keys for CWR conservation have been identified (Indonesian authorities for the second report of the state of PGRFA, 2010). The Ministry of Environment and Forestry, the Ministry of Agriculture, research institutions, local governments, plantation managers, universities, private commercial garden and seed industries, play an important role for *in situ* and *ex situ* conservation and pre-breeding program of CWR in Indonesia and like in other countries such as Mauritius, South Africa and Zambia

(Magos Brehm *et al.*, 2017). The conservation planning of CWR in Indonesia undertaken here aims at solidifying the priority objects and locations for CWR conservation actions. So, the stakeholders will have more precise information on the state of CWR in Indonesia and start to include them in their programs.

About 1,968 native plant taxa that belong to 53 families, 106 genera, 1,890 species and 78 subspecies/variety have been identified as CWR of food crops in Indonesia. About 234 taxa were selected as the priority taxa. These priority taxa were further divided into three levels of priority: first priority, those related to both national and global important crops, second priority, those related to national and regional only important crops, and third priority, those related to globally important crops but less popular in cultivation at the national level. The inclusion of CWR of the Less Popular (LP) crops as the priority taxa is much due to the interdependence of plant genetic resources among the countries worldwide (Khoury *et al.*, 2016). All the priority taxa would be served as the national bargaining position on the access and benefit sharing (ABS) for the plant genetic resources. Since many important exotic crops in Indonesia, such as cabbages, cacao, cassava, coffee, onion, carrot, chilli, maize, palm oil, papaya and peanut have no native wild relatives for their genetic improvements and therefore, depend on the genetic resources from other countries. However, since the mechanism of ABS remains unclear and there is no global agreement among the parties (FAO, 2010), the multilateral exchange of plant genetic resources is cautiously responded by the national and global stakeholders who are worried that this scheme only leads to the growing of the neo-botanical imperialism where only the developed countries and/or the multinational seed companies who have the advance technology will take the benefits of the end products (the improved crops varieties) (Montenegro de Wit, 2017). PricewaterhouseCooper (PwC, 2013) estimated the potential used of CWR could reach \$120 billion each year for only 29 crops. Despite of the controversy of the ABS systems, this utilitarian benefits and the economic value of the CWR are key to attract more attention from a wider range of stakeholders (Petersen and Huntley, 2005).

The conservation gap analyses show that about 154 of the priority CWR taxa have no recorded ex situ collections and 80 taxa with ex situ collections are still under-represented in national genebanks. Moreover, 65 priority taxa have no records within the existing protected areas in Indonesia. These gaps should be a starting points for the collaboration programs within the main stakeholders such as: (i) the Ministry of Environmental and Forestry, who is responsible for the management of national protected areas, (ii) the Ministry of Agriculture and

the Centre of Plant Conservation of the Indonesian Institute of Science, who are responsible for the national genebank and ex situ collections and serve as the national focal point for the ITGPRFA and GSPC, and (iii) research institutes, universities and private agricultural sector, who are responsible for the pre-breeding programs. Those main stakeholders together with the local Non Government Organization (NGO) and farmer's associations are responsible to broadening the awareness of conservation CWR.

For in situ conservation, the managers of protected areas could initiate by identifying and inventorying the CWR in their managed area and monitor their populations by conducting regular field surveys. The information of the occurrences of CWR and their population status are important since most priority CWR have a limited number of records. It is also important to define their threat status more accurately since the threat assessments of priority CWR in this study show that most of the assessed taxa lack information about their actual population size and trend. Since most protected areas are commonly developed in marginal land or remote areas, in situ conservation should be embraced by the manager or land owners the production areas, as well. There are increasing acceptances in many of industrial-size plantations managers to plot part of their land to be unmanaged since they know that the areas have high conservation value (HCV) for wildlife (Purwanto, 2019). These natural unmanaged areas could serve as corridors that link the fragmented natural areas to facilitate the migration of CWR as a response to climate change. The climate change impact analysis carried out in this study show that, without migration, all distribution range of the assessed priority CWR are expected to decline. Conservation of CWR in smaller farms, particularly those used for food crops production, should be more promoted by the agricultural agencies. Since most of closely related wild relatives, such as the weedy types of the crops, are threatened by the anthropogenic disturbances. For example, there is evidence that the closest wild relative of rice (*Oryza rufipogon*) does no longer exists in intensively managed paddy fields with high external production inputs (fertilizers and pesticides) such as in the northern part of Java, which is the main production area of rice in Indonesia (Kumalasari, 2014). The environmental friendly practices in the farm by reducing the pollutant inputs then should be promoted to the cropland owner/managers.

To minimize the gaps of CWR conservation in ex situ collections, further field surveys and collecting programs are required. These efforts should be shared among several stakeholders to reduce the risks, increase the coverage of the collecting area and increase the

efficiency of resources allocations. The ex situ collections then are stored in the national genebanks and the Centre for Plant Conservation and the duplications are sent to local genebanks of provinces and/or local botanic gardens. All of the information related to these collection efforts should be maintained by the national genebanks as the national coordinator. On the other hand, the pre-breeding activities as the outcomes of the mainstreaming process of CWR should be continuously conducted by the research institutes, universities, and private sectors to fuel the loops of dynamic process of mainstreaming and to prevent the genebank collection accessions just like a museum collections.

6.2 Biodiversity conservation agenda post 2020 and the next step of CWR conservation in Indonesia

The preparatory process for the post-2020 biodiversity framework started in 2017 by the Secretariat of the CBD (SCBD, 2017). An iterative process to accommodate the discussion and improvement about the framework from wide range of contributors and flexibility on the implementation by considering the dynamic of global development changes are two of 13 guiding principles that were used on the development of the framework (CBD, 2018a). On January 2020, the zero draft of this framework was published (CBD, 2020c). Based on the draft, the period of the year 2021–2030 will be a crucial stepping stone to achieve the vision of 2050 goals where biodiversity sustaining the planetary systems and human wellbeing. The draft was built based on the theory of change where transformative actions and policies across the socio-economic and monetary sectors at national, regional and global levels will improve the natural ecosystem recovery in the next three decades (CBD, 2020c).

Mace and collaborators (2018) noted that most of the targets of the strategic plan for the CBD (2010–2020) and including the 20 Aichi targets were unlikely to be fully achieved by the 2020. On the other hand, the vision 2050 is expecting more ambitious goals. For example, based on the zero draft appendices (CBD, 2020b), the first goals of the post-2020 biodiversity framework is to achieve at least 20% increase of ecosystem intactness in terms of area and integrity by 2050. CWR conservation is included in the third goals that states that “*by 2050, the genetic diversity is maintained and enhanced for the 90% of species*” (CBD, 2020b). Therefore, the first decade after 2020 (2021–2030) is prepared as the ad interim period to bend the trend of biodiversity loss into positive recovery/net gain by 2050 (Mace *et al.*, 2018; Simmonds *et al.*, 2020).

In developing the framework, many inputs from the parties and observers were proposed to amend the framework targets (CBD, 2020a). Those proposals that related to CWR conservation are essentially similar except on the specific threshold value of the target. For example, the Global Partnership for Plant Conservation explicitly proposed that by 2030, 80% of genetic diversity of crops and their wild relatives is maintained and the strategies to conserve them have been developed and implemented (CBD, 2020a). Whilst, the South Africa party, Environment and Conservation Organization of New Zealand and IUCN proposed this target without an exact threshold (CBD, 2020a). The target threshold value proposed by the Global Partnership for Plant Conservation is 10% higher than the GSPC target for 2020 (Sharrock, 2012). This target will be challenging for many countries, such as Indonesia, which just initiated their national strategies to conserve the CWR.

To accelerate the achievement on CWR conservation to meet the 2030 targets, some following recommendations from the current study can be suggested:

1. The list of the 234 priority CWR taxa (Chapter 2) should be disseminated to the main stakeholders such as the national agricultural genebank, the environment and forestry agencies, the centre for plant conservation, local governments, the universities, non-government conservation organizations, and agricultural private sectors. Feedbacks (critics, comments, and suggestion) related to the priority taxa are compiled for the improvement of conservation planning. Then, remedial process to set up the priority taxa by additional or removal related taxa will be considered appropriately.
2. The existing protected areas managers initiate to inventory all CWR and identify the national priority CWR within their area and monitor the population of priority CWR. Protected areas (PA) that are included in the complementary PA network (Chapter 3) were recommended for active in situ conservation of CWR. Those top ten complementary PA (Mt. Leuser NP, Palung NP, Mt. Gede Pangrango NP, Lore Lindu NP, Kerinci Seblat NP, Bukit Baka-Bukit Raya NP, Kutai NP, Mamberamo Foja WR, Bantimurung NRP, and P. Bawean WR) can be selected to implement pilot national CWR genetic reserves. The procedures to monitor CWR populations should be established through focus group discussion and national meetings and then implemented in the complementary PA. Sequential monitoring reports that provide rigorous time series data are recommended. As a target, by 2030, 80% of priority CWR taxa are maintained and monitored in the existing protected areas.

3. The development of new formal protected areas or informal of Other Effective Area-Based Conservation Measures (OECMs) were also proposed to conserve priority CWR that have no records within the existing PA network and those non-forest taxa (pre-climax community species), based on the complementary grids (Chapter 3): areas in Berau - Malinau of East Kalimantan, Labuhan Batu - Tapanuli Selatan of North Sumatra, or Bangka Selatan in Bangka Island were identified for this purpose. Other locations based on the feedbacks from the stakeholders can be proposed, as well.
4. The existing PA, new formal establishing PA and OECMs are important as the climatic refugia for conservation of the future CWR populations. These areas is key component to support the dynamics of their distribution range shifts. Therefore, the connectivity among the PA networks to facilitate the migration is advised to increase by building green corridors around the riverbanks that connect the PAs.
5. The collecting programs to enhance the ex situ collections should be conducted by considering more involvements from wide range of stakeholders under the coordination of the national genebanks and the Centre for Plant Conservation. Prior to these actions, a good collecting practices and its procedures are intensively communicated among the stakeholders. The collections and all related information of the habitat should be deposited and compiled in the national genebank collections with duplicates at the local institutions. Therefore, the wide range of CWR genetic diversity can be efficiently and effectively conserved.
6. To anticipate the negative impact of future climate change, the holdouts population within the existing PA network should be prioritized for collecting missions (Chapter 4). This collections have high probability to contain rare genetic traits and are important as sources for their assisted migration. For the 56 CWR taxa that included in the analysis of climate change impacts, the priority PAs that contain significant holdouts populations are the Kerinci Seblat NP (in Sumatra) and Bogani nani Wartabone NP (in North Sulawesi).
7. For immediate conservation actions, at least three existing protected areas, i.e. Bukit Tiga Puluh NP, Bukit Soeharto GFP, and Gunung Palung NP, are prioritized for further surveys and collecting mission as those PAs contain significant number of threatened CWR taxa (Chapter 5). Whilst, other PA such as in Northern Papua (Tanjung Wiay NR) is prioritized for further surveys of priority CWR taxa with Data Deficient status.

6.3 Limitation of research

Some limitation on taxonomic issues related to the generation of national CWR checklist and prioritization are recognised. Some CWR are still systematically and taxonomically understudied in Indonesia; for example, the wild relatives of the genera *Diospyros* (Ebenaceae), *Pandanus* (Pandanaceae) and *Syzygium* (Myrtaceae). Some crop genera, such as *Arenga*, *Averrhoa*, *Nephelium*, or *Salacca*, have no subdivision or interspecific-hybridization information, so the degree of relatedness of the species under those genus cannot be further defined based on taxon group or genepool concept. Moreover, systematics of few CWR genera is being revised, such as in *Artocarpus*. Through personal communication, it was said that some of species under the *Artocarpus* are misidentified and therefore, their distributions are biased.

Most of the occurrence data of priority were gathered from global databases such as GBIF and Genesys. Although additional information from herbarium specimens at Herbarium Bogoriense (Indonesia) and Leiden (Netherland) and from ex situ collections of four botanic gardens in Indonesia (Bogor, Cibodas, Purwodadi, and Bali), have been compiled, those datasets are still insufficient for the 76% of priority CWR taxa, particularly for the national endemic taxa, to use for species distribution modelling. Some information from local herbaria such as in the University of Andalas (West Sumatra), Wanariset in Balikpapan (Kalimantan), the University of Tadulako in Sulawesi, and Herbarium Papuaense Manokwari in Papua and from the collections of 31 new establishing local botanic gardens are promising for further generation of occurrences dataset for the priority CWR in Indonesia.

6.4 Conclusion

CWR are important resources to sustaining the crop production at national, regional and global levels, ensuring the future of food security and as part of biodiversity, supporting the planetary health. These resources linked the genetic relationship of cultivated plants that evolved under the man-made directions and their wild/natural evolved relatives. Therefore, the economic value of these resources is clearly tangible. The growing number of initiatives to conserve CWR is driven by the utilitarian perspective to humankind as well as by the concern of the decline of natural habitat and its quality.

The CBD, since it was declared, put these resources as vital objects in the global conservation movement. Currently, the platform to mainstreaming the conservation of these resources into the development sectors to increase public awareness, fundraising, intercrossed-

sectors collaboration, innovative technologies and knowledge production was adopted by the CBD. By this year, the achievement of the implementation of the CBD Strategic Plan for the last decade (2011–2020) will be evaluated. Even though, the positive progress of the targets' achievement can be noticed, there is indication that most of the targets are under achievement. Nevertheless, the attention and contribution from multiple stakeholders on the targets achievement process has been increasingly achieved. This is the important asset to achieve the 2050 vision with more ambitious targets.

Based on the latest national CBD reports, Indonesia is on track to achieve most of its national targets. However, in term of CWR conservation, it is still insufficient. There is no information about systematic conservation planning of CWR at national level. The current study aims to fill this gap and to be the starting point to mainstreaming these resources into the national agenda. About 1,968 native plant taxa are identified as the wild relatives of food crops. 234 of them were further selected as the priority CWR taxa. Of the priority taxa, 95 taxa are related to nationally and globally important crops, 69 taxa are related to national and regionally important crops, and 70 taxa are related to globally important crops but have less in cultivation at national level. The conservation gap analyses of priority CWR revealed that both of the current ex situ and in situ conservation are still insufficient. More than 60% of the priority taxa have no records in ex situ collections. Those 80 priority taxa with ex situ accession are still under-represented in the national genebanks. 65 priority taxa have no records inside the existing PA networks. At least 40 complementary protected areas are required to conserve those taxa with known population within the existing PA. Further surveys and establishment of the new formal PAs or informal OECMs are proposed to justify and conserve the remaining taxa that have no records in the existing PAs. The climate change impact analysis shows that one to six priority CWR with wide distribution range (*Artocarpus sepicanus*, *Averrhoa bilimbi*, *Cocos nucifera*, *Dioscorea alata*, *Ficus chartacea* and *F. oleifolia*) are predicted to have significant reduction of their distribution range. On the other hand, one to seven priority taxa (*Archidendron clypearia*, *Artocarpus lanceifolius*, *A. sepicanus*, *Dioscorea pyrifolia*, *Durio zibethinus*, *Ficus padana* and *Oryza meyeriana*) are predicted to benefit from climate change. The analysis also found that without migration all the distribution range of priority taxa will be declining. The existing PA network is important as the climatic refugia for the priority CWR. Those PAs are also detected to contain holdouts population of priority CWR, those populations that are likely to disappear in the near future due to climate change. Those holdouts populations

are prioritized for the targets of ex situ collections and also to provide materials for assisted migration. About 127 priority taxa were included on novel threat assessments at global level. The result shows that 40 taxa are threatened, 32 taxa are NT, 31 taxa are LC, and 24 taxa are DD. 65% of threatened taxa are mostly found in the lowland of tropical forest of the global biodiversity hotspot, Sundaland (Peninsular Malaya, Sumatra, Java, and Borneo). Habitat loss from the expansion of agricultural land and urban development are the most threatening factors.

By disseminating the findings in this study, more discussion among the main stakeholders is expected to grow. This will trigger for more details on conservation planning and implementation. Then, the path of long-term effective CWR conservation in Indonesia will be established and it is on the track to achieve the 2030 biodiversity targets and the vision for 2050.

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APPENDICES

Appendix 1 Genera and number of taxa of each category of crops

No	National and Globally Important Crops (NGI)	Minor and Underutilised Crops (MUC)	Less Popular Crops (LP)	National Important Crops (NI)	Exotic Important Crops (EI)	Globally Important Crops (GI)
	Genus (No. Taxa)					
1	<i>Artocarpus</i> (31)	<i>Aleurites</i> (1)	<i>Asparagus</i> (1)	<i>Anacardium</i> (1)	<i>Allium</i> (6)	<i>Aegilops</i> (32)
2	<i>Citrus</i> (5)	<i>Amaranthus</i> (2)	<i>Abelmoschus</i> (9)	<i>Annona</i> (3)	<i>Ananas</i> (1)	<i>Agropyron</i> (2)
3	<i>Cocos</i> (1)	<i>Amorphophallus</i> (29)	<i>Cajanus</i> (5)	<i>Apium</i> (1)	<i>Arachis</i> (1)	<i>Amblyopyrum</i> (3)
4	<i>Colocasia</i> (3)	<i>Anacolosa</i> (3)	<i>Cenchrus/ Pennisetum</i> (3)	<i>Canna</i> (1)	<i>Brassica</i> (3)	<i>Amygdalus</i> (1)
5	<i>Cucumis</i> (2)	<i>Antidesma</i> (37)	<i>Clausena</i> (5)	<i>Cyphomandra</i> (1)	<i>Capsicum</i> (2)	<i>Armoracia</i> (1)
6	<i>Ipomoea</i> (24)	<i>Archidendron</i> (39)	<i>Dioscorea</i> (33)	<i>Hylocereus</i> (1)	<i>Carica</i> (1)	<i>Atalantia</i> (1)
7	<i>Mangifera</i> (45)	<i>Arenga</i> (12)	<i>Echinochloa</i> (4)	<i>Luffa</i> (1)	<i>Citrullus</i> (1)	<i>Avena</i> (15)
8	<i>Musa</i> (25)	<i>Averrhoa</i> (4)	<i>Ensete</i> (1)	<i>Maranta</i> (1)	<i>Daucus</i> (1)	<i>Barbarea</i> (1)
9	<i>Oryza</i> (7)	<i>Baccaurea</i> (32)	<i>Ficus</i> (277)	<i>Passiflora</i> (2)	<i>Elaeis</i> (1)	<i>Bertholletia</i> (1)
10	<i>Persea</i> (3)	<i>Benincasa</i> (2)	<i>Lablab</i> (1)	<i>Psidium</i> (1)	<i>Fragaria</i> (1)	<i>Beta</i> (13)
11	<i>Saccharum</i> (3)	<i>Borassus</i> (2)	<i>Olea</i> (6)	<i>Sechium</i> (1)	<i>Glycine</i> (1)	<i>Capsella</i> (1)
12	<i>Solanum</i> (10)	<i>Bouea</i> (2)	<i>Panicum</i> (17)	<i>Tamarindus</i> (1)	<i>Lactuca</i> (2)	<i>Carthamus</i> (10)
13	<i>Sorghum</i> (4)	<i>Breynia</i> (6)	<i>Phoenix</i> (1)		<i>Malus</i> (1)	<i>Chenopodium</i> (27)
14	<i>Vigna</i> (8)	<i>Canarium</i> (33)	<i>Potentilla</i>		<i>Manihot</i> (1)	<i>Cicer</i> (5)
15	<i>Vitis</i> (2)	<i>Canavalia</i> (6)	<i>Prunus</i> (28)		<i>Phaseolus</i> (1)	<i>Coincya</i> (1)
16		<i>Caryota</i> (6)	<i>Rorippa</i> (3)		<i>Pisum</i> (1)	<i>Corylus</i> (15)
17		<i>Chrysophyllum</i> (2)	<i>Rubus</i> (28)		<i>Raphanus</i> (1)	<i>Crambe</i> (2)
18		<i>Cleome</i> (2)	<i>Setaria</i> (9)		<i>Triticum</i> (1)	<i>Cucurbita</i> (11)
19		<i>Coccinia</i> (1)	<i>Vaccinium</i> (170)		<i>Xanthosoma</i> (1)	<i>Cydonia</i> (1)
20		<i>Curcuma</i> (19)	<i>Ziziphus</i> (10)		<i>Zea</i> (1)	<i>Cynara</i> (5)
21		<i>Cynometra</i> (5)				<i>Diplotaxis</i> (3)
22		<i>Cyperus</i> (63)				<i>Eleusine</i> (7)
23		<i>Cyrtosperma</i> (6)				<i>Elymus</i> (5)
24		<i>Dimocarpus</i> (3)				<i>Eruca</i> (3)
25		<i>Diospyros</i> (119)				<i>Erucastrum</i> (2)
26		<i>Durio</i> (21)				<i>Helianthus</i> (44)
27		<i>Eleocharis</i> (16)				<i>Hordeum</i> (4)
28		<i>Emilia</i> (1)				<i>Isatis</i> (4)

Appendix 1 Genera and number of taxa of each category of crops (*contd.*)

No	National and Globally Important Crops (NGI)	Minor and Underutilised Crops (MUC)	Less Popular Crops (LP)	National Important Crops (NI)	Exotic Important Cropss (EI)	Globally Important Crops (GI)
29		<i>Enydra</i> (1)				<i>Juglans</i> (30)
30		<i>Flacourtia</i> (7)				<i>Lathyrus</i> (34)
31		<i>Garcinia</i> (96)				<i>Lens</i> (4)
32		<i>Gnetum</i> (18)				<i>Lepidium</i> (12)
33		<i>Hibiscus</i> (23)				<i>Lupinus</i> (29)
34		<i>Hydrocotyle</i> (2)				<i>Moricandia</i> (1)
35		<i>Lansium</i> (3)				<i>Orychophr agmus</i> (1)
36		<i>Litchi</i> (1)				<i>Pimenta</i> (1)
37		<i>Macadamia</i> (1)				<i>Pistacia</i> (15)
38		<i>Manilkara</i> (5)				<i>Pyrus</i> (36)
39		<i>Metroxylon</i> (1)				<i>Ribes</i> (53)
40		<i>Momordica</i> (5)				<i>Secale</i> (7)
41		<i>Monochoria</i> (2)				<i>Sesamum</i> (8)
42		<i>Nelumbo</i> (1)				<i>Sinapis</i> (3)
43		<i>Nephelium</i> (12)				<i>Spinacia</i> (2)
44		<i>Neptunia</i> (4)				<i>Tornabene a</i> (3)
45		<i>Nypa</i> (1)				<i>Trachystom a</i> (1)
46		<i>Ocimum</i> (3)				<i>Tripsacum</i> (1)
47		<i>Oenanthe</i> (1)				<i>Vasconcell ea</i> (3)
48		<i>Pandanus</i> (41)				<i>Vicia</i> (33)
49		<i>Parkia</i> (5)				
50		<i>Pilea</i> (28)				
51		<i>Plectranthus</i> (6)				
52		<i>Polyscias</i> (17)				
53		<i>Pometia</i> (2)				
54		<i>Portulaca</i> (1)				
55		<i>Pouteria</i> (20)				
56		<i>Psophocarpus</i> (1)				
57		<i>Rhodomyrtus</i> (5)				
58		<i>Rungia</i> (9)				
59		<i>Salacca</i> (7)				
60		<i>Sandoricum</i> (4)				
61		<i>Shorea</i> (117)				
62		<i>Sonchus</i> (2)				

63		<i>Sonneratia (4)</i>				
64		<i>Spondias (5)</i>				
65		<i>Stachys (1)</i>				
66		<i>Stelechocarpus (2)</i>				
67		<i>Syzygium (159)</i>				
68		<i>Tacca (5)</i>				
69		<i>Terminalia (30)</i>				
70		<i>Triadica (1)</i>				
71		<i>Trichosanthes (31)</i>				

Appendix 2 Literature used to generate the Indonesian crop wild relatives checklist

Literature Group	Taxa Covered
Flora Malesiana Series I	Adema F, Leenhouts PW, Welzen PC van (1994) Sapindaceae. Flora Malesiana 11:419–768 Ashton PS (1982) Dipterocarpaceae. Flora Malesiana SerI 9:237–552 Backer CA (1951a) Aizoaceae. Flora Malesiana 4:267–275 Backer CA (1949a) Amaranthaceae. Flora Malesiana 4:69–98 Backer CA (1949b) Chenopodiaceae. Flora Malesiana 4:99–106 Backer CA (1951b) Pontederiaceae. Flora Malesiana 4:255–261 Backer CA, van Steenis CGGJ (1951) Sonneratiaceae. Flora Malesiana 4:280–289 Berg CC, Corner EJH, Jarrett FM (2006) Moraceae Genera Other than Ficus. Flora Malesiana 17:1–152 Buijsen JRM (1993) Alliaceae. Flora Malesiana 11:375–384 Burkill IH (1951) Dioscoreaceae. Flora Malesiana 4:293–335 Buwalda P (1949) Umbelliferae. Flora Malesiana 4:113–140 de Wilde WJJO, Duyfjes BEE (2010) Cucurbitaceae. Flora Malesiana 19:1–333 Drenth E (1976) Taccaceae. Flora Malesiana 7:806–819 Exell AW (1954) Combretaceae. Flora Malesiana 4:533–589 Geesink R (1971) Portulacaceae. Flora Malesiana 7:121–133 Hiepkko P (1984) Opiliaceae. Flora Malesiana 10:31–52 Hou D (1978) Anacardiaceae. Flora Malesiana 8:395–548 Hou D, Larsen K, Larsen SS (1996) Caesalpiniaceae (Leguminosae-Caesalpinioideae). Flora Malesiana 12:409–730 I.C. N, Hopkins HCF (1991) Mimosaceae (Leguminosae-Mimosoideae). Flora Malesiana 11:1–226 Jessop JP (1979) Liliaceae-I. Flora Malesiana 9:189–235 Jonsell B (1988) Cruciferae. Flora Malesiana 10:541–560 Kalkman C (1993) Rosaceae. Flora Malesiana 11:227–351 Kern JH (1974) Cyperaceae. Flora Malesiana 7:435–753 Leenhouts PW, Kalkman C, Lam HJ (1956) Burseraceae. Flora Malesiana 5:209–296 Mabberley DJ, Pannell CM, Sing AM (1995) Meliaceae. Flora Malesiana 12:1–407 Markgraf F (1951) Gnetaceae. Flora Malesiana 4:336–347 Philipso WR (1979) Araliaceae. Flora Malesiana 9:1–105 Sleumer H (1967) Ericaceae. Flora Malesiana SerI 6:746–878 Sleumer H (1954) Flacourtiaceae. Flora Malesiana 5:1–106 Sleumer H (1984) Olacaceae. Flora Malesiana 10:1–29 van Ooststroom SJ, Hoogland RD (1953) Convolvulaceae. Flora Malesiana 4:388–512 van Steenis CGGJ (1957) Basellaceae. Flora Malesiana 5:300–304 van Steenis CGGJ (1949) Moringaceae. Flora Malesiana 4:45–46 Veldkamp JF (1971) Oxalidaceae. Flora Malesiana 7:151–178
Academic Botany Journal	Blumea: Hay A, Boyce PC, Hetterscheid WLA, et al (1995) Checklist of The Araceae of Malasia, Australia, and the Tropical Western Pacific Region. BLUMEA Suppl 8:1–161 Herrmann-Erlee MPM, van Royen P (1957) Revision of the Sapotaceae of the Malaysian Area in a Wider Sense IX. Pouteria Aublet. Blumea 8:452–509 Kostermans AJGH (1977) Notes on Asiatic, Pacific, and Australian Diospyros. Blumea - Biodiversity, Evol Biogeogr Plants 23:449–474 Newman M, Lhuillier A, Poulsen AD (2004) Checklist of the

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GBIF	<i>Pandanus</i>, <i>Garcinia</i>, <i>Syzygium</i>, <i>Pilea</i>

Appendix 3 Number of household cultivating crops in Indonesia based on Agricultural census (Statistics Indonesia (2013) Agricultural Census. <https://st2013.bps.go.id/dev2/index.php>. Accessed 1 Feb 2017). All MCU crop listed in the table below defined later as Minor crops (MC). Therefore, all MCU crops listed in Table S1 that do not present in the table below defined as Underutilised crops (UC).

Crop	Previous Crop Group	New Crop Group	No. of Household Cultivating The Crop (household)
Amaranths	MCU	MC	155,464
Ambarella	MCU	MC	62,993
American Basil	MCU	MC	12,675
Angled Loofah	NI	NI	26,016
Apple	EI	EI	7,103
Archidendron jiringa	MCU	MC	403,986
Avocado	EI	EI	366,959
Banana	NGI	NGI	5,409,875
Bilimbi	MCU	MC	8,954
Bitter Gourd	MCU	MC	29,540
Black Sugar Palm	MCU	MC	174,288
Breadfruit	NGI	NGI	83,006
Cabbage	EI	EI	269,050
Canna	EI	EI	9,891
Carrot	EI	EI	130,693
Cashew	EI	EI	411,284
Cassava	EI	EI	2,895,867
Celery	EI	EI	29,748
Chayote	EI	EI	103,425
Chempedak	NGI	NGI	80,105
Chili	EI	EI	574,872
Chinese Cabbage	EI	EI	263,568
Coconut	NGI	NGI	5,090,583
Common Beans	EI	EI	196,118
Cowpea	NGI	NGI	350,177
Cucumber	NGI	NGI	138,736
Dragon Fruit	NI	NI	15,173
Durian	MCU	MC	1,323,992
Eggplant	NGI	NGI	196,997
Garlic	EI	EI	15,238
Gnetum	MCU	MC	511,312
Grape Fruit	NGI	NGI	83,577
Grapes	NGI	NGI	3,330
Guava	EI	EI	158,941
JackFruit	NGI	NGI	699,305
Java Plum	MCU	MC	4,879
Kangkong	NGI	NGI	190,193
Lansium domesticum	MCU	MC	676,015
Lettuce	EI	EI	12,440

Longan	MCU	MC	45,873
Maize	EI	EI	5,057,532
Malay Apple	MCU	MC	17,242
Mangoes	NGI	NGI	2,315,270
Mangosteen	MCU	MC	282,503
Maranta	EI	EI	4,033
Matoa	MCU	MC	15,515
Mungbean	NGI	NGI	645,825
Musk Melon	NGI	NGI	44,032
Oil Palm	EI	EI	1,458,319
Onion	EI	EI	226,234
Orange	NGI	NGI	554,432
Papaya	EI	EI	466,903
Parkia speciosa	MCU	MC	654,245
Passion Fruit	EI	EI	13,231
Pea	EI	EI	6,225
Peanut	EI	EI	1,337,388
Persimmon	MCU	MC	3,847
Pineapple	EI	EI	96,904
Potato	EI	EI	96,208
Radish	EI	EI	3,807
Rambutans	MCU	MC	1,267,750
Rice	NGI	NGI	14,147,942
Sago	MCU	MC	56,726
Sapote	MCU	MC	163,735
Snake Fruit	MCU	MC	199,108
Sorghum	NGI	NGI	8,089
Soursop	EI	EI	71,503
Soybean	EI	EI	671,774
Spring Onion	EI	EI	122,257
Starfruit	MCU	MC	51,101
Strawberry	EI	EI	5,409
Sugar Apple	EI	EI	35,758
Sugar cane	NGI	NGI	287,099
Sweet Potato	NGI	NGI	866,814
Tabasco	EI	EI	1,116,476
Tamarillo	EI	EI	3,906
Tamarind	NI	NI	70,770
Taro	NGI	NGI	194,103
Tomato	NGI	NGI	189,609
Water Apple	MCU	MC	206,180
Water Melon	EI	EI	60,846
Wheat	EI	EI	204

Appendix 4 Priority wild relatives of food crops in Indonesia

No.	Priority	Taxon	Related crop	Related crop common name	Concept type	Concept level
1	1	<i>Artocarpus altilis</i> (Parkinson) Fosberg	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	1B
2	1	<i>Artocarpus anisophyllus</i> Miq.	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
3	1	<i>Artocarpus brevipedunculatus</i> (F. M. Jarrett) C. C. Berg	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
4	1	<i>Artocarpus camansi</i> Blanco	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Gene Pool	1B
5	1	<i>Artocarpus elasticus</i> Reinw. ex Blume	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
6	1	<i>Artocarpus horridus</i> Jarrett	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
7	1	<i>Artocarpus integer</i> (Thunb.) Merr.	<i>Artocarpus heterophyllus</i> Lamk	Breadfruit	Gene Pool	2
8	1	<i>Artocarpus kemando</i> Miq.	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
9	1	<i>Artocarpus lanceifolius</i> Roxb.	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
10	1	<i>Artocarpus lowii</i> King	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
11	1	<i>Artocarpus maingayi</i> King	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
12	1	<i>Artocarpus odoratissimus</i> Blanco	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
13	1	<i>Artocarpus rigidus</i> Blume	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
14	1	<i>Artocarpus sarawakensis</i> Jarrett	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
15	1	<i>Artocarpus scortechinii</i> King	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
16	1	<i>Artocarpus sepicanus</i> Diels	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
17	1	<i>Artocarpus sericicarpus</i> Jarrett	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
18	1	<i>Artocarpus sumatranus</i> Jarrett	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
19	1	<i>Artocarpus tamaran</i> Becc.	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
20	1	<i>Artocarpus teysmannii</i> Miq.	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Breadfruit	Taxon Group	3
21	1	<i>Citrus hystrix</i> DC.	<i>Citrus aurantiifolia</i> / <i>Citrus aurantium</i> / <i>Citrus limon</i> / <i>Citrus sinensis</i>	Oranges/Lime/Lemon/mandarin oranges	Gene Pool	1B/2/2/2
22	1	<i>Citrus maxima</i> (Burm.) Merr.	<i>Citrus maxima</i> (Burm.) Merr.	Grapefruit	Gene Pool	1B
23	1	<i>Cocos nucifera</i> L.	<i>Cocos nucifera</i> L.	Coconut	Gene Pool	1B
24	1	<i>Colocasia esculenta</i> (L.) Schott	<i>Colocasia esculenta</i> (L.) Schott	Taro	Gene Pool	1B
25	1	<i>Colocasia gigantea</i> (Blume) Hook.f.	<i>Colocasia esculenta</i> (L.) Schott	Taro	Gene Pool	2
26	1	<i>Cucumis melo</i> forma <i>agrestis</i> (Naudin) W.J. De Wilde & Duyfjes	<i>Cucumis melo</i> L.	Melon	Gene Pool	1B
27	1	<i>Ipomoea littoralis</i> Blume	<i>Ipomoea batatas</i> (L.) Lamk	Sweet Potato	Gene Pool	2
28	1	<i>Ipomoea aquatica</i> Forsskal	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	1B
29	1	<i>Ipomoea asarifolia</i> (Desr.) R. & Sch.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
30	1	<i>Ipomoea coptica</i> (L.) Roth ex Sch.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2

Appendix 4 Priority wild relatives of food crops in Indonesia (contd.)

31	1	<i>Ipomoea graminea</i> R.Br.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
32	1	<i>Ipomoea imperati</i> (Vahl) Griseb.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
33	1	<i>Ipomoea sagittifolia</i> Burm.f.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
34	1	<i>Ipomoea obscura</i> (L.) Ker-Gawl	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
35	1	<i>Ipomoea pes-caprae</i> (L.) R.Br	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
36	1	<i>Ipomoea stibaropoda</i> Ooststr.	<i>Ipomoea aquatica</i> Forsskal	Water lettuce	Taxon Group	2
37	1	<i>Mangifera altissima</i> Blanco	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
38	1	<i>Mangifera applanata</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
39	1	<i>Mangifera casturi</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
40	1	<i>Mangifera dewildei</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
41	1	<i>Mangifera lalijiwa</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
42	1	<i>Mangifera laurina</i> Bl.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
43	1	<i>Mangifera magnifica</i> Kochummen	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
44	1	<i>Mangifera minor</i> Bl.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
45	1	<i>Mangifera mucronulata</i> Bl.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
46	1	<i>Mangifera oblongifolia</i> Hooker.f.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
47	1	<i>Mangifera orophila</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
48	1	<i>Mangifera pedicellata</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
49	1	<i>Mangifera quadrifida</i> Jack	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
50	1	<i>Mangifera rigida</i> Bl.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
51	1	<i>Mangifera rubropetala</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
52	1	<i>Mangifera rufocostata</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
53	1	<i>Mangifera similis</i> Bl.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
54	1	<i>Mangifera sulavesiana</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
55	1	<i>Mangifera sumbawaensis</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
56	1	<i>Mangifera swintonioides</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
57	1	<i>Mangifera timorensis</i> Blume	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
58	1	<i>Mangifera torquenda</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
59	1	<i>Manigfera longipetiolata</i> King	<i>Mangifera indica</i> L.	Mango	Taxon Group	2
60	1	<i>Mangifera gedebe</i> Miq.	<i>Mangifera indica</i> L.	Mango	Taxon Group	3
61	1	<i>Mangifera gracilipes</i> Hooker f.	<i>Mangifera indica</i> L.	Mango	Taxon Group	3
62	1	<i>Mangifera griffithii</i> Hooker f.	<i>Mangifera indica</i> L.	Mango	Taxon Group	3
63	1	<i>Mangifera microphylla</i> Griff. ex Hooker.	<i>Mangifera indica</i> L.	Mango	Taxon Group	3
64	1	<i>Mangifera paludosa</i> Kosterm.	<i>Mangifera indica</i> L.	Mango	Taxon Group	3

Appendix 4 Priority wild relatives of food crops in Indonesia (contd.)

65	1	<i>Mangifera parvifolia</i> Boerl. & Koorders	<i>Mangifera indica</i> L.	Mango	Taxon Group	3
66	1	<i>Musa acuminata</i> Colla	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Gene Pool	1B
67	1	<i>Musa acuminata</i> Colla subsp. <i>halabanensis</i> (Meijer) M.Hotta	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
68	1	<i>Musa acuminata</i> Colla subsp. <i>malaccensis</i> (Ridl.) N.W.Simmonds	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
69	1	<i>Musa acuminata</i> Colla subsp. <i>microcarpa</i> (Becc.) N.W.Simmonds	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
70	1	<i>Musa acuminata</i> Colla var. <i>sumatrana</i> (Becc.) Nasution	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
71	1	<i>Musa acuminata</i> Colla var. <i>tomentosa</i> (Warb.) Nasution	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
72	1	<i>Musa balbisiana</i> Colla	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Gene Pool	1B
73	1	<i>Musa balbisiana</i> Colla var. <i>brachycarpa</i> (Backer) Häkkinen	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	1B
74	1	<i>Musa celebica</i> Warb. Ex K. Schum	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	2
75	1	<i>Musa lanceolata</i> Warb. Ex K.Schum.	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	2
76	1	<i>Musa schizocarpa</i> N.W.Simmonds	<i>Musa acuminata</i> Colla/ <i>Musa balbisiana</i> Colla	Banana/Plantain	Taxon Group	2
77	1	<i>Oryza longiglumis</i> Jansen	<i>Oryza sativa</i> L.	Rice	Gene Pool	3
78	1	<i>Oryza meyeriana</i> (Zoll.& Mor.) Baillon	<i>Oryza sativa</i> L.	Rice	Gene Pool	3
79	1	<i>Oryza minuta</i> J.S. Presl	<i>Oryza sativa</i> L.	Rice	Gene Pool	2
80	1	<i>Oryza officinalis</i> Wall ex Watt.	<i>Oryza sativa</i> L.	Rice	Gene Pool	2
81	1	<i>Oryza ridleyi</i> Hook.f.	<i>Oryza sativa</i> L.	Rice	Gene Pool	3
82	1	<i>Oryza rufipogon</i> Griffith	<i>Oryza sativa</i> L.	Rice	Gene Pool	1B
83	1	<i>Oryza schlechteri</i> Pilger	<i>Oryza sativa</i> L.	Rice	Gene Pool	3
84	1	<i>Saccharum officinarum</i> L.	<i>Saccharum officinarum</i> L.	Sugarcane	Gene Pool	1B
85	1	<i>Saccharum robustum</i> Brandes et Jesw. Ex Grassl	<i>Saccharum officinarum</i> L.	Sugarcane	Gene Pool	1B
86	1	<i>Saccharum spontaneum</i> L.	<i>Saccharum officinarum</i> L.	Sugarcane	Gene Pool	2
87	1	<i>Solanum insanum</i> L.	<i>Solanum melongena</i> L.	Aubergines/Eggplant	Gene Pool	1B
88	1	<i>Sorghum nitidum</i> (Vahl) Pers.	<i>Sorghum bicolor</i> (L.) Moench	Sorghum	Gene Pool	3
89	1	<i>Sorghum plumosum</i> (R. Br.) P. Beauv.	<i>Sorghum bicolor</i> (L.) Moench	Sorghum	Gene Pool	3

Appendix 4 Priority wild relatives of food crops in Indonesia (*contd.*)

90	1	<i>Sorghum propinquum</i> (Kunth) Hitchc.	<i>Sorghum bicolor</i> (L.) Moench	Sorghum	Gene Pool	1B
91	1	<i>Sorghum timorense</i> (Kunth) Buse	<i>Sorghum bicolor</i> (L.) Moench	Sorghum	Gene Pool	3
92	1	<i>Vigna radiata</i> (L.) Wilczek	<i>Vigna radiata</i> (L.) Wilczek	Mungbean	Gene Pool	1B
93	1	<i>Vigna trilobata</i> (L.) Verdc.	<i>Vigna radiata</i> (L.) Wilczek	Mungbean	Taxon Group	3
94	1	<i>Vigna minima</i> (Roxb.) Ohwi & Ohashi	<i>Vigna angularis</i> (Willd.) Ohwi & H.Ohashi/ <i>Vigna umbellata</i> (Thunb.) Ohwi&H.Ohashi	Rice bean	Gene Pool	2
95	1	<i>Vigna umbellata</i> (Thunb.) Ohwi & Ohashi	<i>Vigna umbellata</i> (Thunb.) Ohwi&H.Ohashi	Rice bean	Gene Pool	1B
96	2	<i>Amaranthus tricolor</i> Linné	<i>Amaranthus tricolor</i> Linné	Amaranthus	Taxon Group	1B
97	2	<i>Archidendron jiringa</i> (Jack) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	1B
98	2	<i>Archidendron borneense</i> (Benth.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
99	2	<i>Archidendron bubalinum</i> (Jack) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
100	2	<i>Archidendron clypearia</i> (Jack) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
101	2	<i>Archidendron cockburnii</i> Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
102	2	<i>Archidendron contortum</i> (Mart.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
103	2	<i>Archidendron crateradenum</i> (Kosterm.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
104	2	<i>Archidendron ellipticum</i> (Blume) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
105	2	<i>Archidendron fagifolium</i> (Blume ex Miq.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
106	2	<i>Archidendron globosum</i> (Blume) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
107	2	<i>Archidendron havilandii</i> (Ridley) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
108	2	<i>Archidendron kunstleri</i> (Prain) Nielsen Subsp. <i>Ashtonii</i> Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
109	2	<i>Archidendron microcarpum</i> (Benth.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
110	2	<i>Archidendron minahassae</i> (Koord.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
111	2	<i>Archidendron oppositum</i> (Miq.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2

Appendix 4 Priority wild relatives of food crops in Indonesia (*contd.*)

112	2	<i>Archidendron palauense</i> (Kaneh.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
113	2	<i>Archidendron pauciflorum</i> (Benth.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
114	2	<i>Archidendron trichophyllum</i> (Kosterm.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
115	2	<i>Archidendron triplinervium</i> (Kosterm.) Nielsen	<i>Archidendron jiringa</i> (Jack) Nielsen	Jengkol	Taxon Group	2
116	2	<i>Arenga pinnata</i> (Wurmb) Merrill	<i>Arenga pinnata</i> (Wurmb) Merrill	Jengkol	Taxon Group	1B
117	2	<i>Averrhoa bilimbi</i> L.	<i>Averrhoa bilimbi</i> L.	Bilimbi	Taxon Group	1B
118	2	<i>Averrhoa carambola</i> L.	<i>Averrhoa carambola</i> L.	Star fruit	Taxon Group	1B
119	2	<i>Dimocarpus longan</i> Lour. Var. <i>malesianus</i> Leenh.	<i>Dimocarpus longan</i> Lour.	Longan	Taxon Group	1B
120	2	<i>Diospyros discolor</i> Willd.	<i>Diospyros discolor</i> Willd.	Velvet apple	Taxon Group	1B
121	2	<i>Durio affinis</i> Becc.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
122	2	<i>Durio beccarianus</i> Kosterm. & Soegeng	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
123	2	<i>Durio bukitrayaensis</i> Kosterm.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
124	2	<i>Durio carinatus</i> Mast.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
125	2	<i>Durio dulcis</i> Becc.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
126	2	<i>Durio graveolens</i> Becc.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
127	2	<i>Durio kutejensis</i> (Hassk.) Becc.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
128	2	<i>Durio lanceolatus</i> Mast.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
129	2	<i>Durio lissocarpus</i> Mast.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
130	2	<i>Durio lowianus</i> Scort. ex King	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
131	2	<i>Durio macrantha</i> Kosterm.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
132	2	<i>Durio malaccensis</i> Planch. ex Mast.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
133	2	<i>Durio oblongus</i> Mast.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
134	2	<i>Durio oxleyanus</i> Griff.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
135	2	<i>Durio testudinarius</i> Becc.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	3
136	2	<i>Durio zibethinus</i> L.	<i>Durio zibethinus</i> L.	Durian	Taxon Group	1B
137	2	<i>Garcinia mangostana</i> L.	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	1B
138	2	<i>Garcinia celebica</i> L.	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2
139	2	<i>Garcinia diospyrifolia</i> Pierre	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2
140	2	<i>Garcinia nitida</i> Pierre	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2
141	2	<i>Garcinia opaca</i> King	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2

Appendix 4 Priority wild relatives of food crops in Indonesia (contd.)

142	2	<i>Garcinia penangiana</i> Pierre	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2
143	2	<i>Garcinia rigida</i> Miq.	<i>Garcinia mangostana</i> L.	Mangosteen	Taxon Group	2
144	2	<i>Gnetum gnemon</i> L.	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	1B
145	2	<i>Gnetum gnemon</i> L. var. <i>brunonianum</i> (GRIFF.) MGF	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	1B
146	2	<i>Gnetum gnemon</i> L. var. <i>ovalifolium</i> (Poir.) Bl.	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	1B
147	2	<i>Gnetum gnemon</i> L. var. <i>tenerum</i> MGF	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	1B
148	2	<i>Gnetum gnemon</i> L. var. <i>gracile</i> MGF	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	1B
149	2	<i>Gnetum costatum</i> K. Sch.	<i>Gnetum gnemon</i> L.	Gnetum	Taxon Group	2
150	2	<i>Lansium domesticum</i> Corrêa	<i>Lansium domesticum</i> Correa	Langsat	Taxon Group	1B
151	2	<i>Metroxylon sagu</i> Rottboell	<i>Metroxylon sagu</i> Rottboell	Sago	Taxon Group	1B
152	2	<i>Momordica charantia</i> L.	<i>Momordica charantia</i> L.	Bitter gourd	Taxon Group	1B
153	2	<i>Nephelium lappaceum</i> L.	<i>Nephelium lappaceum</i> L.	Rambutans	Taxon Group	1B
154	2	<i>Ocimum americanum</i> L.	<i>Ocimum americanum</i> L.	American basil	Taxon Group	1B
155	2	<i>Parkia speciosa</i> Hassk.	<i>Parkia speciosa</i> Hassk.	Bitter bean	Taxon Group	1B
156	2	<i>Parkia singularis</i> Miq.	<i>Parkia speciosa</i> Hassk.	Bitter bean	Taxon Group	2
157	2	<i>Parkia sumatrana</i> Miq.	<i>Parkia speciosa</i> Hassk.	Bitter bean	Taxon Group	2
158	2	<i>Parkia timoriana</i> (DC.) Merr.	<i>Parkia speciosa</i> Hassk.	Bitter bean	Taxon Group	2
159	2	<i>Parkia versteeghii</i> Merr. & Perry	<i>Parkia speciosa</i> Hassk.	Bitter bean	Taxon Group	2
160	2	<i>Pometia pinnata</i> Forst.&Forst.	<i>Pometia pinnata</i> Forst.&Forst.	Matoa	Taxon Group	1B
161	2	<i>Salacca zalacca</i> (Gaertner) Voss	<i>Salacca zalacca</i> (Gaertner) Voss	Snake fruit	Taxon Group	1B
162	2	<i>Syzygium aqueum</i> (Burm.f.) Alston	<i>Syzygium aqueum</i> (Burm.f.) Alston	Water apple	Taxon Group	1B
163	2	<i>Syzygium cumini</i> (L.) Skeels	<i>Syzygium cumini</i> (L.) Skeels	Jambolans	Taxon Group	1B
164	2	<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry	<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry	Malay apple	Taxon Group	1B
165	3	<i>Cajanus cajan</i> (L.) Millsp.	<i>Cajanus cajan</i> (L.) Millsp.	Pigeon pea	Gene Pool	1B
166	3	<i>Cajanus goensis</i> Dalz.	<i>Cajanus cajan</i> (L.) Millsp.	Pigeon pea	Gene Pool	2
167	3	<i>Cajanus scarabaeoides</i> (L.) Thouars	<i>Cajanus cajan</i> (L.) Millsp.	Pigeon pea	Gene Pool	2
168	3	<i>Dioscorea alata</i> L.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	1B
169	3	<i>Dioscorea bancana</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
170	3	<i>Dioscorea elegans</i> Ridl.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
171	3	<i>Dioscorea filiformis</i> Blume	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
172	3	<i>Dioscorea grata</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
173	3	<i>Dioscorea havilandii</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
174	3	<i>Dioscorea lamprocaula</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2

Appendix 4 Priority wild relatives of food crops in Indonesia (*contd.*)

175	3	<i>Dioscorea madiunensis</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
176	3	<i>Dioscorea nienhuisii</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
177	3	<i>Dioscorea nummularia</i> Lamk.	<i>Dioscorea alata</i> L.	Yam	Gene Pool	2
178	3	<i>Dioscorea orbiculata</i> Hook.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
179	3	<i>Dioscorea platycarpa</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
180	3	<i>Dioscorea polyclados</i> Hook.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
181	3	<i>Dioscorea prainiana</i> R. Knuth	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
182	3	<i>Dioscorea pubera</i> Blume	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
183	3	<i>Dioscorea pyrifolia</i> Kunth.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
184	3	<i>Dioscorea salicifolia</i> Blume	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
185	3	<i>Dioscorea sarasinii</i> Uline ex R. Knuth	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
186	3	<i>Dioscorea sexrimata</i> Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
187	3	<i>Dioscorea tenuifolia</i> Ridl.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
188	3	<i>Dioscorea vanvuureni</i> Prain & Burk.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
189	3	<i>Dioscorea vilis</i> Kunth	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
190	3	<i>Dioscorea warburgiana</i> Uline ex Koord.	<i>Dioscorea alata</i> L.	Yam	Taxon Group	2
191	3	<i>Ficus androchaete</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
192	3	<i>Ficus aurata</i> (Miq.) Miq.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
193	3	<i>Ficus aureocordata</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
194	3	<i>Ficus auricoma</i> Corner ex C.C.Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	3
195	3	<i>Ficus brunneaurata</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
196	3	<i>Ficus chartacea</i> (Wall. ex Kurz) Wall. ex King	<i>Ficus carica</i> L.	Figs	Taxon Group	3
197	3	<i>Ficus deltoidea</i> Jack	<i>Ficus carica</i> L.	Figs	Taxon Group	2
198	3	<i>Ficus deltoidea</i> Jack. subsp. <i>motleyana</i> (Miq.) C. C. Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	2
199	3	<i>Ficus fulva</i> Reinw. ex Bl.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
200	3	<i>Ficus glabristipulata</i> Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	3
201	3	<i>Ficus glandulifera</i> (Wall. ex Miq.) King	<i>Ficus carica</i> L.	Figs	Taxon Group	3
202	3	<i>Ficus grossularioides</i> Burm. fil.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
203	3	<i>Ficus halmaherae</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
204	3	<i>Ficus hirta</i> Vahl subsp. <i>dumosa</i> (King) C.C.Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	3

Appendix 4 Priority wild relatives of food crops in Indonesia (contd.)

205	3	<i>Ficus hirta</i> Vahl subsp. <i>roxburghii</i> (King) C.C.Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	3
206	3	<i>Ficus hirta</i> Vahl	<i>Ficus carica</i> L.	Figs	Taxon Group	3
207	3	<i>Ficus inaequipetiolata</i> Merr.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
208	3	<i>Ficus kofmaniae</i> C.C.Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	2
209	3	<i>Ficus lamponga</i> Miq.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
210	3	<i>Ficus litseifolia</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
211	3	<i>Ficus oleifolia</i> King	<i>Ficus carica</i> L.	Figs	Taxon Group	2
212	3	<i>Ficus oleifolia</i> King subsp. <i>intermedia</i> (Corner) C. C. Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	2
213	3	<i>Ficus padana</i> Burm. fil.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
214	3	<i>Ficus pedunculosa</i> Miq.	<i>Ficus carica</i> L.	Figs	Taxon Group	2
215	3	<i>Ficus ruficaulis</i> Merr.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
216	3	<i>Ficus schefferiana</i> King	<i>Ficus carica</i> L.	Figs	Taxon Group	3
217	3	<i>Ficus setiflora</i> Stapf	<i>Ficus carica</i> L.	Figs	Taxon Group	3
218	3	<i>Ficus subfulva</i> Corner	<i>Ficus carica</i> L.	Figs	Taxon Group	3
219	3	<i>Ficus subglabripetala</i> C.C.Berg	<i>Ficus carica</i> L.	Figs	Taxon Group	3
220	3	<i>Ficus tricolor</i> Miq.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
221	3	<i>Ficus tricolor</i> Miq. var. <i>serroh</i> Miq.	<i>Ficus carica</i> L.	Figs	Taxon Group	3
222	3	<i>Lablab purpureus</i> (L.) Sweet	<i>Lablab purpureus</i> (L.) Sweet	Lablab bean	Gene Pool	1B
223	3	<i>Rubus acuminatissimus</i> Hassk.	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
224	3	<i>Rubus alpestris</i> Blume	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
225	3	<i>Rubus banghamii</i> Merr.	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
226	3	<i>Rubus ferdinandi-muelleri</i> Focke	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
227	3	<i>Rubus fraxinifolius</i> Poiret	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
228	3	<i>Rubus lineatus</i> Reinw. ex Blume	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
229	3	<i>Rubus lorentzianus</i> Pulle	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
230	3	<i>Rubus macgregorii</i> F. Muel	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
231	3	<i>Rubus niveus</i> Thunb	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
232	3	<i>Rubus papuanus</i> Schltr. ex Diels	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
233	3	<i>Rubus rosifolius</i> J.E. Smith	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3
234	3	<i>Rubus sumatranus</i> Miq.	<i>Rubus idaeus</i> L.	Raspberry	Taxon Group	3

Appendix 5 Literature for additional presence records of priority CWR taxa in Indonesia

No	Literatures
1	Abdul Haris Mustari, Afroh Manshur, Burhanuddin Masyud. 2012. Food Plants and Habitats' Carrying Capacity of Sambar Deer, <i>Cervus Unicolor</i> Kerr, 1972) In Teluk Pulai Resort, Tanjung Puting National Park, Central Kalimantan. <i>Media Konservasi</i> 17(2): 47 – 54
2	Abdul Haris Mustari, Fadhilah Iqra Mansyur, Dones Rinaldi. 2013. Habitat Characteristics and Population of <i>Tarsius Fuscus</i> In Balocci Resort, Bantimurung bulusaraung National Park, South Sulawesi. <i>Media Konservasi</i> 18(1): 47 – 53
3	Agung Wahyu Nugroho, Heru Dwi Riyanto. 2018. Vegetasi Riparian Dalam Hutan Produksi Di Sungai Cemoro-Modang, Cepu, Jawa Tengah. <i>Jurnal Penelitian Kehutanan Wallacea</i> 7(2): 119-129
4	Agustin Sukistyanawati, Wiwin Sepiastini, Sukro Makmun, Sapto Andriyono. 2016. Vegetation Analysis of Coastal Forests, Lowland Tropical Forests and Mangroves Ecosystem in Sempu Island Nature Reserve. <i>Journal of Marine and Coastal Science</i> 5(1): 22-35
5	Ahmad Dwi Setyawan, Ari Susilowati, Wiryanto. 2002. Habitat Reliks Vegetasi Mangrove Di Pantai Selatan Jawa. <i>Biodiversitas</i> 3(2): 242-256
6	Ahmad Dwi Setyawan. 1999. Distribusi dan Kemelimpahan <i>Rubus</i> Di Gunung Lawu. <i>Biosmart</i> 1 (2): 34-41
7	Akas Pinarangan Sujalu, Achmad Ariffien Bratawinata, Sigit Hardwinarto. 2006. Ephyte Diversity at The Trees' Base in The Log-Over Forest of Malinau Research Forest. <i>Jurnal Kehutanan Unmul</i> 2 (2): 131-143
8	Akbar Arafah Emboa, Roni Koneria, Saroyoa, Adelfia Papua. 2015. Inventarisasi Jenis Pohon Pada Cagar Alam Gunung Ambang, Sulawesi Utara. <i>Jurnal Mipa Unsrat Online</i> 4 (2): 115-119
9	Albasri, Faisal Danu Tuheteru, Aldi Darmawan. 2016. Keanekaragaman Vegetasi Pada Hutan Riparian di Taman Nasional Rawa Aopa Watumohai. <i>Ecogreen</i> 2(2): 107-113
10	Andes Hamuraby Rozak, Sri Astutik, Zaenal Mutaqien, Didik Widyatmoko, Endah Sulistyawati. 2016. Tree Species Richness in Forest of Mount Gede-Pangrango National Park, West Java. <i>Jurnal Penelitian Hutan Dan Konservasi Alam</i> 13 (1): 1-14
11	Andi Kusumo, Azis Nur Bambang, Munifatul Izzati. 2016. Struktur Vegetasi Kawasan Hutan Alam Dan Hutan Terdegradasi Di Taman Nasional Tesso Nilo. <i>Jurnal Ilmu Lingkungan</i> 14(1): 19-26
12	Arnold, Herman Harijanto, Sustri. 2017. Keanekaragaman Jenis dan Pemanfaatan Tumbuhan Obat di Kawasan Taman Nasional Lore Lindu (TNLL) di Desa Mataue Kecamatan Kulawi Kabupaten Sigi. <i>Warta Rimba</i> 5(1): 71-79
13	Ary Susatyo Nugroho, Tria Anis, Maria Ulfah. 2015. Analysis of The Fruit Plant Species Diversity in Surokonto Conservation Forest, Kendal, Central Java and Its Potential as A Bird Conservation Area. <i>Pros Sem Nas Masy Biodiv Indon</i> 1(3): 472-476
14	Asep Sadili. 2012. Kajian Struktur Tegakan Vegetasi dan Komposisi Jenis Tumbuhan pada Habitat Jenis Burung Paruh Bengkok (<i>Psittacidae</i>) di Pulau Alor, Nusa Tenggara Timur. <i>Jurnal Teknologi Lingkungan (Edisi Khusus: Hari Lingkungan Hidup)</i> : 97-106

Appendix 5 Literature for additional presence records of priority CWR taxa in Indonesia (*Contd.*)

15	Asep Sadili. 2016. Peat Forest on Siak Kecil Wildlife Sanctuary and Pt Arara Abadi, Riau Province: Vegetation Within of Damages. <i>Jurnal Biologi Indonesia</i> 12(1): 9-17
16	Atmansyah, Defri Yoza, Tuti Arlita. 2017. The Identification of Ecotourism Potential in Pulau Jemur Conservation Area Pasir Limau Kapas District Rokan Hilir Regency. <i>Jom Faperta</i> 4(1): 1-11
17	Baharuddin Nurkin, Amran Achmad, Ngakan Putu Oka, Wirianto Rachman, Samuel A Paembonan. 2002. Karakteristik Ekologi dan Aspek Silvikultur Eboni (<i>Diospyros Celebica</i> Bakh.) Sulawesi Selatan. <i>Berita Biologi</i> 6(2): 267-275
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Appendix 5 Literature for additional presence records of priority CWR taxa in Indonesia (*Contd.*)

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Appendix 6 Environmental Variables

No	Component	Variables Code	Description	Unit	Source
1	Bioclim	bio_1	Annual average temperature	°C	Worldclim
2	Bioclim	bio_2	Average daytime temperature range	°C	Worldclim
3	Bioclim	bio_3	Isothermality (BIOCLIM2/BIOCLIM7)(*100)		Worldclim
4	Bioclim	bio_4	Temperature seasonality (standarddeviation*100)		Worldclim
5	Bioclim	bio_5	Maximum temperature for the warmest month	°C	Worldclim
6	Bioclim	bio_6	Minimum temperature for the coldest month	°C	Worldclim
7	Bioclim	bio_7	Annual temperature range (BIOCLIM5 - BIOCLIM6)	°C	Worldclim
8	Bioclim	bio_8	Average temperature for the quarter with most precipitation(3 rainiest months)	°C	Worldclim
9	Bioclim	bio_9	Average temperature for the driest quarter (3 driest months)	°C	Worldclim
10	Bioclim	bio_10	Average temperature for the hottest quarter (3 hottest months)	°C	Worldclim
11	Bioclim	bio_11	Average temperature for the coldest quarter (3 coldest months)	°C	Worldclim
12	Bioclim	bio_12	Annual precipitation	mm	Worldclim
13	Bioclim	bio_13	precipitation during the wettest month	mm	Worldclim
14	Bioclim	bio_14	precipitation during the driest month	mm	Worldclim
15	Bioclim	bio_15	Seasonality of precipitation (variation coefficient)	mm	Worldclim
16	Bioclim	bio_16	precipitation during the wettest quarter (3 rainiest months)	mm	Worldclim
17	Bioclim	bio_17	precipitation during the driest quarter (3 driest months)	mm	Worldclim
18	Bioclim	bio_18	precipitation during the hottest quarter (3 hottest months)	mm	Worldclim
19	Bioclim	bio_19	precipitation during the coldest quarter (3 coldest months)	mm	Worldclim
20	Bioclim	prec_1	Average precipitation for January	mm	Worldclim
21	Bioclim	prec_2	Average precipitation for February	mm	Worldclim
22	Bioclim	prec_3	Average precipitation for March	mm	Worldclim
23	Bioclim	prec_4	Average precipitation for April	mm	Worldclim
24	Bioclim	prec_5	Average precipitation for May	mm	Worldclim
25	Bioclim	prec_6	Average precipitation for June	mm	Worldclim

Appendix 6 Environmental Variables (contd.)

26	Bioclim	prec_7	Average precipitation for July	mm	Worldclim
27	Bioclim	prec_8	Average precipitation for August	mm	Worldclim
28	Bioclim	prec_9	Average precipitation for September	mm	Worldclim
29	Bioclim	prec_10	Average precipitation for October	mm	Worldclim
30	Bioclim	prec_11	Average precipitation for November	mm	Worldclim
31	Bioclim	prec_12	Average precipitation for December	mm	Worldclim
32	Bioclim	tmean_1	Average temperature for January	°C	Worldclim
33	Bioclim	tmean_2	Average temperature for February	°C	Worldclim
34	Bioclim	tmean_3	Average temperature for March	°C	Worldclim
35	Bioclim	tmean_4	Average temperature for April	°C	Worldclim
36	Bioclim	tmean_5	Average temperature for May	°C	Worldclim
37	Bioclim	tmean_6	Average temperature for June	°C	Worldclim
38	Bioclim	tmean_7	Average temperature for July	°C	Worldclim
39	Bioclim	tmean_8	Average temperature for August	°C	Worldclim
40	Bioclim	tmean_9	Average temperature for September	°C	Worldclim
41	Bioclim	tmean_10	Average temperature for October	°C	Worldclim
42	Bioclim	tmean_11	Average temperature for November	°C	Worldclim
43	Bioclim	tmean_12	Average temperature for December	°C	Worldclim
44	Bioclim	tmin_1	Minimum temperature for January	°C	Worldclim
45	Bioclim	tmin_2	Minimum temperature for February	°C	Worldclim
46	Bioclim	tmin_3	Minimum temperature for March	°C	Worldclim
47	Bioclim	tmin_4	Minimum temperature for April	°C	Worldclim
48	Bioclim	tmin_5	Minimum temperature for May	°C	Worldclim
49	Bioclim	tmin_6	Minimum temperature for June	°C	Worldclim
50	Bioclim	tmin_7	Minimum temperature for July	°C	Worldclim
51	Bioclim	tmin_8	Minimum temperature for August	°C	Worldclim
52	Bioclim	tmin_9	Minimum temperature for September	°C	Worldclim
53	Bioclim	tmin_10	Minimum temperature for October	°C	Worldclim
54	Bioclim	tmin_11	Minimum temperature for November	°C	Worldclim
55	Bioclim	tmin_12	Minimum temperature for December	°C	Worldclim

Appendix 6 Environmental Variables (contd.)

56	Bioclim	tmax_1	Maximum temperature for January	°C	Worldclim
57	Bioclim	tmax_2	Maximum temperature for February	°C	Worldclim
58	Bioclim	tmax_3	Maximum temperature for March	°C	Worldclim
59	Bioclim	tmax_4	Maximum temperature for April	°C	Worldclim
60	Bioclim	tmax_5	Maximum temperature for May	°C	Worldclim
61	Bioclim	tmax_6	Maximum temperature for June	°C	Worldclim
62	Bioclim	tmax_7	Maximum temperature for July	°C	Worldclim
63	Bioclim	tmax_8	Maximum temperature for August	°C	Worldclim
64	Bioclim	tmax_9	Maximum temperature for September	°C	Worldclim
65	Bioclim	tmax_10	Maximum temperature for October	°C	Worldclim
66	Bioclim	tmax_11	Maximum temperature for November	°C	Worldclim
67	Bioclim	tmax_12	Maximum temperature for December	°C	Worldclim
68	Edaphic	ref_depth	Depth reference for the soil unit	M	HWS Database
69	Edaphic	t_gravel	Gravel content in top soil	% vol.	HWS Database
70	Edaphic	t_sand	Sand content in top soil	% weight	HWS Database
71	Edaphic	t_silt	Silt content in top soil	% weight	HWS Database
72	Edaphic	t_clay	Clay content in top soil	% weight	HWS Database
73	Edaphic	t_ref_bulk	Apparent bulk density reference in top soil	kg/dm3	HWS Database
74	Edaphic	t_oc	Organic carbon content in top soil	% weight	HWS Database
75	Edaphic	t_ph_h2o	top soil pH in a soil-water solution	-log(H ⁺)	HWS Database
76	Edaphic	t_cec_clay	Clay cation exchange capacity in top soil	cmol/kg	HWS Database
77	Edaphic	t_cec_soil	Cation exchange capacity in top soil (general)	cmol/kg	HWS Database
78	Edaphic	t_bs	Saturation of bases in top soil	%	HWS Database
79	Edaphic	t_teb	Total exchangeable bases in top soil	cmol/kg	HWS Database
80	Edaphic	t_caco3	Calcium carbonate in top soil	% weight	HWS Database
81	Edaphic	t_caso4	Gypsisols in top soil	% weight	HWS Database
82	Edaphic	t_esp	Sodicity of top soil	%	HWS Database
83	Edaphic	t_ece	Salinity of top soil	dS/m	HWS Database
84	Edaphic	s_gravel	Gravel content of subsoil	%vol	HWS Database
85	Edaphic	s_sand	Sand content of subsoil	% weight	HWS Database

Appendix 6 Environmental Variables (*contd.*)

86	Edaphic	s_silt	Silt content of subsoil	% weight	HWS Database
87	Edaphic	s_clay	Clay content of subsoil	% weight	HWS Database
88	Geophysics	alt	Altitude	m	Worldclim
89	Geophysics	slope	the Gradient (indegrees) of the land surface	degree (°)	SRTM DEM
90	Geophysics	aspect	the Orientation (in degrees) of the land surface	degree (°)	SRTM DEM
91	Geophysics	northness	Northness	1 if it faces northwards, -1 if it faces southwards	SRTM DEM
92	Geophysics	Eastness	Eastness	1 if it faces eastwards, -1 if it faces westwards	SRTM DEM
93	Biogeographic Unit	BU	Major Island group in Indonesia: Java (-0.3133), Kalimantan (-1.3525), Lesser Sunda Islands (0.2645), Moluccas (1.0553), Papua (2.483), Sulawesi (0.4054), and Sumatra (-1.0028)	Detrended correspondence Analysis axis 1 (DCA1)	Raes <i>et al.</i> (2013)

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map)

Taxon	No. presence points	Bioclim Variables					Edaphic Variables					Geophysics Variables					Biogeographic Variable
<i>Amaranthus tricolor</i>	47	bio_13	bio_15	bio_7	prec_10	tmin_10	s_gravel	t_bs	t_caco3	t_ece	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Archidendron borneense</i>	21	tmean_2	tmean_7	tmin_9	-	-	s_clay	s_gravel	t_cec_soil	t_ph_h2o	-	aspect	eastness	northness	slope	-	BU
<i>Archidendron bubalinum</i>	41	prec_1	prec_11	prec_7	tmin_5	-	s_silt	t_esp	t_ph_h2o	t_ref_bulk	t_sand	alt	aspect	eastness	northness	slope	BU
<i>Archidendron clypearia</i>	212	bio_19	bio_2	prec_4	prec_7	tmax_8	s_clay	s_gravel	t_ece	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Archidendron cockburnii</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron contortum</i>	12	bio_11	bio_8	bio_9	tmean_4	tmean_8	s_clay	t_gravel	t_ph_h2o	t_sand	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Archidendron crateradenum</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron ellipticum</i>	93	bio_19	bio_4	bio_7	prec_6	tmax_2	ref_dept	t_cec_clay	t_cec_soil	t_ph_h2o	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Archidendron fagifolium</i>	83	bio_19	bio_4	prec_11	prec_3	prec_6	s_gravel	t_cec_clay	t_oc	t_ref_bulk	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Archidendron globosum</i>	14	bio_4	bio_8	prec_3	prec_5	prec_9	s_clay	s_silt	t_caco3	t_cec_clay	t_gravel	alt	aspect	eastness	northness	slope	BU
<i>Archidendron havilandii</i>	22	bio_14	bio_3	prec_2	tmean_4	-	t_gravel	t_ref_bulk	-	-	-	alt	aspect	eastness	northness	slope	BU
<i>Archidendron jiringa</i>	91	bio_19	bio_3	bio_7	prec_7	tmax_8	s_gravel	s_sand	t_ece	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Archidendron kunstleri</i>	17	bio_14	bio_19	bio_3	tmax_2	tmin_7	s_clay	s_gravel	t_bs	t_cec_soil	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Archidendron microcarpum</i>	56	bio_7	prec_6	prec_8	tmax_12	tmax_7	s_gravel	s_sand	t_caco3	t_ph_h2o	t_teb	aspect	eastness	northness	slope	-	BU
<i>Archidendron minahassae</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Archidendron oppositum</i>	12	bio_15	bio_4	bio_7	prec_12	tmax_7	t_esp	t_oc	t_sand	-	-	aspect	eastness	northness	slope	-	BU
<i>Archidendron palauense</i>	15	bio_18	bio_4	bio_9	prec_1	prec_9	ref_depth	s_gravel	t_cac_o3	t_esp	t_oc	aspect	eastness	northness	slope	-	BU
<i>Archidendron pauciflorum</i>	18	bio_12	bio_17	bio_7	prec_5	tmean_4	ref_depth	t_bs	t_gravel	t_ref_bulk	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Archidendron trichophyllum</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron triplinervium</i>	15	bio_17	bio_18	bio_3	prec_1	tmean_6	s_clay	t_cec_soil	t_ph_h2o	t_silt	-	alt	aspect	eastness	northness	-	BU
<i>Arenga pinnata</i>	108	bio_3	bio_7	prec_4	prec_7	tmax_1	s_sand	t_bs	t_cac_o3	t_ece	t_gravel	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus altilis</i>	72	bio_7	prec_2	prec_4	prec_1	tmax_8	t_bs	t_cec_clay	t_ece	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus anisophyllus</i>	84	bio_18	bio_19	bio_3	bio_4	prec_6	t_bs	t_cac_o3	t_cec_soil	t_esp	t_sand	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus brevipedunculatus</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus camansi</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus elasticus</i>	259	bio_18	bio_19	prec_4	prec_7	tmax_11	s_gravel	s_silt	t_cac_o3	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus horridus</i>	14	bio_13	bio_2	bio_4	tmax_9	tmin_7	t_oc	t_sand	-	-	-	aspect	eastness	northness	-	-	BU
<i>Artocarpus integer</i>	125	bio_19	bio_4	bio_7	prec_5	tmax_2	s_silt	t_bs	t_cac_o3	t_esp	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus kemando</i>	83	bio_3	bio_4	prec_2	prec_4	prec_5	s_silt	t_bs	t_cec_clay	t_gravel	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus lanceifolius</i>	62	bio_7	prec_2	prec_4	prec_7	tmax_8	s_gravel	s_sand	t_cac_o3	t_ph_h2o	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus lowii</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus maingayi</i>	13	bio_17	bio_19	bio_3	-	-	s_gravel	s_sand	t_cec_soil	t_esp	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus odoratissimus</i>	45	bio_18	bio_2	prec_3	prec_6	tmin_8	ref_depth	s_silt	t_bs	t_cec_soil	t_sand	aspect	eastness	northness	slope	-	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Artocarpus rigidus</i>	105	bio_19	bio_3	bio_4	prec_12	prec_9	s_clay	s_gravel	t_ph_h2o	t_silt	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus sarawakensis</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus scortechinii</i>	18	bio_2	bio_3	prec_12	prec_2	prec_7	s_silt	t_gravel	t_oc	t_ph_h2o	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus sepicanus</i>	14	bio_9	tmean_4	tmean_8	-	-	s_gravel	t_esp	t_gravel	-	-	aspect	northness	slope	-	-	BU
<i>Artocarpus sericicarpus</i>	32	bio_16	bio_19	prec_4	prec_9	tmean_11	ref_depth	t_esp	t_oc	t_ph_h2o	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus sumatranus</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus tamaran</i>	17	bio_19	bio_7	prec_3	prec_7	-	s_sand	t_caco3	t_cec_clay	t_esp	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Artocarpus teysmannii</i>	68	bio_18	bio_7	prec_2	prec_8	tmean_10	ref_depth	s_gravel	t_gravel	t_ph_h2o	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Averrhoa bilimbi</i>	61	bio_7	prec_3	prec_7	prec_9	tmin_2	s_gravel	s_sand	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Averrhoa carambola</i>	57	bio_7	prec_5	prec_9	tmax_1	-	s_gravel	t_ece	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Cajanus cajan</i>	39	bio_4	bio_7	prec_10	prec_5	tmax_7	s_gravel	t_bs	t_ece	t_gravel	t_sand	alt	aspect	eastness	northness	slope	BU
<i>Cajanus goensis</i>	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cajanus scarabaeoides</i>	41	bio_18	bio_19	bio_7	tmax_9	tmin_11	t_bs	t_gravel	t_ph_h2o	t_silt	-	alt	aspect	eastness	northness	slope	BU
<i>Citrus hystrix</i>	60	bio_1	bio_19	bio_3	prec_1	prec_7	t_ece	t_gravel	t_oc	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Citrus maxima</i>	46	bio_2	prec_8	tmax_1	-	-	t_caco3	t_ece	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Cocos nucifera</i>	57	bio_7	prec_4	prec_6	prec_9	tmax_6	s_gravel	t_ece	t_gravel	t_oc	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Colocasia esculenta</i>	110	bio_19	bio_3	bio_7	prec_11	tmax_1	s_gravel	s_silt	t_caco3	t_ece	t_gravel	alt	aspect	eastness	northness	slope	BU
<i>Colocasia gigantea</i>	44	bio_16	bio_3	prec_10	prec_4	tmean_11	s_gravel	t_caco3	t_cec_clay	t_gravel	t_silt	alt	aspect	eastness	northness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Cucumis melo</i>	36	bio_2	bio_5	prec_10	prec_6	tmin_9	t_bs	t_cac_o3	t_cec_clay	t_ece	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Dimocarpus longan</i>	85	bio_19	bio_3	bio_7	prec_6	tmax_12	s_gravel	t_bs	t_cec_soil	t_esp	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea alata</i>	73	bio_19	bio_7	prec_1	prec_4	tmax_2	s_gravel	t_cac_o3	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea bancana</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea elegans</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea filiformis</i>	30	bio_15	bio_4	prec_2	tmean_9	-	s_gravel	t_bs	t_cac_o3	t_ece	t_gravel	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea grata</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea havilandii</i>	11	bio_18	prec_12	prec_5	prec_8	tmax_12	t_cac_o3	t_clay	t_esp	t_gravel	t_silt	alt	eastness	slope	-	-	BU
<i>Dioscorea lamprocaula</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea madiunensis</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea niewenhuisii</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea nummularia</i>	46	bio_15	bio_16	bio_3	prec_4	tmin_4	ref_d_ept	t_bs	t_oc	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea orbiculata</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea platycarpa</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea polyclados</i>	12	bio_3	bio_4	prec_1	prec_4	prec_7	s_clay	s_gravel	t_bs	t_cac_o3	t_esp	alt	aspect	northness	slope	-	BU
<i>Dioscorea prainiana</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea pubera</i>	16	bio_2	prec_12	prec_8	tmax_2	-	s_gravel	s_sand	t_cec_soil	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea pyrifolia</i>	73	bio_13	bio_19	bio_7	prec_6	tmax_1	t_bs	t_cac_o3	t_cec_clay	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Dioscorea salicifolia</i>	13	bio_12	bio_19	prec_1	tmean_3	-	ref_d_ept	s_silt	t_cac_o3	t_sand	t_teb	alt	aspect	eastness	northness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Dioscorea sarasinii</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea sexrimata</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea tenuifolia</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea vanvuurenii</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea vilis</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea warburgiana</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Diospyros discolor</i>	11	bio_14	bio_6	prec_5	tmax_12	tmax_8	s_gravel	t_caco3	t_clay	t_oc	t_silt	aspect	eastness	northness	slope	-	BU
<i>Durio affinis</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio beccarianus</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio bukitrayaensis</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio carinatus</i>	35	bio_15	bio_3	bio_6	prec_10	prec_5	s_sand	t_cec_clay	t_cec_soil	t_esp	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Durio dulcis</i>	31	prec_9	tmean_8	tmin_9	-	-	t_caco3	t_cec_clay	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	-	BU
<i>Durio graveolens</i>	33	tmean_2	tmean_7	tmin_9	-	-	s_clay	t_caco3	t_gravel	t_ph_h2o	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Durio kutejensis</i>	34	bio_18	bio_19	prec_11	prec_6	tmin_2	s_gravel	s_silt	t_cec_soil	-	-	alt	aspect	eastness	northness	slope	BU
<i>Durio lanceolatus</i>	34	tmean_10	tmean_6	tmin_9	-	-	s_gravel	s_silt	t_cec_soil	-	-	alt	aspect	eastness	northness	slope	BU
<i>Durio lissocarpus</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio lowianus</i>	13	bio_16	bio_17	-	-	-	t_bs	t_cec_soil	t_esp	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Durio macrantha</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio malaccensis</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oblongus</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oxleyanus</i>	35	bio_13	bio_15	prec_10	prec_4	tmax_7	t_bs	t_esp	t_oc	t_teb	-	alt	aspect	eastness	northness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Durio testudinarius</i>	13	bio_13	bio_2	prec_9	tmin_3	-	s_clay	s_gravel	t_esp	t_oc	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Durio zibethinus</i>	132	bio_13	bio_19	bio_7	prec_4	tmax_1	s_gravel	s_sand	t_ece	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Ficus androchaete</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus aurata</i>	42	bio_13	bio_2	bio_3	tmax_9	tmin_9	s_gravel	s_silt	t_cac_o3	t_cec_soil	-	alt	aspect	eastness	northness	slope	BU
<i>Ficus aureocordata</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus auricoma</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus brunneoaurata</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus chartacea</i>	14	bio_7	prec_12	-	-	-	s_gravel	t_esp	t_oc	-	-	alt	aspect	eastness	northness	slope	BU
<i>Ficus deltoidea</i>	31	bio_12	bio_7	prec_3	prec_9	tmin_8	ref_dept	s_sand	t_cac_o3	t_cec_soil	t_gravel	aspect	eastness	northness	slope	-	BU
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	41	bio_18	prec_4	prec_5	prec_9	tmax_8	s_clay	s_gravel	s_silt	t_esp	-	aspect	eastness	northness	slope	-	BU
<i>Ficus fulva</i>	52	bio_7	prec_6	prec_9	tmax_9	-	t_bs	t_cec_clay	t_ece	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ficus glabristipulata</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus glandulifera</i>	62	bio_19	bio_7	prec_2	prec_4	tmax_10	ref_dept	t_bs	t_cac_o3	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ficus grossularioides</i>	138	bio_19	bio_3	bio_4	bio_7	tmax_9	s_clay	s_silt	t_bs	t_cec_clay	t_cec_soil	alt	aspect	eastness	northness	slope	BU
<i>Ficus halmaherae</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i>	60	bio_2	prec_12	prec_2	prec_6	tmax_9	s_clay	s_gravel	t_cec_clay	t_esp	-	alt	aspect	eastness	northness	slope	BU
<i>Ficus hirta</i> subsp. <i>dumosa</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus inaequipetiolata</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (contd.)

<i>Ficus kofmaniae</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus lamponga</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus litseifolia</i>	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus oleifolia</i>	71	bio_7	prec_1	prec_11	prec_4	tmax_12	t_bs	t_ph_h2o	t_san_d	t_silt	t_teb	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	10	bio_14	prec_3	tmean_12	-	-	t_esp	t_ph_h2o	t_ref_bulk	-	-	asp ect	eastn ess	north ness	slope	-	BU
<i>Ficus padana</i>	112	bio_13	bio_19	bio_2	prec_7	tmax_7	s_gra vel	t_bs	t_cec_clay	t_ece	t_gra vel	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Ficus pedunculosa</i>	27	bio_15	bio_4	bio_7	prec_5	prec_7	ref_d epth	s_silt	t_bs	t_cla y	t_gra vel	asp ect	eastn ess	north ness	slope	-	BU
<i>Ficus ruficaulis</i>	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus schefferiana</i>	15	bio_15	bio_5	bio_7	prec_2	-	s_silt	t_cec_clay	t_gra vel	t_oc	-	asp ect	eastn ess	north ness	slope	-	BU
<i>Ficus setiflora</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subfulva</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subglabripetala</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus tricolor</i>	42	bio_17	bio_6	prec_11	prec_12	-	s_silt	t_cec_clay	t_esp	t_gra vel	t_teb	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Ficus tricolor</i> var. <i>serroh</i>	12	bio_12	bio_15	bio_6	prec_10	prec_2	ref_d epth	t_bs	t_cac o3	t_ref_bulk	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Garcinia celebica</i>	116	bio_19	bio_4	bio_7	prec_2	tmax_1	s_silt	t_bs	t_cac o3	t_ece	t_gra vel	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Garcinia diospyrifolia</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia mangostana</i>	36	tmax_5	tmax_9	tmin_10	-	-	s_cla y	t_cec_clay	t_cec_soil	t_ph_h2o	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Garcinia nitida</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia opaca</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia penangiana</i>	11	bio_12	bio_4	bio_6	prec_3	-	s_cla y	t_esp	t_gra vel	t_teb	-	alt	aspe ct	eastn ess	north ness	-	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Garcinia rigida</i>	36	bio_16	bio_6	bio_7	prec_8	tmin_7	t_cac_o3	t_cec_clay	t_oc	t_ph_h2o	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Gnetum costatum</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i>	205	bio_15	bio_19	prec_11	tmax_10	tmin_7	s_clay	s_gravel	t_bs	t_cec_clay	t_ece	alt	aspect	eastness	northness	slope	BU
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>gracile</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	10	bio_12	bio_2	bio_3	bio_5	prec_3	t_esp	t_oc	t_teb	-	-	aspect	eastness	northness	slope	-	BU
<i>Gnetum gnemon</i> var. <i>tenerum</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea aquatica</i>	77	bio_13	bio_19	bio_3	prec_11	tmax_8	s_gravel	t_bs	t_cac_o3	t_cec_clay	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ipomoea asarifolia</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea coptica</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea graminea</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea imperati</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea littoralis</i>	91	bio_7	prec_12	prec_2	prec_4	prec_5	s_gravel	s_silt	t_cec_clay	t_ece	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Ipomoea obscura</i>	84	bio_19	bio_4	bio_7	prec_7	tmax_2	s_gravel	t_cac_o3	t_ece	t_gravel	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ipomoea pes-caprae</i>	136	bio_18	bio_19	bio_3	prec_10	tmin_10	s_gravel	t_cec_clay	t_oc	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ipomoea sagittifolia</i>	45	tmax_2	tmax_9	tmin_8	-	-	s_gravel	t_cec_clay	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Ipomoea stibaropoda</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lablab purpureus</i>	47	bio_2	prec_9	tmax_10	-	-	t_cac_o3	t_ece	t_gravel	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Lansium domesticum</i>	89	bio_13	bio_18	bio_7	prec_7	tmean_1	ref_d_ept	t_clay	t_ph_h2o	t_silt	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Mangifera altissima</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Mangifera applanata</i>	24	bio_17	bio_19	prec_2	prec_4	-	s_clay	t_cac_o3	t_cec_clay	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Mangifera casturi</i>	14	bio_6	bio_7	bio_8	bio_9	prec_7	s_gravel	t_bs	t_clay	t_silt	-	aspect	eastness	northness	slope	-	BU
<i>Mangifera dewildei</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera gedebe</i>	24	bio_8	tmean_10	tmean_4	tmin_5	-	s_silt	t_cac_o3	t_esp	t_gravel	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Mangifera gracilipes</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera griffithii</i>	53	bio_7	prec_12	prec_2	prec_4	prec_8	t_cac_o3	t_clay	t_esp	t_gravel	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Mangifera lalijiwa</i>	19	bio_18	bio_3	bio_7	prec_1	-	s_gravel	s_silt	t_cac_o3	t_clay	t_teb	alt	aspect	eastness	northness	-	BU
<i>Mangifera laurina</i>	92	bio_18	bio_19	bio_7	prec_11	tmax_1	s_gravel	t_bs	t_cec_clay	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Mangifera longipetiolata</i>	15	bio_19	bio_4	prec_1	prec_10	prec_5	s_clay	s_silt	t_esp	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Mangifera magnifica</i>	22	tmean_1	tmean_7	tmin_7	-	-	s_silt	t_bs	t_esp	t_ph_h2o	t_teb	alt	aspect	eastness	northness	-	BU
<i>Mangifera microphylla</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera minor</i>	73	bio_15	bio_2	bio_4	prec_4	tmax_10	t_bs	t_cec_clay	t_ece	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Mangifera mucronulata</i>	20	bio_16	bio_17	bio_4	prec_7	tmax_8	s_silt	t_cec_clay	t_oc	t_sand	-	alt	aspect	eastness	northness	slope	BU
<i>Mangifera oblongifolia</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera orophila</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera paludosa</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera parvifolia</i>	36	bio_9	tmean_1	tmean_11	tmin_2	tmin_6	s_clay	t_bs	t_esp	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Mangifera pedicellata</i>	14	bio_12	bio_4	prec_1	prec_8	tmax_10	t_cac_o3	t_cec_soil	t_esp	t_sand	-	alt	aspect	eastness	northness	slope	BU
<i>Mangifera quadrifida</i>	81	bio_18	bio_19	bio_4	tmax_1	tmin_10	t_cac_o3	t_cec_clay	t_clay	t_esp	t_ph_h2o	alt	aspect	eastness	northness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Mangifera rigida</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rubropetala</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rufocostata</i>	19	bio_2	prec_7	tmax_1	tmax_9	tmin_12	s_gravel	t_esp	t_ref_bulk	t_silt	-	alt	aspect	eastness	northness	slope	BU
<i>Mangifera similis</i>	14	bio_15	bio_16	prec_11	tmax_2	-	s_silt	t_oc	t_ph_h2o	t_teb	-	aspect	eastness	northness	slope	-	BU
<i>Mangifera sulavesiana</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera sumbawaensis</i>	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera swintonioides</i>	20	tmean_10	tmean_7	tmin_8	-	-	t_cec_clay	t_cec_soil	t_esp	-	-	alt	aspect	eastness	northness	-	BU
<i>Mangifera timorensis</i>	24	bio_15	bio_2	bio_5	prec_10	prec_12	s_silt	t_bs	t_ece	t_silt	-	alt	aspect	eastness	northness	slope	BU
<i>Mangifera torquenda</i>	29	tmean_2	tmean_7	tmin_2	-	-	s_clay	t_bs	t_esp	t_gravel	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Metroxylon sagu</i>	45	tmax_3	tmax_9	tmin_8	-	-	ref_depth	t_caco3	t_cec_clay	t_esp	t_sand	alt	aspect	eastness	northness	slope	BU
<i>Momordica charantia</i>	98	bio_19	bio_3	bio_4	prec_6	tmax_8	s_gravel	t_ece	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Musa acuminata</i>	84	bio_15	bio_19	bio_7	prec_11	tmax_7	s_gravel	s_sand	t_ece	t_ph_h2o	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	13	bio_19	prec_2	-	-	-	s_clay	t_gravel	-	-	-	alt	aspect	eastness	northness	-	BU
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	21	bio_19	bio_5	bio_6	prec_12	prec_8	t_bs	t_cec_clay	t_teb	-	-	alt	aspect	eastness	northness	slope	BU
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa acuminata</i> var. <i>sumatrana</i>	13	bio_14	bio_3	prec_3	-	-	t_gravel	t_teb	-	-	-	aspect	eastness	northness	slope	-	BU
<i>Musa acuminata</i> var. <i>tomentosa</i>	15	bio_17	bio_5	tmax_10	-	-	t_bs	t_caco3	t_clay	t_gravel	t_oc	alt	aspect	eastness	northness	slope	BU
<i>Musa balbisiana</i>	11	bio_17	bio_7	prec_11	prec_5	-	ref_depth	t_bs	t_clay	t_esp	t_silt	alt	aspect	eastness	northness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (contd.)

<i>Musa balbisiana</i> var. <i>brachycarpa</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa celebica</i>	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa lanceolata</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa schizocarpa</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Nephelium lappaceum</i>	85	bio_19	bio_3	bio_4	bio_7	tmax_12	ref_dept	s_silt	t_clay	t_esp	t_ph_h2o	alt	aspect	eastness	northness	slope	BU
<i>Ocimum americanum</i>	26	bio_2	bio_3	prec_12	prec_5	tmax_4	s_sand	s_silt	t_bs	t_cec_clay	t_gravel	alt	aspect	eastness	northness	slope	BU
<i>Oryza longiglumis</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oryza meyeriana</i>	73	bio_13	bio_18	bio_19	bio_4	prec_9	s_gravel	t_gravel	t_oc	t_sand	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Oryza minuta</i>	54	prec_4	prec_7	tmax_11	tmax_3	tmin_1	t_cac_o3	t_ece	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Oryza officinalis</i>	146	bio_19	bio_3	bio_7	prec_6	tmax_4	ref_dept	s_sand	s_silt	t_cec_clay	t_esp	alt	aspect	eastness	northness	slope	BU
<i>Oryza ridleyi</i>	22	tmean_1	tmean_6	tmin_8	-	-	s_clay	s_silt	t_esp	t_silt	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Oryza rufipogon</i>	90	bio_13	bio_19	bio_4	bio_7	tmax_12	s_gravel	t_bs	t_cac_o3	t_cec_clay	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Oryza schlechteri</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Parkia singularis</i>	21	bio_7	prec_3	prec_9	tmax_1	tmin_6	s_clay	t_gravel	t_silt	t_teb	-	alt	aspect	eastness	northness	slope	BU
<i>Parkia speciosa</i>	84	bio_19	bio_4	prec_4	prec_6	tmax_2	t_bs	t_cec_clay	t_oc	t_silt	t_teb	alt	aspect	eastness	northness	slope	BU
<i>Parkia sumatrana</i>	10	bio_2	prec_1	prec_3	prec_5	tmean_1	s_gravel	t_cac_o3	t_gravel	t_ref_bulk	-	alt	aspect	eastness	northness	slope	BU
<i>Parkia timoriana</i>	49	bio_7	tmax_1	tmax_11	tmax_8	-	s_gravel	t_cac_o3	t_gravel	t_oc	t_silt	alt	aspect	eastness	northness	slope	BU
<i>Parkia versteeghii</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pometia pinnata</i>	232	bio_15	bio_19	prec_2	prec_7	tmax_10	s_gravel	t_ece	t_gravel	t_oc	t_ref_bulk	alt	aspect	eastness	northness	slope	BU
<i>Rubus acuminatissimus</i>	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Rubus alpestris</i>	25	bio_17	bio_2	prec_1	tmax_4	-	t_esp	t_oc	t_ph_h2o	-	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus banghamii</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus ferdinandimuelleri</i>	10	bio_16	tmin_7	-	-	-	s_clay	t_cec_soil	t_san d	t_teb	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus fraxinifolius</i>	95	bio_15	bio_19	bio_7	prec_4	tmax_10	t_bs	t_cec_clay	t_ece	t_gra vel	t_ref_bulk	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus lineatus</i>	98	bio_18	bio_19	bio_7	prec_7	tmin_6	t_cec_clay	t_cec_soil	t_ece	t_gra vel	t_ph_h2o	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus lorentzianus</i>	10	bio_2	bio_7	-	-	-	s_san d	t_gra vel	-	-	-	alt	aspe ct	eastn ess	north ness	-	BU
<i>Rubus macgregorii</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus niveus</i>	53	bio_2	prec_5	prec_7	prec_9	tmax_6	t_cec_clay	t_ece	t_gra vel	t_ph_h2o	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus papuanus</i>	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus rosifolius</i>	123	bio_18	bio_2	bio_4	bio_8	prec_7	s_clay	t_cac o3	t_ece	t_gra vel	t_oc	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Rubus sumatranus</i>	15	bio_13	bio_15	prec_6	tmean_12	-	t_cec_soil	t_gra vel	t_ref_bulk	-	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Saccharum officinarum</i>	66	bio_13	bio_4	bio_7	prec_4	tmax_10	ref_d eph	s_silt	t_clay	t_esp	t_ph_h2o	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Saccharum robustum</i>	25	bio_9	tmean_11	tmean_8	tmin_9	-	s_san d	t_cac o3	t_gra vel	t_san d	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Saccharum spontaneum</i>	150	bio_19	bio_4	bio_7	prec_11	tmax_3	t_bs	t_cec_clay	t_ece	t_oc	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Salacca zalacca</i>	17	bio_16	bio_18	bio_2	prec_1	tmean_8	t_bs	t_ece	t_gra vel	t_ref_bulk	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Solanum melongena</i>	75	bio_13	bio_19	bio_3	bio_4	tmax_8	s_gra vel	t_cac o3	t_gra vel	t_oc	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Sorghum nitidum</i>	97	bio_13	bio_4	bio_7	prec_1	tmax_2	s_gra vel	t_ece	t_gra vel	t_oc	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Sorghum plumosum</i>	13	bio_15	bio_2	bio_4	prec_1	tmin_5	ref_d eph	t_bs	t_silt	-	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Sorghum propinquum</i>	83	bio_15	bio_4	prec_5	tmax_10	tmin_10	s_gra vel	t_bs	t_ece	t_gra vel	t_san d	alt	aspe ct	eastn ess	north ness	slope	BU

Appendix 7 Selected environmental variables for species distribution modelling and species-specific ecogeographic land characterization maps (ELC map) (*contd.*)

<i>Sorghum timorense</i>	13	bio_14	prec_11	prec_2	tmax_8	-	t_bs	t_ph_h2o	t_silt	-	-	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Syzygium aqueum</i>	40	bio_13	bio_2	prec_1	prec_4	tmean_9	s_gra vel	t_ece	t_gra vel	t_oc	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Syzygium cumini</i>	49	bio_7	prec_6	prec_9	tmax_1	tmax_9	s_gra vel	t_ece	t_oc	t_san d	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Syzygium malaccense</i>	35	bio_13	bio_2	prec_12	prec_5	tmean_10	ref_d epth	s_san d	t_gra vel	t_oc	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Vigna minima</i>	33	bio_13	bio_18	bio_3	bio_7	tmin_3	t_cac o3	t_cec _clay	t_ece	t_gra vel	t_teb	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Vigna radiata</i>	99	bio_13	bio_18	bio_19	bio_7	tmax_2	s_gra vel	t_ece	t_gra vel	t_san d	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Vigna trilobata</i>	40	bio_18	bio_19	bio_4	bio_9	prec_10	s_gra vel	t_bs	t_cac o3	t_ph_h2o	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU
<i>Vigna umbellata</i>	20	bio_12	bio_4	tmax_1	-	-	ref_d epth	t_bs	t_gra vel	t_ref _bulk	t_silt	alt	aspe ct	eastn ess	north ness	slope	BU

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Amaranthus tricolor</i>	47	0.7224	0.0929	0.5615	64688	87622	73.8262	No	CA50
<i>Archidendron borneense</i>	21	0.8016	0.0679	0.288	187429	170046	110.2225	No	CA50
<i>Archidendron bubalinum</i>	41	0.9475	0.0149	0.2568	49956	160994	31.0297	No	CA50
<i>Archidendron clypearia</i>	212	0.7726	0.0554	0.4799	5630	301917	1.8648	Yes	SDM
<i>Archidendron cockburnii</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Archidendron contortum</i>	12	0.6909	0.1011	0.5441	99779	358937	27.7985	No	CA50
<i>Archidendron crateradenum</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Archidendron ellipticum</i>	93	0.7962	0.0758	0.4025	10664	366168	2.9123	Yes	SDM
<i>Archidendron fagifolium</i>	83	0.8719	0.0439	0.2581	5371	299994	1.7904	Yes	SDM
<i>Archidendron globosum</i>	14	0.7203	0.092	0.6572	24746	332238	7.4483	Yes	SDM
<i>Archidendron havilandii</i>	22	0.8675	0.0329	0.5022	125363	109599	114.3833	No	CA50
<i>Archidendron jiringa</i>	91	0.7634	0.0776	0.4276	8700	434781	2.0010	Yes	SDM
<i>Archidendron kunstleri</i>	17	0.7679	0.0752	0.5278	100558	301482	33.3546	No	CA50
<i>Archidendron microcarpum</i>	56	0.8688	0.049	0.2914	2324	410817	0.5657	Yes	SDM
<i>Archidendron minahassae</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Archidendron oppositum</i>	12	0.8146	0.1228	0.593	17892	52315	34.2005	No	CA50
<i>Archidendron palauense</i>	15	0.8658	0.0838	0.5479	74957	72128	103.9222	No	CA50
<i>Archidendron pauciflorum</i>	18	0.9278	0.0265	0.441	78544	117068	67.0926	No	CA50
<i>Archidendron trichophyllum</i>	6	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Archidendron triplinervium</i>	15	0.8822	0.0214	0.5345	26172	282193	9.2745	Yes	SDM
<i>Arenga pinnata</i>	108	0.8337	0.0572	0.3394	9221	393715	2.3420	Yes	SDM
<i>Artocarpus altilis</i>	72	0.7466	0.0912	0.4834	7621	411006	1.8542	Yes	SDM
<i>Artocarpus anisophyllum</i>	84	0.8155	0.0524	0.3524	439	609384	0.0720	Yes	SDM
<i>Artocarpus brevipedunculatus</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Artocarpus camansi</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Artocarpus elasticus</i>	259	0.7514	0.0477	0.462	6042	551987	1.0946	Yes	SDM

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Artocarpus horridus</i>	14	0.9228	0.0399	0.4266	82734	131585	62.8749	No	CA50
<i>Artocarpus integer</i>	125	0.6732	0.0791	0.5029	27635	501913	5.5059	No	CA50
<i>Artocarpus kemando</i>	83	0.7681	0.0556	0.432	6680	591290	1.1297	Yes	SDM
<i>Artocarpus lanceifolius</i>	62	0.8766	0.0593	0.2436	1963	283749	0.6918	Yes	SDM
<i>Artocarpus lowii</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Artocarpus maingayi</i>	13	0.7384	0.1206	0.4821	131914	534280	24.6901	No	CA50
<i>Artocarpus odoratissimus</i>	45	0.8772	0.034	0.386	76003	210328	36.1355	No	CA50
<i>Artocarpus rigidus</i>	105	0.7854	0.0508	0.4592	20119	427167	4.7099	Yes	SDM
<i>Artocarpus sarawakensis</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Artocarpus scortechinii</i>	18	0.9167	0.0371	0.4291	60737	172509	35.2080	No	CA50
<i>Artocarpus sepicanus</i>	14	0.9869	-0.4993	0.6731	116	30821	0.3764	Yes	SDM
<i>Artocarpus sericarpus</i>	32	0.8099	0.0633	0.3676	107676	204574	52.6343	No	CA50
<i>Artocarpus sumatranus</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Artocarpus tamaran</i>	17	0.7953	0.0948	0.4014	60893	393106	15.4902	No	CA50
<i>Artocarpus teysmannii</i>	68	0.7626	0.0815	0.3297	6550	570958	1.1472	Yes	SDM
<i>Averrhoa bilimbi</i>	61	0.7156	0.0874	0.5094	33024	350381	9.4252	Yes	SDM
<i>Averrhoa carambola</i>	57	0.8159	0.0867	0.3094	16237	366620	4.4288	Yes	SDM
<i>Cajanus cajan</i>	39	0.8549	0.0589	0.3354	78058	130604	59.7669	No	CA50
<i>Cajanus goensis</i>	9	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Cajanus scarabaeoides</i>	41	0.9718	0.0141	0.1107	9513	108469	8.7702	Yes	SDM
<i>Citrus hystrix</i>	60	0.6984	0.0971	0.4595	44602	313950	14.2067	No	CA50
<i>Citrus maxima</i>	46	0.7355	0.0908	0.5598	64558	170962	37.7616	No	CA50
<i>Cocos nucifera</i>	57	0.805	0.0936	0.3831	20266	292275	6.9339	Yes	SDM
<i>Colocasia esculenta</i>	110	0.7781	0.0693	0.3355	29068	362085	8.0279	Yes	SDM
<i>Colocasia gigantea</i>	44	0.8931	0.0383	0.2584	77960	200694	38.8452	No	CA50
<i>Cucumis melo</i>	36	0.8161	0.0726	0.3325	106884	111543	95.8231	No	CA50
<i>Dimocarpus longan</i>	85	0.7566	0.0743	0.4279	4220	561219	0.7519	Yes	SDM

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Dioscorea alata</i>	73	0.8855	0.0517	0.184	1642	288085	0.5700	Yes	SDM
<i>Dioscorea bancana</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea elegans</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea filiformis</i>	30	0.8432	0.0785	0.4071	68329	91446	74.7206	No	CA50
<i>Dioscorea grata</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea havilandii</i>	11	0.8286	0.0724	0.554	84239	220453	38.2118	No	CA50
<i>Dioscorea lamprocaula</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea madiunensis</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea nienwenhuisii</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea nummularia</i>	46	0.7739	0.0984	0.509	53879	168607	31.9554	No	CA50
<i>Dioscorea orbiculata</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea platycarpa</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea polyclados</i>	12	0.5072	0.1317	0.5967	100925	446424	22.6074	No	CA50
<i>Dioscorea prainiana</i>	6	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea pubera</i>	16	0.9219	0.0382	0.3127	72846	48097	151.4564	No	CA50
<i>Dioscorea pyriformis</i>	73	0.7765	0.1014	0.3792	15570	204412	7.6170	Yes	SDM
<i>Dioscorea salicifolia</i>	13	0.6293	0.1507	0.6191	86802	248522	34.9273	No	CA50
<i>Dioscorea sarasinii</i>	6	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea sexrimata</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea tenuifolia</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea vanvuurenii</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea vilis</i>	5	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Dioscorea warburgiana</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Diospyros discolor</i>	11	0.7529	0.0945	0.5858	66298	273227	24.2648	No	CA50
<i>Durio affinis</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio beccarianus</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio bukitrayaensis</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Durio carinatus</i>	35	0.8704	0.05	0.258	62616	179684	34.8478	No	CA50
<i>Durio dulcis</i>	31	0.9512	0.0204	0.1728	25233	160151	15.7558	No	CA50
<i>Durio graveolens</i>	33	0.8012	0.0734	0.2591	148568	369376	40.2213	No	CA50
<i>Durio kutejensis</i>	34	0.8418	0.0352	0.4294	72851	292291	24.9241	No	CA50
<i>Durio lanceolatus</i>	34	0.9224	0.0344	0.2378	25571	199982	12.7867	No	CA50
<i>Durio lissocarpus</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio lowianus</i>	13	0.8546	0.0644	0.6206	61024	107587	56.7206	No	CA50
<i>Durio macrantha</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio malaccensis</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio oblongus</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Durio oxleyanus</i>	35	0.8053	0.0595	0.3969	111508	327744	34.0229	No	CA50
<i>Durio testudinarius</i>	13	0.9119	0.031	0.569	37017	130579	28.3484	No	CA50
<i>Durio zibethinus</i>	132	0.7959	0.0586	0.4347	13695	359965	3.8045	Yes	SDM
<i>Ficus androchaete</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus aurata</i>	42	0.8125	0.0646	0.286	100833	403561	24.9858	No	CA50
<i>Ficus aureocordata</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus auricoma</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus brunneoaurata</i>	5	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus chartacea</i>	14	0.7895	0.0604	0.6096	32109	493895	6.5012	Yes	SDM
<i>Ficus deltoidea</i>	31	0.7588	0.0817	0.3411	181253	290155	62.4676	No	CA50
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	41	0.8215	0.0405	0.4243	50511	416095	12.1393	No	CA50
<i>Ficus fulva</i>	52	0.7733	0.0945	0.3828	22748	462675	4.9166	Yes	SDM
<i>Ficus glabristipulata</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus glandulifera</i>	62	0.5719	0.1067	0.5406	26683	529353	5.0407	No	CA50
<i>Ficus grossularioides</i>	138	0.857	0.0415	0.3408	4928	409963	1.2021	Yes	SDM
<i>Ficus halmaherae</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus hirta</i>	60	0.854	0.0777	0.2176	5300	275185	1.9260	Yes	SDM

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Ficus hirta</i> subsp. <i>dumosa</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus inaequipetiolata</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus kofmaniae</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus lamponga</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus litseifolia</i>	8	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus oleifolia</i>	71	0.9221	0.0378	0.1347	1174	262185	0.4478	Yes	SDM
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	10	0.9197	0.0464	0.4173	94795	37232	254.6063	No	CA50
<i>Ficus padana</i>	112	0.9159	0.0319	0.2913	5847	214997	2.7196	Yes	SDM
<i>Ficus pedunculosa</i>	27	0.8251	0.0588	0.492	83149	64590	128.7336	No	CA50
<i>Ficus ruficaulis</i>	9	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus schefferiana</i>	15	0.9417	0.0449	0.1427	16329	56999	28.6479	No	CA50
<i>Ficus setiflora</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus subfulva</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus subglabripetala</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ficus tricolor</i>	42	0.9877	0.0059	0.0695	4035	62707	6.4347	Yes	SDM
<i>Ficus tricolor</i> var. <i>serroh</i>	12	0.8818	0.0848	0.4685	59141	56498	104.6780	No	CA50
<i>Garcinia celebica</i>	116	0.7101	0.0827	0.4244	26819	410181	6.5383	Yes	SDM
<i>Garcinia diospyrifolia</i>	6	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Garcinia mangostana</i>	36	0.6105	0.0584	0.532	93630	478833	19.5538	No	CA50
<i>Garcinia nitida</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Garcinia opaca</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Garcinia penangiana</i>	11	0.6119	0.1482	0.6399	81617	134710	60.5872	No	CA50
<i>Garcinia rigida</i>	36	0.7534	0.0724	0.3103	148745	449700	33.0765	No	CA50
<i>Gnetum costatum</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Gnetum gnemon</i>	205	0.8126	0.0514	0.3058	1854	479690	0.3865	Yes	SDM
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Gnetum gnemon</i> var. <i>gracile</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	10	0.7942	0.0533	0.5861	87548	323408	27.0704	No	CA50
<i>Gnetum gnemon</i> var. <i>tenerum</i>	5	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ipomoea aquatica</i>	77	0.7204	0.0982	0.3926	18349	489138	3.7513	Yes	SDM
<i>Ipomoea asarifolia</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ipomoea coptica</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ipomoea graminea</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ipomoea imperati</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Ipomoea littoralis</i>	91	0.7771	0.0921	0.3838	20787	288955	7.1939	Yes	SDM
<i>Ipomoea obscura</i>	84	0.9095	0.0362	0.2026	6176	235651	2.6208	Yes	SDM
<i>Ipomoea pes-caprae</i>	136	0.8344	0.0564	0.2712	17379	338374	5.1360	Yes	SDM
<i>Ipomoea sagittifolia</i>	45	0.922	0.048	0.1934	21927	78738	27.8481	No	CA50
<i>Ipomoea stibaropoda</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Lablab purpureus</i>	47	0.8347	0.0472	0.34	106881	277580	38.5046	No	CA50
<i>Lansium domesticum</i>	89	0.6204	0.0968	0.6202	4244	510221	0.8318	No	CA50
<i>Mangifera altissima</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera applanata</i>	24	0.838	0.0649	0.3557	120778	135940	88.8465	No	CA50
<i>Mangifera casturi</i>	14	0.949	0.0366	0.106	30358	240910	12.6014	No	CA50
<i>Mangifera dewildei</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera gedebe</i>	24	0.7228	0.0796	0.2522	395101	319361	123.7161	No	CA50
<i>Mangifera gracilipes</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera griffithii</i>	53	0.8482	0.0553	0.2804	8637	440941	1.9588	Yes	SDM
<i>Mangifera lalijiwa</i>	19	0.9476	0.0151	0.3765	48453	106003	45.7091	No	CA50
<i>Mangifera laurina</i>	92	0.7394	0.0635	0.4499	12705	518665	2.4496	Yes	SDM
<i>Mangifera longipetiolata</i>	15	0.8321	0.0814	0.5434	44070	215378	20.4617	No	CA50
<i>Mangifera magnifica</i>	22	0.8142	0.066	0.562	73970	142483	51.9150	No	CA50
<i>Mangifera microphylla</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Mangifera minor</i>	73	0.9032	0.0339	0.3499	9199	258986	3.5519	Yes	SDM
<i>Mangifera mucronulata</i>	20	0.8731	0.0646	0.1157	196290	127882	153.4931	No	CA50
<i>Mangifera oblongifolia</i>	5	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera orophila</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera paludosa</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera parvifolia</i>	36	0.8549	0.0556	0.414	60993	148945	40.9500	No	CA50
<i>Mangifera pedicellata</i>	14	0.9013	0.0453	0.4526	45608	52749	86.4623	No	CA50
<i>Mangifera quadrifida</i>	81	0.6938	0.0749	0.543	21917	422429	5.1883	No	CA50
<i>Mangifera rigida</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera rubropetala</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera rufocostata</i>	19	0.8203	0.0659	0.5341	70713	263491	26.8370	No	CA50
<i>Mangifera similis</i>	14	0.8217	0.0576	0.512	68122	326353	20.8737	No	CA50
<i>Mangifera sulavesiana</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera sumbawaensis</i>	7	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Mangifera swintonioides</i>	20	0.8182	0.0661	0.3677	137717	233321	59.0247	No	CA50
<i>Mangifera timorensis</i>	24	0.9738	0.0095	0.45	27416	26235	104.5016	No	CA50
<i>Mangifera torquenda</i>	29	0.7267	0.0556	0.4583	182638	262520	69.5711	No	CA50
<i>Metroxylon sagu</i>	45	0.6824	0.0999	0.4905	120366	382851	31.4394	No	CA50
<i>Momordica charantia</i>	98	0.8331	0.0607	0.3287	46748	321940	14.5207	No	CA50
<i>Musa acuminata</i>	84	0.8349	0.0685	0.3772	6709	298283	2.2492	Yes	SDM
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	13	0.9661	0.0176	0.4893	31496	49555	63.5577	No	CA50
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	21	0.9667	0.0254	0.3181	24172	31508	76.7170	No	CA50
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Musa acuminata</i> var. <i>sumatrana</i>	13	0.9063	0.0433	0.4582	76639	142047	53.9533	No	CA50
<i>Musa acuminata</i> var. <i>tomentosa</i>	15	0.9327	0.0229	0.4837	116735	74114	157.5074	No	CA50
<i>Musa balbisiana</i>	11	0.5734	0.09	0.6684	11614	245808	4.7248	No	CA50
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Musa celebica</i>	4	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Musa lanceolata</i>	1	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Musa schizocarpa</i>	6	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Nephelium lappaceum</i>	85	0.7433	0.061	0.384	8945	732727	1.2208	Yes	SDM
<i>Ocimum americanum</i>	26	0.9029	0.0373	0.2492	104193	182719	57.0236	No	CA50
<i>Oryza longiglumis</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Oryza meyeriana</i>	73	0.8625	0.0646	0.42	8964	159525	5.6192	Yes	SDM
<i>Oryza minuta</i>	54	0.8375	0.0634	0.3627	16073	287166	5.5971	Yes	SDM
<i>Oryza officinalis</i>	146	0.8825	0.0417	0.358	2959	241739	1.2240	Yes	SDM
<i>Oryza ridleyi</i>	22	0.7349	0.1058	0.6677	73680	151226	48.7218	No	CA50
<i>Oryza rufipogon</i>	90	0.8601	0.0614	0.1729	2002	304794	0.6568	Yes	SDM
<i>Oryza schlechteri</i>	2	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Parkia singularis</i>	21	0.7993	0.0553	0.4056	226259	362150	62.4766	No	CA50
<i>Parkia speciosa</i>	84	0.7994	0.0578	0.3862	2227	537720	0.4142	Yes	SDM
<i>Parkia sumatrana</i>	10	0.6477	0.1079	0.6709	316	543173	0.0582	No	CA50
<i>Parkia timoriana</i>	49	0.7997	0.0532	0.4542	68262	189485	36.0250	No	CA50
<i>Parkia versteeghii</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Pometia pinnata</i>	232	0.6904	0.0555	0.5574	8178	456609	1.7910	No	CA50
<i>Rubus acuminatissimus</i>	9	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Rubus alpestris</i>	25	0.9684	0.0177	0.2618	9484	9881	95.9822	No	CA50
<i>Rubus banghamii</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Rubus ferdinandmuelleri</i>	10	0.9929	0.0036	0.3342	15701	15086	104.0766	No	CA50
<i>Rubus fraxinifolius</i>	95	0.9529	0.0201	0.1164	280	204590	0.1369	Yes	SDM
<i>Rubus lineatus</i>	98	0.992	0.0033	0.1118	1	24310	0.0041	Yes	SDM
<i>Rubus lorentzianus</i>	10	0.9954	0.0017	0.5171	1484	10778	13.7688	No	CA50
<i>Rubus macgregorii</i>	3	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Rubus niveus</i>	53	0.9908	0.0051	0.0286	184	57120	0.3221	Yes	SDM

Appendix 8 Validation criteria for species distribution models and remarks for predicted distribution areas (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid	Remarks
<i>Rubus papuanus</i>	5	NA	NA	NA	NA	NA	NA	NA	CA50
<i>Rubus rosifolius</i>	123	0.9116	0.036	0.2	5410	195520	2.7670	Yes	SDM
<i>Rubus sumatranus</i>	15	0.9804	0.0081	0.436	14038	46975	29.8840	No	CA50
<i>Saccharum officinarum</i>	66	0.8004	0.0828	0.3919	7412	322625	2.2974	Yes	SDM
<i>Saccharum robustum</i>	25	0.9402	0.0216	0.3375	41845	47694	87.7364	No	CA50
<i>Saccharum spontaneum</i>	150	0.8391	0.0467	0.4048	15475	343676	4.5028	Yes	SDM
<i>Salacca zalacca</i>	17	0.8596	0.0653	0.5249	77320	87484	88.3819	No	CA50
<i>Solanum melongena</i>	75	0.8905	0.0564	0.289	3492	246666	1.4157	Yes	SDM
<i>Sorghum nitidum</i>	97	0.8636	0.0409	0.3184	24260	317675	7.6367	Yes	SDM
<i>Sorghum plumosum</i>	13	0.774	0.0827	0.5397	54776	23555	232.5451	No	CA50
<i>Sorghum propinquum</i>	83	0.811	0.069	0.3048	11988	430799	2.7827	Yes	SDM
<i>Sorghum timorense</i>	13	0.9778	0.0102	0.2179	37059	67244	55.1112	No	CA50
<i>Syzygium aqueum</i>	40	0.6304	0.0915	0.4627	199389	342233	58.2612	No	CA50
<i>Syzygium cumini</i>	49	0.8017	0.069	0.3825	88836	138980	63.9200	No	CA50
<i>Syzygium malaccense</i>	35	0.6098	0.101	0.4972	170686	294949	57.8697	No	CA50
<i>Vigna minima</i>	33	0.8708	0.0362	0.4009	103173	92290	111.7922	No	CA50
<i>Vigna radiata</i>	99	0.8414	0.0607	0.3501	15995	200602	7.9735	Yes	SDM
<i>Vigna trilobata</i>	40	0.9314	0.0446	0.2172	22892	94072	24.3346	No	CA50
<i>Vigna umbellata</i>	20	0.8197	0.0995	0.4558	55525	209940	26.4480	No	CA50

Appendix 9 Frequency of ELC categories based on generalist ELC in Indonesia, within the existing protected area network, complementary grids and complementary PA.

Level	Country (Indonesia)			Existing protected area network			Complementary Grid Cells			Complementary PA		
ELC Category	Freq.	Percent . (%)	ELC Quartile Classes	Freq. in PA	Percent. in PA (%)	ELC Quartile Class	Freq. in CompGrids	Percent. in CompGrids	ELC Quartile Class in CompGrids	Freq. in CompPA	Percent.in CompPA	ELC Quartile Class in CompPA
1	2570	2.90	mid-high	456	4.32	mid-high	127	2.49	mid-low	100	2.24	mid-high
2	2013 8	22.71	high	1502	14.24	high	1176	23.08	high	638	14.30	high
3	3935	4.44	high	636	6.03	high	114	2.24	mid-low	465	10.42	high
4	5955	6.72	high	363	3.44	mid-high	365	7.16	high	106	2.38	mid-high
5	1692 5	19.09	high	1290	12.23	high	896	17.59	high	580	13.00	high
6	4601	5.19	high	691	6.55	high	141	2.77	mid-high	496	11.11	high
7	5480	6.18	high	356	3.37	mid-high	344	6.75	high	124	2.78	mid-high
8	1581	1.78	mid-low	393	3.73	mid-high	109	2.14	mid-low	172	3.85	mid-high
9	1244	1.40	mid-low	438	4.15	mid-high	32	0.63	low	94	2.11	mid-low
10	146	0.16	low	10	0.09	low	10	0.20	low	2	0.04	low
11	1403	1.58	mid-low	239	2.27	mid-low	206	4.04	high	141	3.16	mid-high
12	35	0.04	low	4	0.04	low	NA	NA	NA	NA	NA	NA
13	573	0.65	mid-low	71	0.67	mid-low	75	1.47	mid-low	32	0.72	mid-low
14	1226	1.38	mid-low	231	2.19	mid-low	178	3.49	high	120	2.69	mid-high
15	50	0.06	low	3	0.03	low	NA	NA	NA	NA	NA	NA
16	489	0.55	low	50	0.47	low	54	1.06	low	17	0.38	mid-low
17	4251	4.79	high	1193	11.31	high	287	5.63	high	449	10.06	high
18	2164	2.44	mid-high	791	7.50	high	77	1.51	mid-low	418	9.37	high
19	1895	2.14	mid-high	582	5.52	high	151	2.96	mid-high	370	8.29	high
20	2538	2.86	mid-high	117	1.11	mid-low	131	2.57	mid-high	37	0.83	mid-low

Appendix 9 Frequency of ELC categories based on generalist ELC in Indonesia, within the existing protected area network, complementary grids and complementary PA (*contd.*).

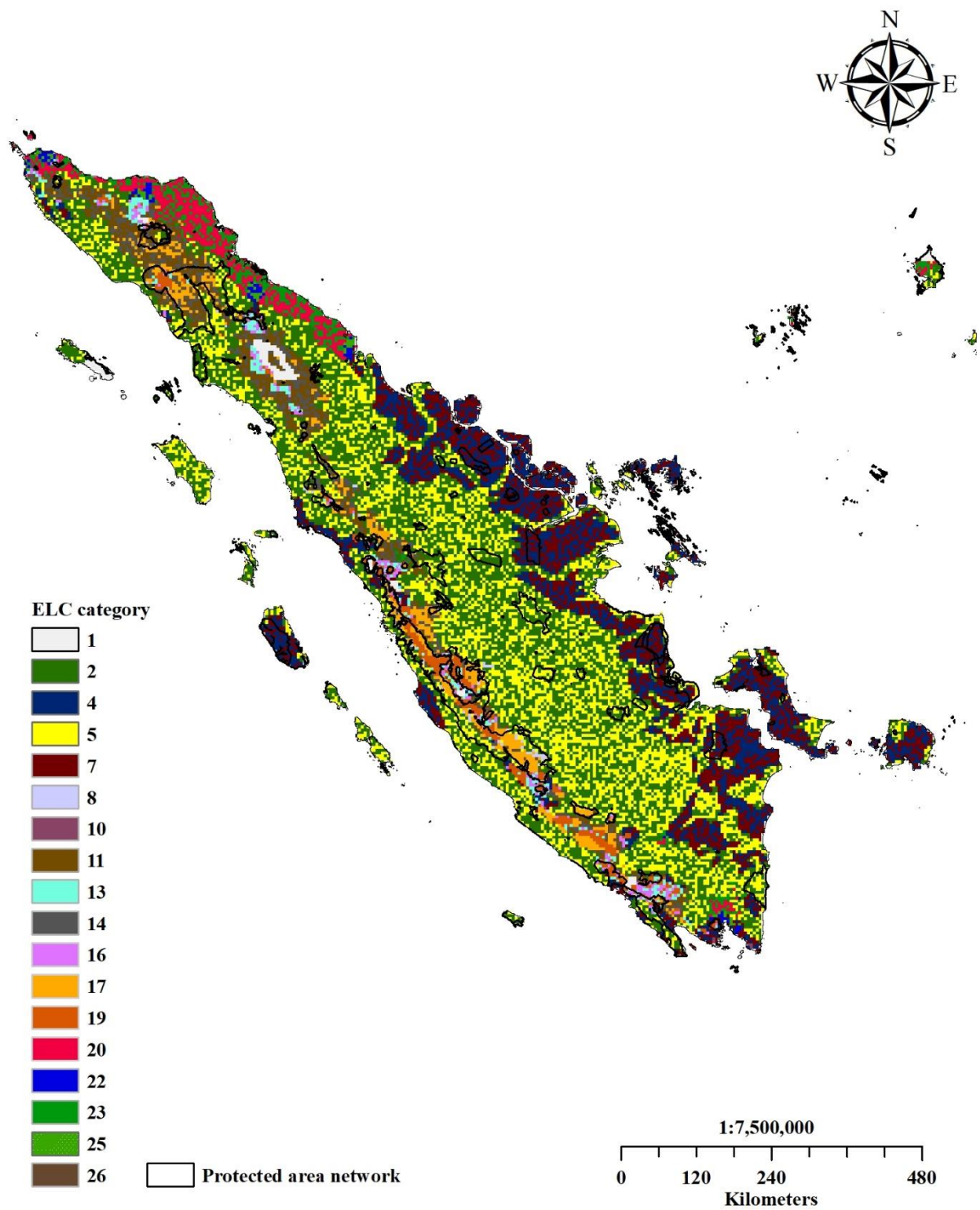
Level	Country (Indonesia)			Existing protected area network			Complementary Grid Cells			Complementary PA		
ELC Category	Freq.	Percent. (%)	ELC Quartile Classes	Freq. in PA	Percent. in PA (%)	ELC Quartile Class	Freq. in CompGrids	Percent. in CompGrids	ELC Quartile Class in CompGrids	Freq. in CompPA	Percent.in CompPA	ELC Quartile Class in CompPA
21	1174	1.32	mid-low	276	2.62	mid-high	46	0.90	low	7	0.16	low
22	2160	2.44	mid-high	85	0.81	mid-low	146	2.87	mid-high	5	0.11	low
23	2655	2.99	mid-high	155	1.47	mid-low	131	2.57	mid-high	55	1.23	mid-low
24	1856	2.09	mid-low	412	3.91	mid-high	70	1.37	mid-low	7	0.16	low
25	2666	3.01	mid-high	123	1.17	mid-low	168	3.30	mid-high	10	0.22	low
26	453	0.51	low	39	0.37	low	18	0.35	low	2	0.04	low
27	53	0.06	low	1	0.01	low	NA	NA	NA	3	0.07	low
28	457	0.52	low	43	0.41	low	43	0.84	low	13	0.29	mid-low

Appendix 10 The average value of environmental variables within each ELC category based on generalist ELC map

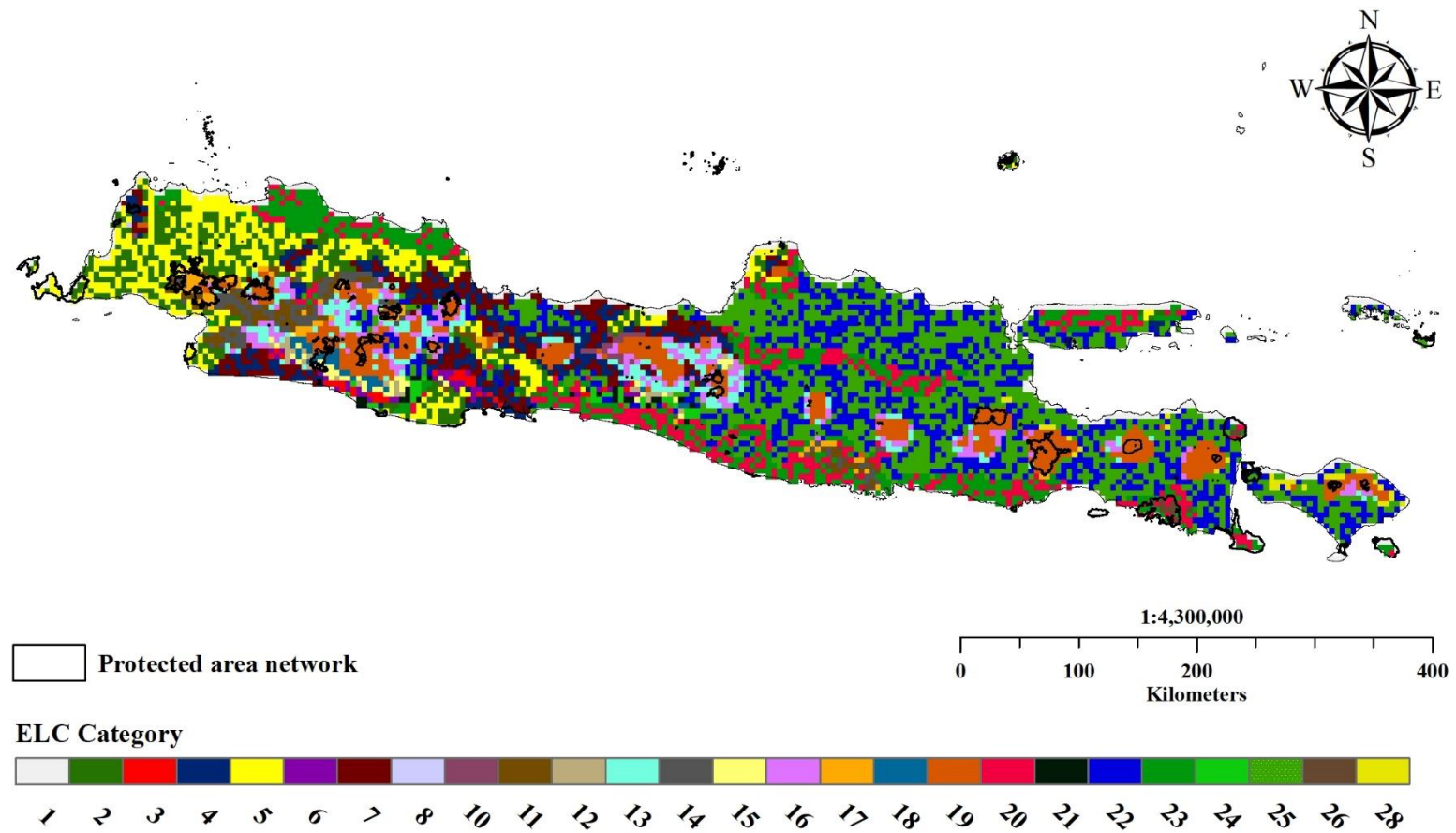
ELC Category	bio_4	bio_19 (mm)	prec_4 (mm)	bio_7 (°C)	tmax_1 (°C)	t_oc (% weight)	t_cec_clay (cmol/kg)	t_gravel (% vol.)	t_bs (%)	t_esp (%)	alt (m)	aspect (°)	slope (°)	eastness (1 if it faces eastwards, -1 if it faces westwards)	northness (1 if it faces northwards, -1 if it faces southwards)
1	473.47	537.07	204.92	101.36	297.78	NA	NA	NA	NA	NA	178.53	196.38	1.87	0.00	0.03
2	323.86	798.55	281.15	94.84	295.35	1.52	19.17	8.12	38.89	1.46	178.72	174.64	1.51	-0.09	-0.08
3	491.44	729.05	298.99	92.50	306.21	13.19	39.99	14.39	68.62	1.07	167.22	177.38	1.36	-0.10	-0.10
4	317.67	750.70	243.90	94.48	299.05	13.66	46.85	3.11	68.52	1.58	78.87	172.94	0.67	-0.10	-0.08
5	332.84	801.97	280.52	95.11	296.04	1.58	19.53	8.10	38.44	1.48	166.12	175.95	1.39	0.11	0.12
6	501.09	735.69	303.74	93.19	306.84	14.40	39.87	15.17	69.87	1.06	157.09	179.19	1.22	0.10	0.11
7	324.51	766.49	242.65	95.15	299.18	14.88	46.95	2.96	67.98	1.60	69.53	172.24	0.55	0.11	0.13
8	332.74	733.25	284.98	89.42	270.82	1.40	16.50	7.43	37.11	1.28	700.86	181.18	7.98	0.00	-0.01
9	511.94	762.92	297.34	94.51	282.59	2.29	39.23	9.24	45.60	1.01	712.25	176.53	8.20	0.00	0.01
10	352.62	792.38	272.92	97.11	275.49	1.95	55.05	4.18	72.06	1.47	602.69	181.57	8.82	0.01	-0.02
11	333.41	494.65	256.73	109.19	259.83	1.90	22.40	6.85	31.96	1.07	991.03	169.98	5.09	-0.07	-0.07
12	454.26	479.03	306.80	110.40	274.40	3.25	42.45	23.81	95.11	3.47	651.17	189.90	3.58	-0.11	-0.09
13	352.57	420.52	267.26	112.91	261.48	4.09	64.14	6.38	46.73	1.19	887.19	175.71	3.80	-0.08	-0.08
14	336.19	492.22	261.46	108.98	259.21	1.86	22.53	6.88	32.52	1.09	999.82	171.33	5.42	0.13	0.12
15	509.46	515.18	294.94	108.08	271.32	4.32	43.00	23.27	97.05	3.25	731.53	188.98	4.20	0.13	0.14
16	362.74	417.58	271.31	113.90	261.22	4.10	65.09	6.29	47.77	1.17	880.13	175.29	3.91	0.12	0.13
17	429.20	512.61	273.45	99.90	244.51	1.68	19.34	6.78	33.34	1.17	1256.30	179.17	8.21	-0.01	0.00
18	659.60	806.30	288.22	114.10	228.87	2.29	47.90	8.85	47.10	1.08	2041.94	172.93	10.19	0.00	0.01
19	480.26	484.92	286.17	115.63	229.25	3.93	71.50	5.79	48.75	1.60	1634.78	180.17	9.33	0.00	0.00
20	566.56	404.44	164.98	109.93	297.78	1.48	17.19	7.31	42.79	1.25	178.39	173.73	1.99	-0.09	-0.09
21	807.44	301.98	238.22	108.03	309.87	17.99	38.10	22.04	87.80	1.23	46.24	173.80	0.39	-0.14	-0.09
22	601.54	226.27	168.00	122.60	297.12	2.33	60.07	4.80	75.45	1.35	195.70	182.27	1.72	-0.10	-0.10
23	585.90	388.10	167.57	112.04	297.94	1.53	17.82	6.84	42.80	1.26	174.28	176.52	1.87	0.11	0.12
24	821.14	292.68	238.91	108.32	310.27	19.51	37.49	22.90	87.66	1.24	37.68	175.76	0.27	0.08	0.12

Appendix 10 The average value of environmental variables within each ELC category based on generalist ELC map (*contd.*)

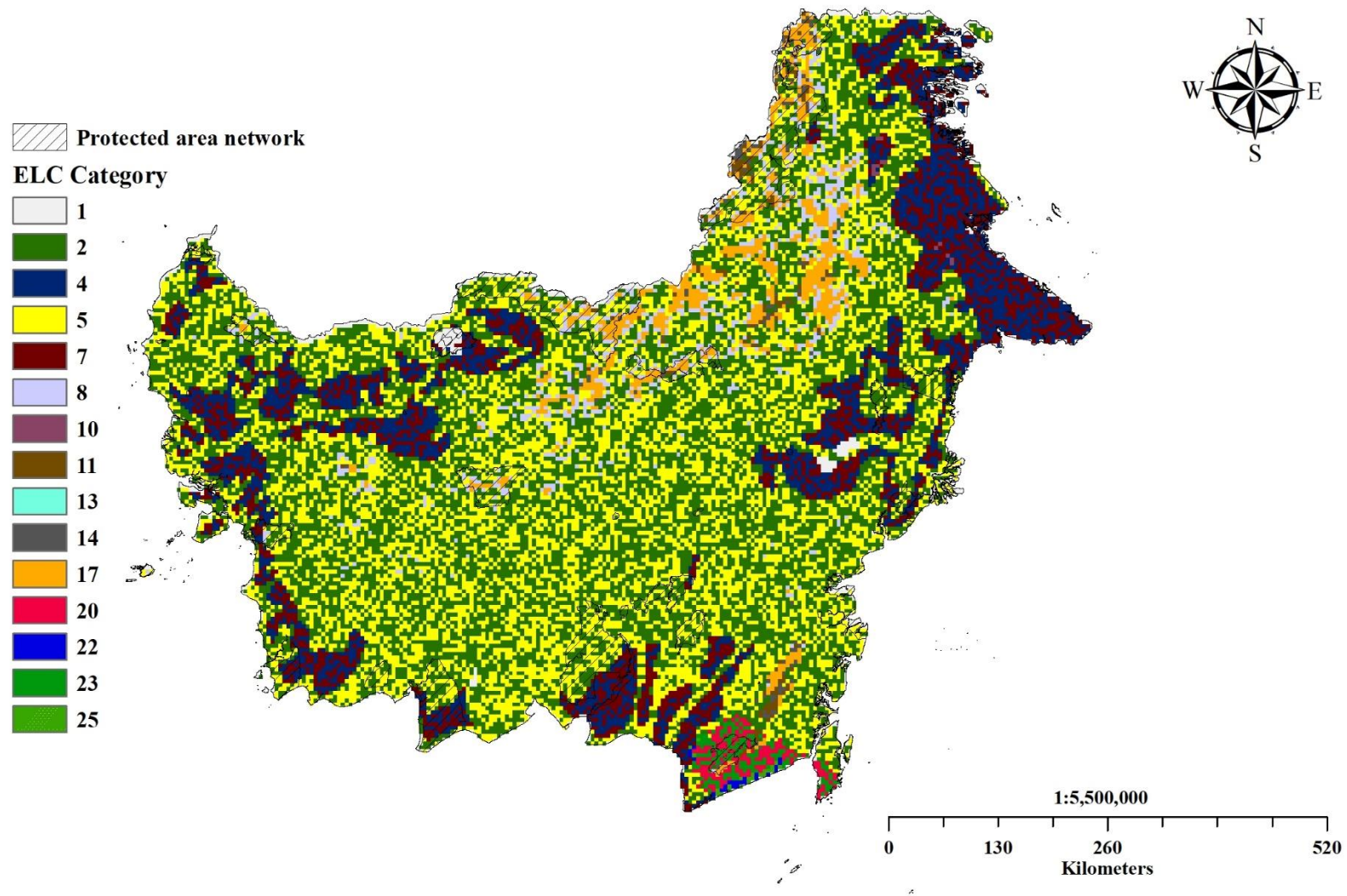
ELC Category	bio_4	bio_19 (mm)	prec_4 (mm)	bio_7 (°C)	tmax_1 (°C)	t_oc (% weight)	t_cec_clay (cmol/kg)	t_gravel (% vol.)	t_bs (%)	t_esp (%)	alt (m)	aspect (°)	slope (°)	eastness (1 if it faces eastwards, -1 if it faces westwards)	northness (1 if it faces northwards, -1 if it faces southwards)
25	604.57	217.27	166.78	123.86	297.53	2.13	59.38	4.72	77.32	1.37	188.99	181.65	1.58	0.11	0.11
26	651.52	387.40	166.19	106.65	274.57	1.57	16.98	7.07	42.65	1.11	643.22	175.06	7.67	-0.01	-0.01
27	760.45	548.87	255.06	92.91	289.72	2.12	32.39	5.60	79.58	1.00	552.65	180.20	8.36	0.02	-0.01
28	727.69	134.73	155.15	123.07	269.96	3.81	73.12	4.58	48.02	1.17	704.05	183.87	7.79	0.00	-0.01



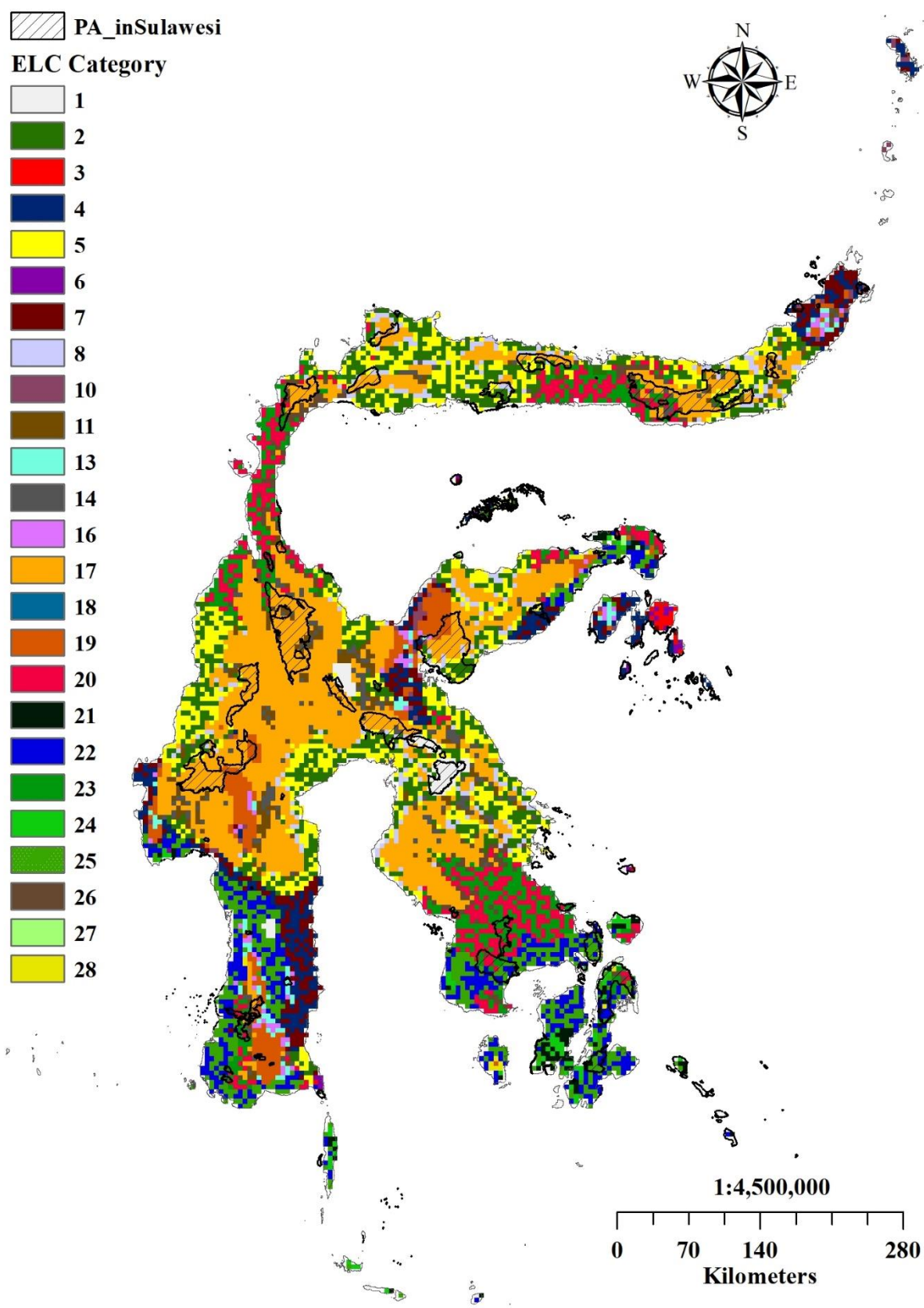
Appendix 11 ELC generalist Sumatra



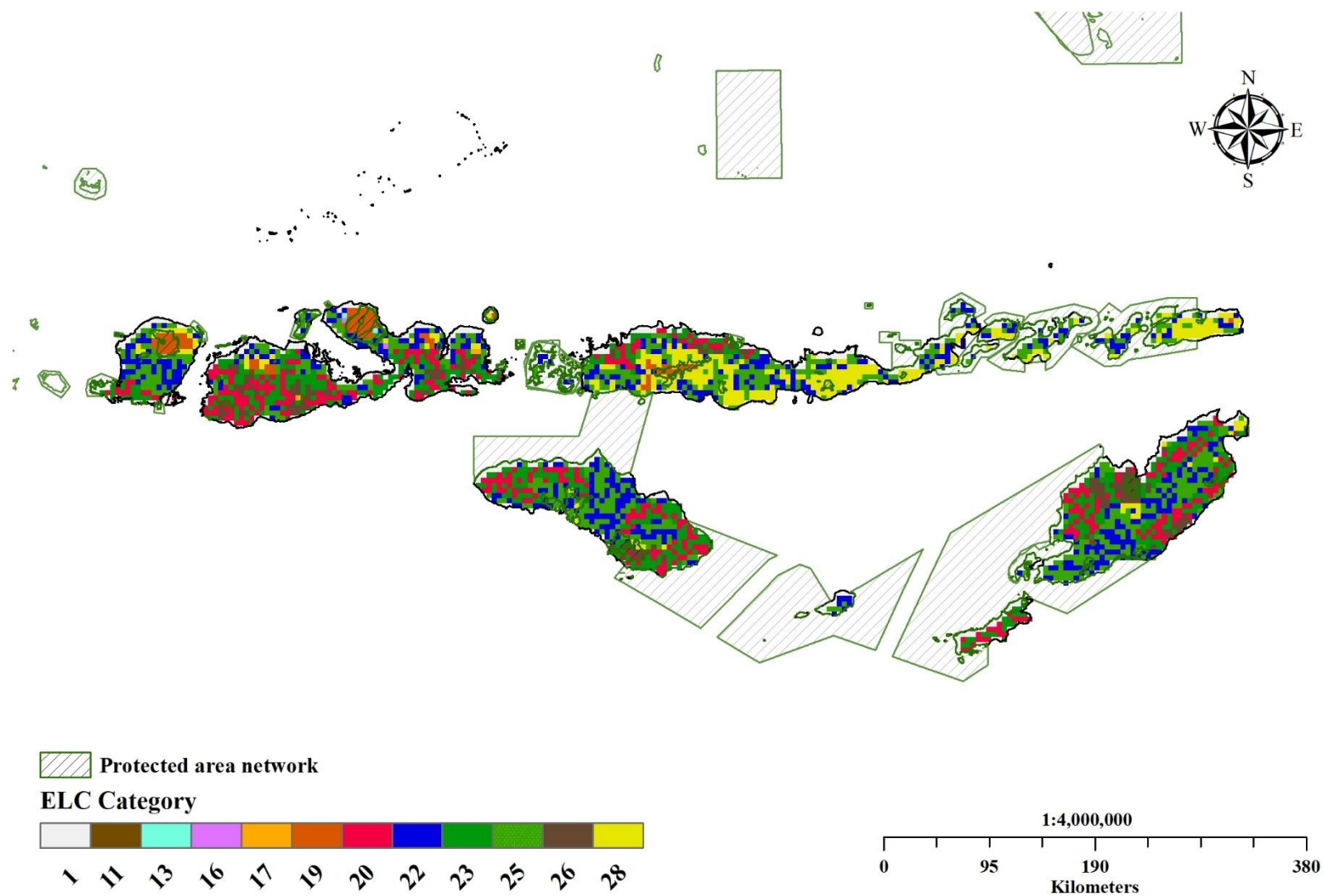
Appendix 12 ELC generalist Java-Bali



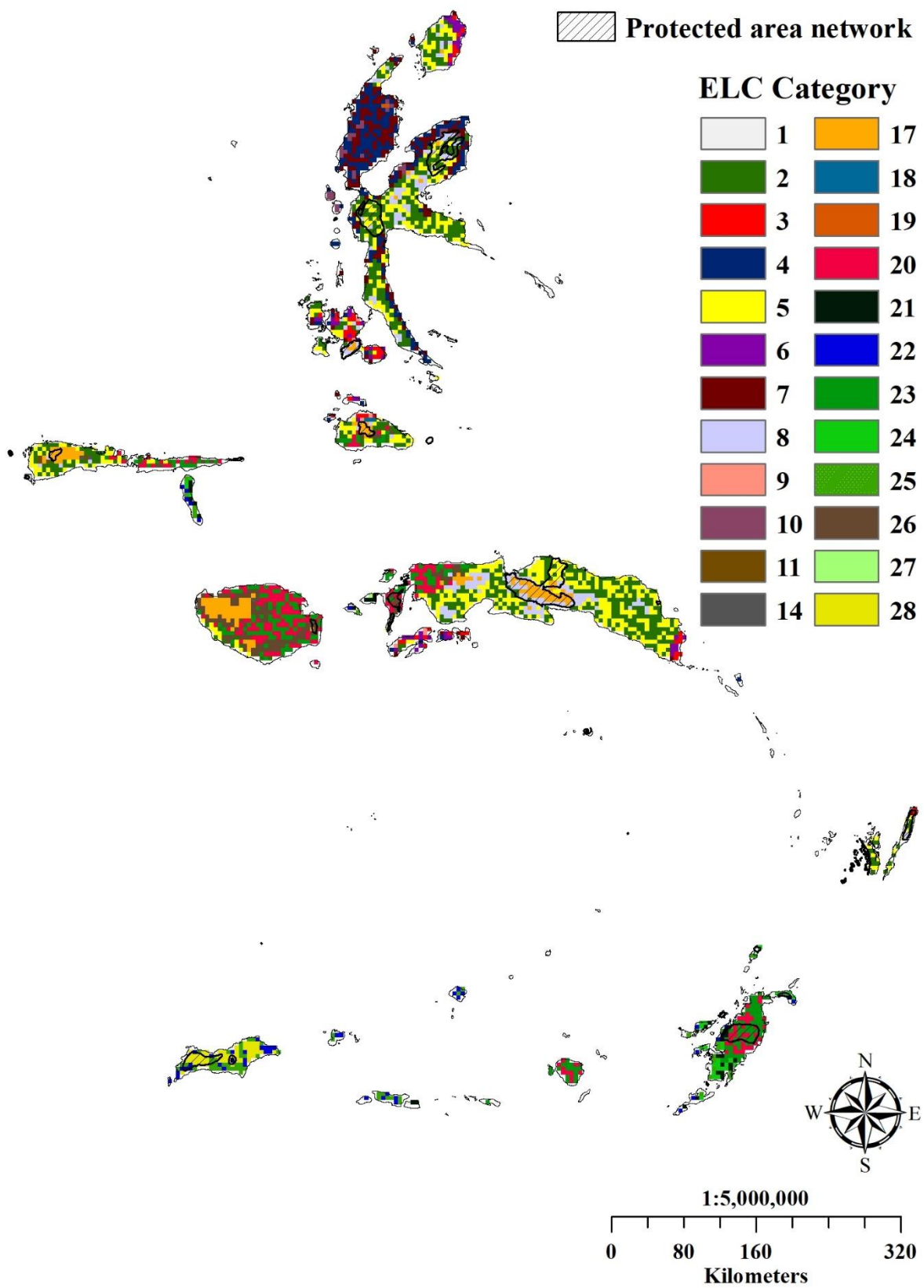
Appendix 13 ELC generalist Kalimantan



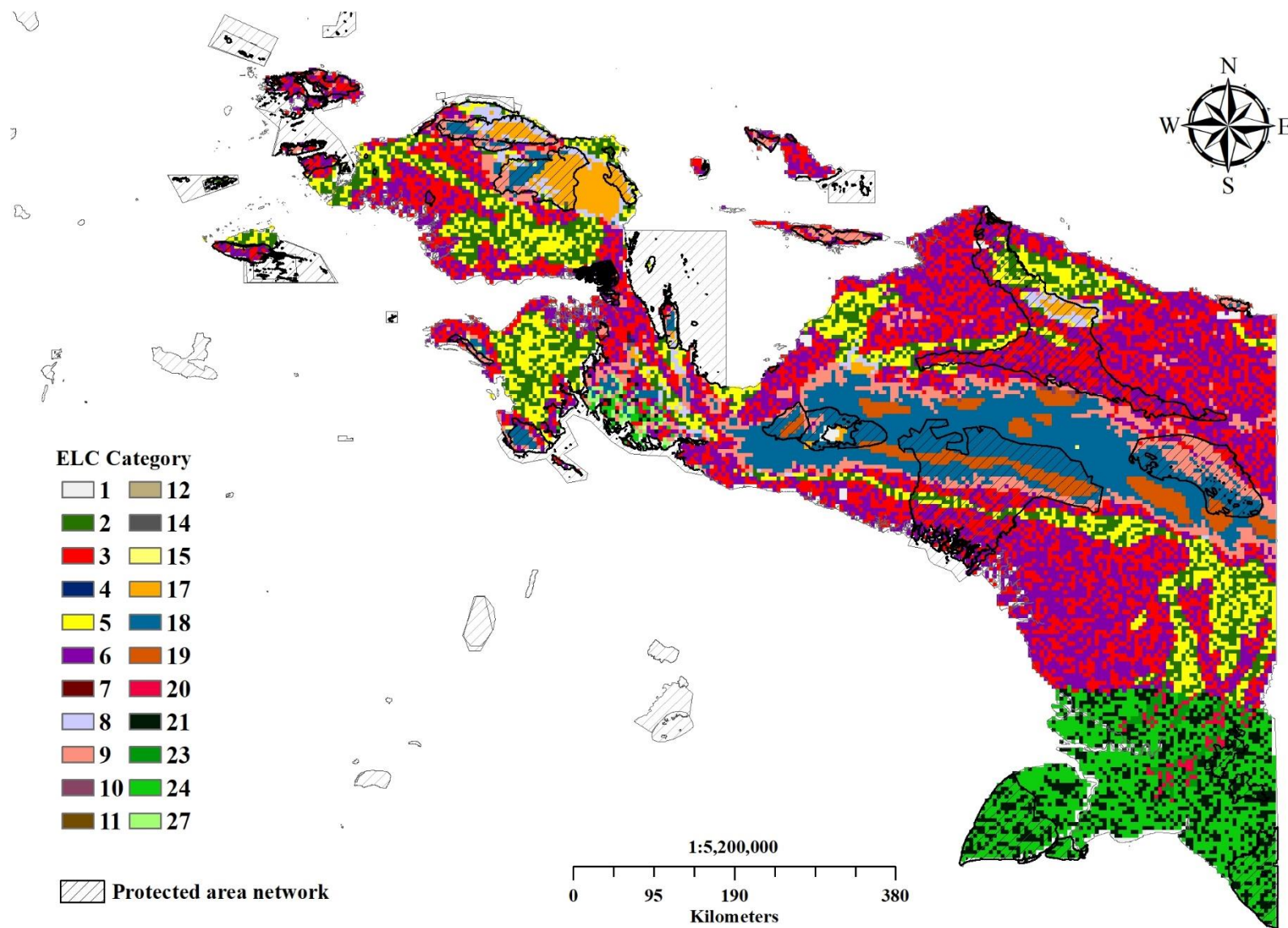
Appendix 14 ELC generalist Sulawesi



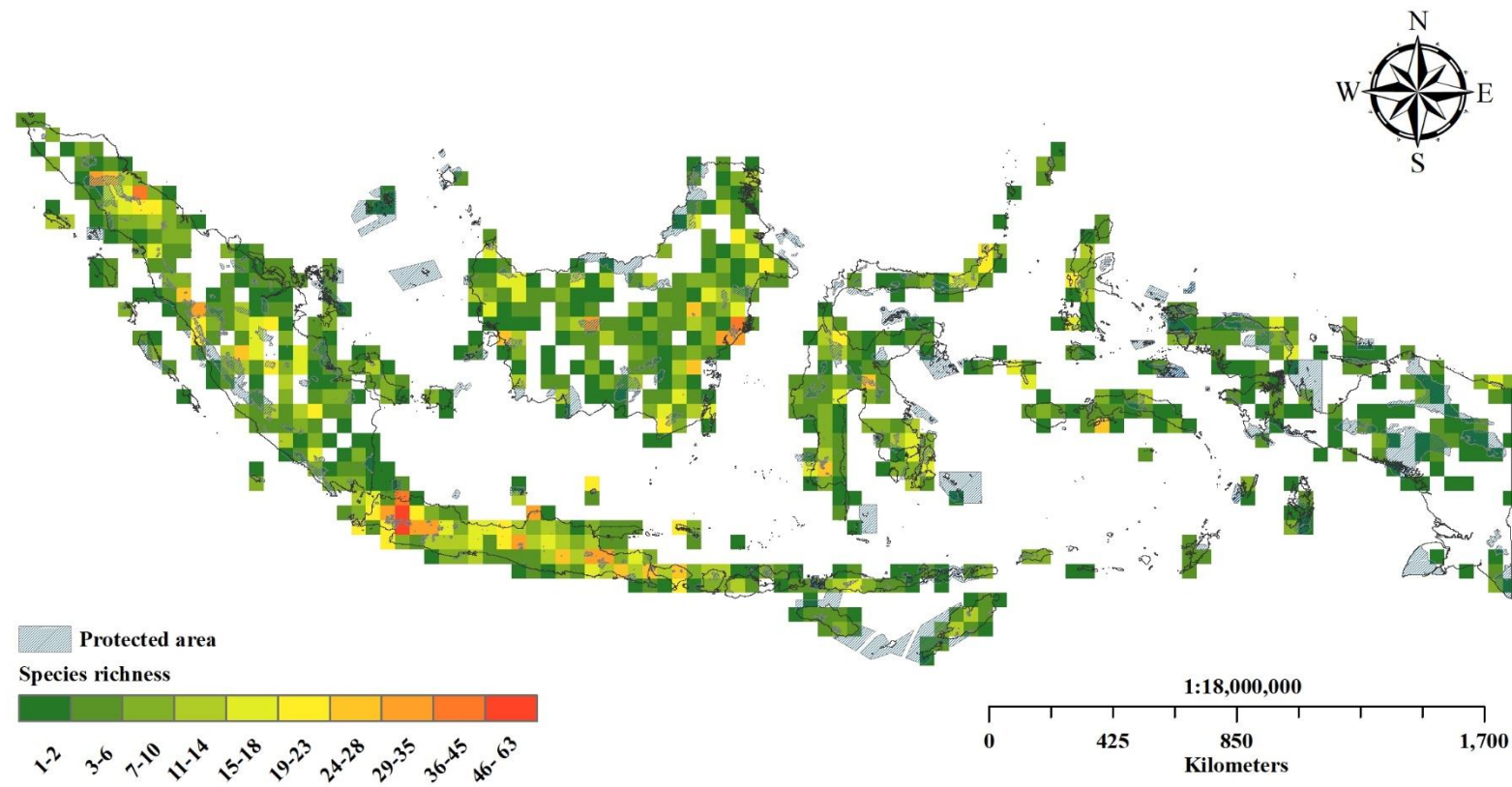
Appendix 15 ELC generalist Lesser Sunda Islands



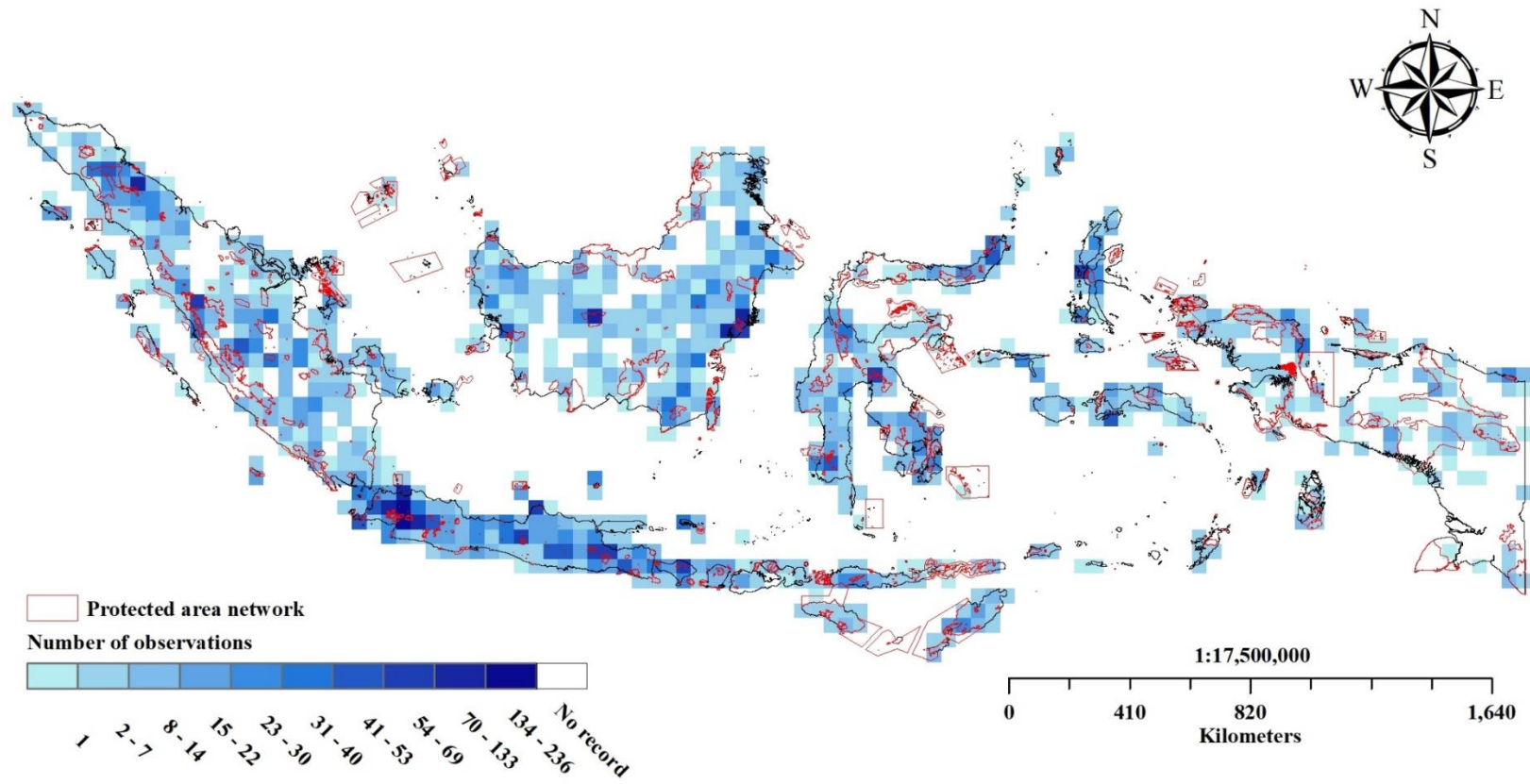
Appendix 16 ELC generalist Sulawesi



Appendix 17 ELC generalist Papua



Appendix 18 Observed species richness of priority CWR in Indonesia



Appendix 19 Biased map based on number of observations of priority CWR in Indonesia

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
1	Gunung Leuser	National Park	II	8677.89	48
2	Gunung Palung	National Park	II	900.00	30
3	Gunung Gede - Pangrango	National Park	II	219.75	27
4	Gunung Halimun - Salak	National Park	II	1133.57	23
5	Kerinci Seblat	National Park	II	13753.50	23
6	Bukit Baka - Bukit Raya	National Park	II	1810.90	22
7	Ujung Kulon	National Park	II	1229.56	21
8	Bukit Dua Belas	National Park	II	605.00	20
9	Lore Lindu	National Park	II	2179.92	17
10	Bogani Nani Wartabone	National Park	II	2851.05	15
11	Cibanteng	Nature Reserve	III	4.47	14
12	Tanjung Puting National Park	Ramsar Site, Wetland of International Importance	II	4082.86	14
13	Memberamo Foja	Wildlife Reserve	Not Reported	17800.53	13
14	Sebangau	National Park	II	5687.00	13
15	Kutai	National Park	II	1986.29	12
16	P. Bawean	Wildlife Reserve	IV	38.32	12
17	Lambusango	Wildlife Reserve	IV	285.10	12
18	Gunung Sago Malintang	Nature Recreation Park	VI	54.86	12
19	P. Bawean	Nature Reserve	Ia	7.25	12
20	Manusela	National Park	II	1890.00	11
21	Nusa Gede Panjalu	Nature Reserve	III	0.16	11
22	Bukit Soeharto	Grand Forest Park	VI	677.66	11
23	Tesso Nilo	National Park	II	830.68	11
24	Bromo Tengger Semeru	National Park	II	502.76	10
25	Gunung Rinjani	National Park	II	413.30	10

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
26	Buton Utara	Wildlife Reserve	IV	820.00	10
27	Sultan Adam	Grand Forest Park	VI	1120.00	10
28	Bantimurung	Nature Recreation Park	Not Reported	0.18	10
29	Karimunjawa	Nature Reserve	Ia	1198.15	10
30	Arau Hilir dan Air Terusan	Wildlife Reserve	Not Reported	914.78	10
31	Kepulauan Krakatau	Nature Reserve	VI	12626.86	10
32	Kayan Mentarang	National Park	II	13605.00	9
33	Rimbo Panti	Nature Recreation Park	V	5.70	9
34	Rawa Aopa Watumohai	National Park	II	1051.94	9
35	Gunung Nyiut Penrissen	Nature Reserve	Ia	1800.00	9
36	Ruteng	Nature Recreation Park	V	322.49	9
37	Lorentz	National Park	II	24500.00	8
38	Pegunungan Cycloops	Nature Reserve	Ia	225.00	8
39	Dungus Iwul	Nature Reserve	III	0.09	8
40	Gunung Merapi	National Park	II	64.10	8
41	Bali Barat	National Park	II	190.03	7
42	Pulau Batanta Barat	Nature Reserve	Ia	167.49	7
43	Singgalang Tandikat	Nature Recreation Park	VI	96.58	7
44	Sembilang	National Park	II	2028.96	7
45	Danau Sentarum	National Park	II	1320.00	7
46	Seblat	Nature Recreation Park	V	77.38	7
47	Gunung Tumpa (Haveworang)	Grand Forest Park	Not Reported	2.96	7
48	Gunung Ambang	Nature Recreation Park	Ia	336.38	6
49	Yapen Tengah	Nature Reserve	Ia	590.00	6
50	Talaga Bodas	Nature Reserve	III	2.62	6
51	Gunung Ciremai	National Park	II	155.00	6
52	Gunung Baung	Nature Recreation Park	V	1.97	6
53	Gunung Nanua	Hunting Park	VI	100.00	6

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
54	Siberut	National Park	II	1905.00	6
55	Batang Gadis	National Park	II	1080.00	6
56	R. Soeryo	Grand Forest Park	VI	278.28	6
57	Bukit Kelam	Nature Recreation Park	Not Reported	11.36	6
58	Berbak	National Park	II	1627.00	5
59	Rawa Dano	Nature Reserve	III	25.00	5
60	Tanjung Peropa	Wildlife Reserve	IV	389.37	5
61	Biak Utara	Nature Reserve	Ia	61.38	5
62	Takokak	Nature Reserve	III	0.50	5
63	Lingga Isaq	Hunting Park	VI	800.00	5
64	Bukit Batu	Wildlife Reserve	IV	240.00	5
65	Dolok Sibual-buali	Nature Reserve	Ia	50.00	5
66	Wai Wuul	Nature Reserve	Ia	14.85	5
67	Karakelang	Wildlife Reserve	IV	246.69	5
68	Gunung Raya	Wildlife Reserve	IV	395.00	4
69	Teluk Cendrawasih	Marine National Park	II	14535.00	4
70	Pegunungan Arfak	Nature Reserve	Ia	683.25	4
71	Papandayan	Nature Reserve	V	2.25	4
72	Gunung Burangrang	Nature Reserve	Ia	27.00	4
73	Gunung Tambora Selatan	Wildlife Reserve	IV	216.75	4
74	Gunung Mutis	Nature Reserve	Not Reported	900.00	4
75	Kepulauan Karimata	Marine Nature Reserve	Ib	770.00	4
76	Wan Abdul Rahman	Grand Forest Park	VI	222.45	4
77	Malino	Nature Recreation Park	V	35.00	4
78	Nusakambangan Barat	Nature Reserve	III	6.75	4
79	Kaimana	Locally Managed Marine Area	VI	5977.47	4
80	Sungai Liku	Nature Recreation Park	V	11.42	4
81	Pocut Meurah Intan	Grand Forest Park	Not Reported	62.41	4

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
82	Zamrud	National Park	Not Reported	316.43	4
83	Bukit Barisan Selatan	National Park	II	2950.00	3
84	Kawah Ijen	Nature Reserve	III	24.68	3
85	Leuwang Sancang	Nature Reserve	Ia	11.50	3
86	Cikepuh	Wildlife Reserve	IV	81.28	3
87	Dataran Tinggi Yang	Wildlife Reserve	IV	141.45	3
88	Kawah Kamojang	Nature Reserve	V	5.00	3
89	Ir. H. Juanda	Grand Forest Park	VI	5.90	3
90	Muara Kaman Sedulang	Nature Reserve	IV	0.25	3
91	Pulau Sempu	Nature Reserve	III	8.77	3
92	Betung Kerihun	National Park	II	8000.00	3
93	Nantu	Wildlife Reserve	III	0.09	3
94	Mega Mendung	Nature Recreation Park	Not Reported	0.13	3
95	Gunung Merbabu	National Park	II	57.25	3
96	Wasur National Park	Ramsar Site, Wetland of International Importance	Not Reported	4138.10	3
97	Cabak I/II	Nature Reserve	III	0.30	3
98	Teluk Klowe	Nature Reserve	Ia	6.85	3
99	Buluh Cina	Nature Recreation Park	Not Reported	9.78	3
100	Waigeo Barat Timur	Nature Reserve	Ia	2147.00	3
101	Gunung Celering	Nature Reserve	Ia	13.28	2
102	Meru Betiri	National Park	II	580.00	2
103	Gunung Tangkuban Parahu	Nature Recreation Park	V	3.70	2
104	Padang Luway	Nature Reserve	III	50.00	2
105	Isau-isau Pasemah	Wildlife Reserve	IV	121.44	2
106	Alas Purwo	National Park	II	434.20	2
107	Baluran	National Park	II	250.00	2
108	Sorong	Nature Recreation Park	V	9.46	2

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
109	Pegunungan Wondiboy	Nature Reserve	Ia	795.00	2
110	Tamrau Utara	Nature Reserve	IV	3683.65	2
111	Waigeo Barat Timur	Nature Reserve	Ia	2147.00	2
112	Tuti Adagae/ KH Gunung Besar	Nature Recreation Park	V	55.37	2
113	Gunung Sibela	Nature Reserve	Ia	230.24	2
114	Sibolangit	Nature Recreation Park	Not Reported	0.25	2
115	Lembah Anai	Nature Reserve	Not Reported	2.21	2
116	Pulau Laut	Nature Reserve	Ia	4.00	2
117	Kawah Kamojang	Nature Recreation Park	Ia	75.36	2
118	Morowali	Nature Reserve	III	0.04	2
119	Pangi Binangga	Nature Reserve	Ia	60.00	2
120	Way Kambas	National Park	II	1256.21	2
121	Gunung Marapi	Nature Recreation Park	Not Reported	96.70	2
122	Rawa Singkil	Wildlife Reserve	IV	1025.00	2
123	Nanggala III	Nature Recreation Park	V	5.00	2
124	Murhum (Nipa-Nipa)	Grand Forest Park	VI	78.77	2
125	Gunung Pancar	Nature Recreation Park	V	4.48	2
126	Nuraksa	Grand Forest Park	VI	27.54	2
127	KKPD BIAK NUMFOR	Locally Managed Marine Area	VI	46982.34	2
128	Martelu Purba	Nature Reserve	Ia	1.95	2
129	Sungai Barito	Undesigned	Ia	10.00	2
130	Camplong	Nature Recreation Park	V	6.97	2
131	Gunung Menumbing	Grand Forest Park	VI	41.56	2
132	Gunung Mangkol	Grand Forest Park	Not Reported	55.24	2
133	Gunung Tangkuban Parahu	Nature Reserve	V	3.70	2
134	Bukit Tangkiling	Nature Recreation Park	Ia	20.61	2
135	Gunung Dua Saudara	Nature Reserve	V	30.00	2
136	Panua	Nature Reserve	Ia	455.75	1

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
137	Gunung Tilu	Nature Reserve	Ia	80.19	1
138	Batukahu I-II-III	Nature Reserve	Ia	17.63	1
139	Gunung Raya Passi	Nature Reserve	Ia	37.00	1
140	Muara Kaman Sedulang	Nature Reserve	Ia	647.00	1
141	Gumai Pasemah	Wildlife Reserve	IV	458.83	1
142	Gunung Meja	Nature Recreation Park	V	5.00	1
143	Pegunungan Jayawijaya	Wildlife Reserve	Not Reported	7897.47	1
144	Selat Dampier (Raja Ampat)	Locally Managed Marine Area	VI	462.40	1
145	Pananjung Pangandaran	Nature Reserve	Ia	4.70	1
146	Gunung Masigit Kareumbi	Hunting Park	VI	124.21	1
147	Gunung Tampomas	Nature Recreation Park	V	12.50	1
148	Kecubung Ulolanang	Nature Reserve	Ia	0.70	1
149	Sigogor	Nature Reserve	III	1.91	1
150	Danau Matano	Nature Recreation Park	V	650.00	1
151	Danau Towuti	Nature Recreation Park	V	650.00	1
152	Lamedae	Nature Reserve	Ia	6.35	1
153	Selat Muna	Game Reserve	Not Reported	647.17	1
154	Malampah Alahan Panjang	Wildlife Reserve	Not Reported	369.19	1
155	Maninjau	Nature Reserve	Not Reported	221.06	1
156	Giam Siak Kecil	Wildlife Reserve	IV	500.00	1
157	Pegunungan Tamrau Selatan	Nature Reserve	Ia	2478.75	1
158	Teluk Bintuni	Nature Reserve	Ia	1248.51	1
159	Telaga Warna	Nature Recreation Park	V	0.05	1
160	Kawah Ijen	Nature Recreation Park	Not Reported	382.40	1
161	Pulau Sangiang	Nature Recreation Park	Ia	7.20	1
162	Teluk Maumere	Nature Recreation Park	V	594.50	1
163	Rimbo Panti	Nature Reserve	III	25.50	1
164	Baning	Nature Recreation Park	V	2.13	1

Appendix 20 Number of observed total priority CWR in protected area network in Indonesia (*contd.*)

No	Protected area	Designation	IUCN Category	Area (km ²)	Total priority CWR
165	Kelimutu	National Park	II	53.57	1
166	Lembah Harau	Nature Reserve	III	234.67	1
167	Gunung Batur Bukit Payang	Nature Recreation Park	V	30.00	1
168	Laiwangi Wanggameti	National Park	II	470.14	1
169	Ganda Dewata	National Park	II	2149.80	1
170	Pamona	Nature Reserve	Ia	259.67	1
171	Faruhumpenai	Nature Reserve	Ia	915.03	1
172	Tanjung Malatayur	Undesigned	Not Reported	656.21	1
173	Air Putih	Nature Recreation Park	Not Reported	64.81	1
174	Peson Subah I, II	Nature Reserve	Ia	0.30	1
175	Pleihari Tanah Laut	Nature Recreation Park	V	15.00	1

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Amaranthus tricolor</i>	79	1	47	1	2.13	11	23.40	1	2.13
<i>Archidendron borneense</i>	17	1	20	1	5.00	9	45.00	1	5.00
<i>Archidendron bubalinum</i>	43	3	36	4	11.11	6	16.67	1	2.78
<i>Archidendron clypearia</i>	322	22	191	39	20.42	45	23.56	16	8.38
<i>Archidendron cockburnii</i>	5	0	5	0	0.00	2	40.00	0	0.00
<i>Archidendron contortum</i>	16	2	12	2	16.67	4	33.33	1	8.33
<i>Archidendron crateradenum</i>	7	0	1	0	0.00	1	100.00	0	0.00
<i>Archidendron ellipticum</i>	318	13	85	19	22.35	17	20.00	11	12.94
<i>Archidendron fagifolium</i>	267	8	69	8	11.59	11	15.94	2	2.90
<i>Archidendron globosum</i>	24	2	14	2	14.29	5	35.71	1	7.14
<i>Archidendron havilandii</i>	10	2	18	4	22.22	5	27.78	4	22.22
<i>Archidendron jiringa</i>	265	11	79	13	16.46	19	24.05	7	8.86
<i>Archidendron kunstleri</i>	19	2	16	3	18.75	4	25.00	3	18.75
<i>Archidendron microcarpum</i>	138	8	48	9	18.75	16	33.33	6	12.50
<i>Archidendron minahassae</i>	7	0	1	0	0.00	1	100.00	0	0.00
<i>Archidendron oppositum</i>	22	3	11	3	27.27	1	9.09	1	9.09
<i>Archidendron palauense</i>	21	1	15	1	6.67	2	13.33	1	6.67
<i>Archidendron pauciflorum</i>	34	4	18	6	33.33	4	22.22	5	27.78
<i>Archidendron trichophyllum</i>	16	0	5	0	0.00	1	20.00	0	0.00
<i>Archidendron triplinervium</i>	23	2	12	3	25.00	4	33.33	3	25.00
<i>Arenga pinnata</i>	325	30	105	40	38.10	19	18.10	13	12.38
<i>Artocarpus altilis</i>	300	11	67	13	19.40	9	13.43	7	10.45

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Artocarpus anisophyllus</i>	159	8	74	12	16.22	11	14.86	9	12.16
<i>Artocarpus brevipedunculatus</i>	1	1	1	1	100.00	1	100.00	1	100.00
<i>Artocarpus camansi</i>	20	1	4	1	25.00	2	50.00	1	25.00
<i>Artocarpus elasticus</i>	382	46	237	61	25.74	36	15.19	21	8.86
<i>Artocarpus horridus</i>	3	0	11	0	0.00	4	36.36	0	0.00
<i>Artocarpus integer</i>	158	14	109	19	17.43	22	20.18	8	7.34
<i>Artocarpus kemando</i>	192	13	76	17	22.37	12	15.79	7	9.21
<i>Artocarpus lanceifolius</i>	145	2	57	2	3.51	14	24.56	2	3.51
<i>Artocarpus lowii</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Artocarpus maingayi</i>	24	0	13	0	0.00	2	15.38	0	0.00
<i>Artocarpus odoratissimus</i>	13	2	36	6	16.67	6	16.67	6	16.67
<i>Artocarpus rigidus</i>	272	12	87	13	14.94	15	17.24	5	5.75
<i>Artocarpus sarawakensis</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Artocarpus scortechinii</i>	21	1	17	1	5.88	3	17.65	1	5.88
<i>Artocarpus sepicanus</i>	35	0	13	0	0.00	2	15.38	0	0.00
<i>Artocarpus sericarpus</i>	52	2	31	3	9.68	7	22.58	1	3.23
<i>Artocarpus sumatranus</i>	4	0	4	0	0.00	1	25.00	0	0.00
<i>Artocarpus tamaran</i>	12	0	16	0	0.00	2	12.50	0	0.00
<i>Artocarpus teysmannii</i>	291	4	64	6	9.38	15	23.44	3	4.69
<i>Averrhoa bilimbi</i>	342	9	54	11	20.37	9	16.67	6	11.11
<i>Averrhoa carambola</i>	310	6	50	7	14.00	5	10.00	3	6.00
<i>Cajanus cajan</i>	110	4	37	4	10.81	9	24.32	1	2.70
<i>Cajanus goensis</i>	40	2	9	2	22.22	2	22.22	1	11.11

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Cajanus scarabaeoides</i>	173	0	40	0	0.00	10	25.00	0	0.00
<i>Citrus hystrix</i>	89	7	53	8	15.09	7	13.21	1	1.89
<i>Citrus maxima</i>	137	3	46	3	6.52	9	19.57	2	4.35
<i>Cocos nucifera</i>	300	7	55	9	16.36	16	29.09	3	5.45
<i>Colocasia esculenta</i>	337	19	104	26	25.00	17	16.35	8	7.69
<i>Colocasia gigantea</i>	105	9	44	10	22.73	10	22.73	4	9.09
<i>Cucumis melo</i>	101	2	34	2	5.88	5	14.71	1	2.94
<i>Dimocarpus longan</i>	198	4	64	11	17.19	12	18.75	6	9.38
<i>Dioscorea alata</i>	285	4	72	4	5.56	7	9.72	1	1.39
<i>Dioscorea bancana</i>	3	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea elegans</i>	4	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea filiformis</i>	55	3	30	4	13.33	7	23.33	3	10.00
<i>Dioscorea grata</i>	3	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea havilandii</i>	10	1	11	2	18.18	8	72.73	2	18.18
<i>Dioscorea lamprocaula</i>	5	1	2	1	50.00	2	100.00	1	50.00
<i>Dioscorea madiunensis</i>	7	1	2	1	50.00	1	50.00	1	50.00
<i>Dioscorea niewenhuissii</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea nummularia</i>	58	2	44	2	4.55	9	20.45	1	2.27
<i>Dioscorea orbiculata</i>	1	0	3	0	0.00	2	66.67	0	0.00
<i>Dioscorea platycarpa</i>	5	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea polyclados</i>	40	0	11	0	0.00	2	18.18	0	0.00
<i>Dioscorea prainiana</i>	18	1	6	1	16.67	3	50.00	1	16.67
<i>Dioscorea pubera</i>	46	1	16	1	6.25	1	6.25	1	6.25

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Dioscorea pyrifolia</i>	291	11	62	12	19.35	18	29.03	4	6.45
<i>Dioscorea salicifolia</i>	48	4	13	4	30.77	5	38.46	2	15.38
<i>Dioscorea sarasinii</i>	10	1	6	1	16.67	2	33.33	1	16.67
<i>Dioscorea sexrimata</i>	6	0	2	0	0.00	1	50.00	0	0.00
<i>Dioscorea tenuifolia</i>	0	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea vanvuurenii</i>	2	0	1	0	0.00	1	100.00	0	0.00
<i>Dioscorea vilis</i>	15	1	5	1	20.00	2	40.00	1	20.00
<i>Dioscorea warburgiana</i>	6	0	3	0	0.00	3	100.00	0	0.00
<i>Diospyros discolor</i>	21	0	10	0	0.00	1	10.00	0	0.00
<i>Durio affinis</i>	1	0	3	0	0.00	1	33.33	0	0.00
<i>Durio beccarianus</i>	3	2	3	2	66.67	2	66.67	2	66.67
<i>Durio bukitrayaensis</i>	1	0	2	0	0.00	1	50.00	0	0.00
<i>Durio carinatus</i>	32	6	31	7	22.58	4	12.90	4	12.90
<i>Durio dulcis</i>	10	0	29	0	0.00	9	31.03	0	0.00
<i>Durio graveolens</i>	26	2	27	2	7.41	7	25.93	1	3.70
<i>Durio kutejensis</i>	12	1	25	1	4.00	9	36.00	1	4.00
<i>Durio lanceolatus</i>	9	1	31	1	3.23	11	35.48	1	3.23
<i>Durio lissocarpus</i>	7	1	3	1	33.33	1	33.33	1	33.33
<i>Durio lowianus</i>	22	1	13	1	7.69	1	7.69	1	7.69
<i>Durio macrantha</i>	1	1	1	1	100.00	1	100.00	1	100.00
<i>Durio malaccensis</i>	19	1	4	1	25.00	1	25.00	1	25.00
<i>Durio oblongus</i>	2	0	4	0	0.00	1	25.00	0	0.00

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Durio oxleyanus</i>	29	4	27	4	14.81	8	29.63	2	7.41
<i>Durio testudinarius</i>	4	2	12	3	25.00	3	25.00	3	25.00
<i>Durio zibethinus</i>	304	17	129	18	13.95	38	29.46	7	5.43
<i>Ficus androchaete</i>	1	0	4	0	0.00	1	25.00	0	0.00
<i>Ficus aurata</i>	38	3	40	6	15.00	15	37.50	5	12.50
<i>Ficus aureocordata</i>	2	1	3	1	33.33	1	33.33	1	33.33
<i>Ficus auricoma</i>	0	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus brunneoaurata</i>	7	3	5	3	60.00	1	20.00	2	40.00
<i>Ficus chartacea</i>	123	0	14	0	0.00	4	28.57	0	0.00
<i>Ficus deltoidea</i>	61	9	31	12	38.71	7	22.58	5	16.13
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	52	4	41	5	12.20	15	36.59	3	7.32
<i>Ficus fulva</i>	319	8	50	9	18.00	12	24.00	3	6.00
<i>Ficus glabristipulata</i>	14	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus glandulifera</i>	107	7	60	9	15.00	9	15.00	6	10.00
<i>Ficus grossularioides</i>	267	13	135	26	19.26	40	29.63	14	10.37
<i>Ficus halmaherae</i>	0	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus hirta</i>	239	8	56	9	16.07	23	41.07	1	1.79
<i>Ficus hirta</i> subsp. <i>dumosa</i>	3	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	6	1	3	1	33.33	3	100.00	1	33.33
<i>Ficus inaequipetiolata</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus kofmaniae</i>	4	0	2	0	0.00	1	50.00	0	0.00
<i>Ficus lamponga</i>	15	1	5	1	20.00	1	20.00	1	20.00

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Ficus litseifolia</i>	24	2	8	4	50.00	6	75.00	3	37.50
<i>Ficus oleifolia</i>	166	12	58	20	34.48	9	15.52	11	18.97
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	13	2	10	3	30.00	3	30.00	1	10.00
<i>Ficus padana</i>	200	16	98	28	28.57	22	22.45	11	11.22
<i>Ficus pedunculosa</i>	38	1	27	1	3.70	4	14.81	1	3.70
<i>Ficus ruficaulis</i>	25	2	7	2	28.57	1	14.29	1	14.29
<i>Ficus schefferiana</i>	25	4	15	9	60.00	5	33.33	5	33.33
<i>Ficus setiflora</i>	1	0	3	0	0.00	1	33.33	0	0.00
<i>Ficus subfulva</i>	3	1	2	1	50.00	1	50.00	1	50.00
<i>Ficus subglabritepala</i>	0	0	1	0	0.00	1	100.00	0	0.00
<i>Ficus tricolor</i>	88	7	37	9	24.32	7	18.92	3	8.11
<i>Ficus tricolor</i> var. <i>serroh</i>	40	1	12	2	16.67	3	25.00	2	16.67
<i>Garcinia celebica</i>	371	19	105	32	30.48	13	12.38	19	18.10
<i>Garcinia diospyrifolia</i>	7	1	6	1	16.67	3	50.00	1	16.67
<i>Garcinia mangostana</i>	69	10	35	10	28.57	11	31.43	4	11.43
<i>Garcinia nitida</i>	2	1	4	2	50.00	1	25.00	2	50.00
<i>Garcinia opaca</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Garcinia penangiana</i>	27	2	8	2	25.00	1	12.50	1	12.50
<i>Garcinia rigida</i>	40	5	33	8	24.24	9	27.27	5	15.15
<i>Gnetum costatum</i>	9	0	2	0	0.00	1	50.00	0	0.00
<i>Gnetum gnemon</i>	312	29	188	38	20.21	21	11.17	18	9.57

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	11	2	7	2	28.57	1	14.29	2	28.57
<i>Gnetum gnemon</i> var. <i>gracile</i>	9	0	2	0	0.00	2	100.00	0	0.00
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	11	0	10	0	0.00	6	60.00	0	0.00
<i>Gnetum gnemon</i> var. <i>tenerum</i>	3	1	5	1	20.00	3	60.00	1	20.00
<i>Ipomoea aquatica</i>	397	7	75	7	9.33	9	12.00	3	4.00
<i>Ipomoea asarifolia</i>	7	0	2	0	0.00	1	50.00	0	0.00
<i>Ipomoea coptica</i>	5	0	1	0	0.00	1	100.00	0	0.00
<i>Ipomoea graminea</i>	2	0	1	0	0.00	1	100.00	0	0.00
<i>Ipomoea imperati</i>	1	0	4	0	0.00	1	25.00	0	0.00
<i>Ipomoea littoralis</i>	316	7	77	18	23.38	9	11.69	14	18.18
<i>Ipomoea obscura</i>	294	4	82	4	4.88	11	13.41	2	2.44
<i>Ipomoea pes-caprae</i>	347	10	126	14	11.11	11	8.73	8	6.35
<i>Ipomoea sagittifolia</i>	67	2	42	2	4.76	4	9.52	1	2.38
<i>Ipomoea stibaropoda</i>	1	0	1	0	0.00	1	100.00	0	0.00
<i>Lablab purpureus</i>	101	5	46	5	10.87	11	23.91	3	6.52
<i>Lansium domesticum</i>	156	8	75	11	14.67	19	25.33	8	10.67
<i>Mangifera altissima</i>	12	3	7	3	42.86	1	14.29	3	42.86
<i>Mangifera applanata</i>	28	2	24	3	12.50	7	29.17	2	8.33
<i>Mangifera casturi</i>	14	0	14	0	0.00	6	42.86	0	0.00
<i>Mangifera dewildei</i>	4	1	4	2	50.00	2	50.00	2	50.00
<i>Mangifera gedebe</i>	30	4	24	7	29.17	1	4.17	1	4.17

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Mangifera gracilipes</i>	7	0	7	0	0.00	1	14.29	0	0.00
<i>Mangifera griffithii</i>	233	3	53	5	9.43	12	22.64	4	7.55
<i>Mangifera lalijiwa</i>	39	1	19	1	5.26	3	15.79	1	5.26
<i>Mangifera laurina</i>	384	15	91	17	18.68	17	18.68	8	8.79
<i>Mangifera longipetiolata</i>	37	3	15	3	20.00	2	13.33	1	6.67
<i>Mangifera magnifica</i>	30	3	22	3	13.64	5	22.73	3	13.64
<i>Mangifera microphylla</i>	2	0	1	0	0.00	1	100.00	0	0.00
<i>Mangifera minor</i>	173	4	73	6	8.22	14	19.18	1	1.37
<i>Mangifera mucronulata</i>	17	1	20	2	10.00	3	15.00	2	10.00
<i>Mangifera oblongifolia</i>	20	0	5	0	0.00	2	40.00	0	0.00
<i>Mangifera orophila</i>	3	1	3	1	33.33	1	33.33	1	33.33
<i>Mangifera paludosa</i>	12	1	7	1	14.29	1	14.29	1	14.29
<i>Mangifera parvifolia</i>	35	4	36	6	16.67	3	8.33	1	2.78
<i>Mangifera pedicellata</i>	26	0	14	0	0.00	1	7.14	0	0.00
<i>Mangifera quadrifida</i>	111	7	81	8	9.88	12	14.81	6	7.41
<i>Mangifera rigida</i>	6	0	3	0	0.00	1	33.33	0	0.00
<i>Mangifera rubropetala</i>	6	1	2	1	50.00	1	50.00	1	50.00
<i>Mangifera rufocostata</i>	15	4	19	4	21.05	4	21.05	2	10.53
<i>Mangifera similis</i>	10	1	14	1	7.14	1	7.14	1	7.14
<i>Mangifera sulavesiana</i>	15	0	4	0	0.00	2	50.00	0	0.00
<i>Mangifera sumbawaensis</i>	15	1	7	1	14.29	1	14.29	1	14.29
<i>Mangifera swintonioides</i>	19	1	20	2	10.00	3	15.00	2	10.00
<i>Mangifera timorensis</i>	41	1	23	2	8.70	9	39.13	2	8.70

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Mangifera torquenda</i>	27	2	29	2	6.90	6	20.69	1	3.45
<i>Metroxylon sagu</i>	71	6	44	6	13.64	11	25.00	2	4.55
<i>Momordica charantia</i>	173	7	95	7	7.37	14	14.74	4	4.21
<i>Musa acuminata</i>	267	12	73	14	19.18	21	28.77	6	8.22
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	23	3	12	3	25.00	3	25.00	1	8.33
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	39	2	17	4	23.53	8	47.06	3	17.65
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	0	0	2	0	0.00	2	100.00	0	0.00
<i>Musa acuminata</i> var. <i>sumatrana</i>	26	4	12	6	50.00	5	41.67	5	41.67
<i>Musa acuminata</i> var. <i>tomentosa</i>	30	1	12	1	8.33	1	8.33	1	8.33
<i>Musa balbisiana</i>	32	2	11	2	18.18	3	27.27	1	9.09
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	4	0	2	0	0.00	1	50.00	0	0.00
<i>Musa celebica</i>	10	1	4	2	50.00	1	25.00	2	50.00
<i>Musa lanceolata</i>	4	0	1	0	0.00	1	100.00	0	0.00
<i>Musa schizocarpa</i>	9	1	4	1	25.00	1	25.00	1	25.00
<i>Nephelium lappaceum</i>	334	9	80	10	12.50	23	28.75	6	7.50
<i>Ocimum americanum</i>	76	0	26	0	0.00	5	19.23	0	0.00
<i>Oryza longiglumis</i>	2	0	2	0	0.00	2	100.00	0	0.00
<i>Oryza meyeriana</i>	199	7	68	9	13.24	2	2.94	2	2.94

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Oryza minuta</i>	285	2	52	3	5.77	2	3.85	1	1.92
<i>Oryza officinalis</i>	243	2	130	9	6.92	8	6.15	9	6.92
<i>Oryza ridleyi</i>	22	3	20	5	25.00	2	10.00	4	20.00
<i>Oryza rufipogon</i>	230	3	78	3	3.85	19	24.36	1	1.28
<i>Oryza schlechteri</i>	1	0	2	0	0.00	1	50.00	0	0.00
<i>Parkia singularis</i>	29	2	20	2	10.00	2	10.00	2	10.00
<i>Parkia speciosa</i>	237	7	76	8	10.53	15	19.74	3	3.95
<i>Parkia sumatrana</i>	34	2	9	2	22.22	3	33.33	1	11.11
<i>Parkia timoriana</i>	84	5	44	8	18.18	4	9.09	3	6.82
<i>Parkia versteeghii</i>	2	1	3	2	66.67	1	33.33	2	66.67
<i>Pometia pinnata</i>	250	35	222	54	24.32	37	16.67	28	12.61
<i>Rubus acuminatissimus</i>	33	4	9	5	55.56	4	44.44	3	33.33
<i>Rubus alpestris</i>	67	8	24	13	54.17	7	29.17	10	41.67
<i>Rubus banghamii</i>	18	2	3	2	66.67	1	33.33	1	33.33
<i>Rubus ferdinandimuelleri</i>	7	2	10	5	50.00	4	40.00	4	40.00
<i>Rubus fraxinifolius</i>	239	15	90	30	33.33	14	15.56	10	11.11
<i>Rubus lineatus</i>	71	21	93	62	66.67	27	29.03	39	41.94
<i>Rubus lorentzianus</i>	4	1	10	4	40.00	1	10.00	4	40.00
<i>Rubus macgregorii</i>	4	0	3	0	0.00	2	66.67	0	0.00
<i>Rubus niveus</i>	99	9	52	22	42.31	1	1.92	5	9.62
<i>Rubus papuanus</i>	2	1	5	1	20.00	2	40.00	1	20.00
<i>Rubus rosifolius</i>	168	23	119	38	31.93	10	8.40	11	9.24
<i>Rubus sumatranus</i>	35	3	15	4	26.67	4	26.67	3	20.00

Appendix 21 Population of priority CWR in protected area network, complementary protected area, and complementary grids (*contd.*)

Taxon	No. of protected areas that potentially occupied based on predicted distribution	No. of protected areas recorded	Total pop. recorded	Pop. in existing Protected area network	Percent. Pop. in existing protected area network (%)	No. of pop. in compl. grids	Percent. Pop. in compl. grids (%)	No. of population in compl. PA	Percent. Pop. in compl. PA (%)
<i>Saccharum officinarum</i>	39	4	66	6	9.09	7	10.61	3	4.55
<i>Saccharum robustum</i>	29	0	25	0	0.00	6	24.00	0	0.00
<i>Saccharum spontaneum</i>	312	18	149	25	16.78	23	15.44	12	8.05
<i>Salacca zalacca</i>	50	5	17	5	29.41	5	29.41	2	11.76
<i>Solanum melongena</i>	304	5	74	5	6.76	14	18.92	1	1.35
<i>Sorghum nitidum</i>	303	6	95	14	14.74	9	9.47	5	5.26
<i>Sorghum plumosum</i>	33	0	13	0	0.00	1	7.69	0	0.00
<i>Sorghum propinquum</i>	359	8	81	8	9.88	11	13.58	2	2.47
<i>Sorghum timorense</i>	23	0	13	0	0.00	3	23.08	0	0.00
<i>Syzygium aqueum</i>	119	7	39	7	17.95	10	25.64	4	10.26
<i>Syzygium cumini</i>	113	7	49	7	14.29	4	8.16	5	10.20
<i>Syzygium malaccense</i>	82	5	33	5	15.15	4	12.12	4	12.12
<i>Vigna minima</i>	76	8	32	8	25.00	7	21.88	5	15.63
<i>Vigna radiata</i>	250	7	94	7	7.45	30	31.91	2	2.13
<i>Vigna trilobata</i>	50	1	37	1	2.70	4	10.81	1	2.70
<i>Vigna umbellata</i>	39	0	20	0	0.00	2	10.00	0	0.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Amaranthus tricolor</i>	17	5.88	5.88	29.41
<i>Archidendron borneense</i>	4	25.00	25.00	75.00
<i>Archidendron bubalinum</i>	5	80.00	20.00	60.00
<i>Archidendron clypearia</i>	19	47.37	21.05	57.89
<i>Archidendron cockburnii</i>	4	0.00	0.00	75.00
<i>Archidendron contortum</i>	4	25.00	25.00	75.00
<i>Archidendron crateradenum</i>	1	0.00	0.00	100.00
<i>Archidendron ellipticum</i>	18	55.56	38.89	44.44
<i>Archidendron fagifolium</i>	17	29.41	5.88	47.06
<i>Archidendron globosum</i>	6	33.33	16.67	66.67
<i>Archidendron havilandii</i>	6	33.33	33.33	50.00
<i>Archidendron jiringa</i>	18	38.89	16.67	50.00
<i>Archidendron kunstleri</i>	4	75.00	75.00	75.00
<i>Archidendron microcarpum</i>	6	83.33	66.67	83.33
<i>Archidendron minahassae</i>	1	0.00	0.00	100.00
<i>Archidendron oppositum</i>	5	40.00	20.00	20.00
<i>Archidendron palauense</i>	9	11.11	11.11	22.22
<i>Archidendron pauciflorum</i>	10	50.00	40.00	30.00
<i>Archidendron trichophyllum</i>	4	0.00	0.00	25.00
<i>Archidendron triplinervium</i>	5	60.00	60.00	80.00
<i>Arenga pinnata</i>	18	83.33	44.44	44.44
<i>Artocarpus altilis</i>	17	41.18	29.41	35.29
<i>Artocarpus anisophyllum</i>	6	33.33	33.33	66.67
<i>Artocarpus brevipedunculatus</i>	1	100.00	100.00	100.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Artocarpus camansi</i>	4	25.00	25.00	50.00
<i>Artocarpus elasticus</i>	18	77.78	38.89	55.56
<i>Artocarpus horridus</i>	5	0.00	0.00	40.00
<i>Artocarpus integer</i>	19	52.63	31.58	47.37
<i>Artocarpus kemando</i>	7	100.00	71.43	71.43
<i>Artocarpus lanceifolius</i>	7	28.57	28.57	85.71
<i>Artocarpus lowii</i>	1	0.00	0.00	100.00
<i>Artocarpus maingayi</i>	4	0.00	0.00	50.00
<i>Artocarpus odoratissimus</i>	7	57.14	57.14	42.86
<i>Artocarpus rigidus</i>	10	60.00	40.00	50.00
<i>Artocarpus sarawakensis</i>	1	0.00	0.00	100.00
<i>Artocarpus scortechinii</i>	3	33.33	33.33	33.33
<i>Artocarpus sepicanus</i>	5	0.00	0.00	20.00
<i>Artocarpus sericicarpus</i>	12	16.67	8.33	41.67
<i>Artocarpus sumatranus</i>	2	0.00	0.00	50.00
<i>Artocarpus tamaran</i>	5	0.00	0.00	40.00
<i>Artocarpus teysmannii</i>	12	25.00	8.33	41.67
<i>Averrhoa bilimbi</i>	15	33.33	20.00	46.67
<i>Averrhoa carambola</i>	15	26.67	13.33	20.00
<i>Cajanus cajan</i>	13	7.69	7.69	46.15
<i>Cajanus goensis</i>	5	20.00	20.00	40.00
<i>Cajanus scarabaeoides</i>	9	0.00	0.00	44.44
<i>Citrus hystrix</i>	14	42.86	7.14	35.71
<i>Citrus maxima</i>	16	18.75	12.50	37.50
<i>Cocos nucifera</i>	15	20.00	6.67	46.67

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Colocasia esculenta</i>	24	62.50	25.00	33.33
<i>Colocasia gigantea</i>	14	28.57	21.43	42.86
<i>Cucumis melo</i>	11	9.09	9.09	36.36
<i>Dimocarpus longan</i>	13	38.46	23.08	30.77
<i>Dioscorea alata</i>	15	26.67	6.67	40.00
<i>Dioscorea bancana</i>	1	0.00	0.00	100.00
<i>Dioscorea elegans</i>	1	0.00	0.00	100.00
<i>Dioscorea filiformis</i>	11	18.18	18.18	36.36
<i>Dioscorea grata</i>	1	0.00	0.00	100.00
<i>Dioscorea havilandii</i>	5	40.00	40.00	100.00
<i>Dioscorea lamprocaula</i>	1	100.00	100.00	100.00
<i>Dioscorea madiunensis</i>	1	100.00	100.00	100.00
<i>Dioscorea nienhensis</i>	1	0.00	0.00	100.00
<i>Dioscorea nummularia</i>	19	5.26	5.26	31.58
<i>Dioscorea orbiculata</i>	3	0.00	0.00	66.67
<i>Dioscorea platycarpa</i>	1	0.00	0.00	100.00
<i>Dioscorea polyclados</i>	8	0.00	0.00	25.00
<i>Dioscorea prainiana</i>	4	25.00	25.00	75.00
<i>Dioscorea pubera</i>	7	14.29	14.29	14.29
<i>Dioscorea pyriformis</i>	15	60.00	26.67	40.00
<i>Dioscorea salicifolia</i>	9	33.33	22.22	55.56
<i>Dioscorea sarasinii</i>	4	25.00	25.00	25.00
<i>Dioscorea sexrimata</i>	2	0.00	0.00	50.00
<i>Dioscorea tenuifolia</i>	1	0.00	0.00	100.00
<i>Dioscorea vanvuurenii</i>	1	0.00	0.00	100.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Dioscorea vilis</i>	3	33.33	33.33	66.67
<i>Dioscorea warburgiana</i>	2	0.00	0.00	100.00
<i>Diospyros discolor</i>	5	0.00	0.00	20.00
<i>Durio affinis</i>	3	0.00	0.00	33.33
<i>Durio beccarianus</i>	2	100.00	100.00	100.00
<i>Durio bukitrayaensis</i>	2	0.00	0.00	50.00
<i>Durio carinatus</i>	5	80.00	80.00	60.00
<i>Durio dulcis</i>	4	0.00	0.00	100.00
<i>Durio graveolens</i>	6	33.33	16.67	50.00
<i>Durio kutejensis</i>	6	16.67	16.67	83.33
<i>Durio lanceolatus</i>	4	25.00	25.00	100.00
<i>Durio lissocarpus</i>	3	33.33	33.33	33.33
<i>Durio lowianus</i>	6	16.67	16.67	16.67
<i>Durio macrantha</i>	1	100.00	100.00	100.00
<i>Durio malaccensis</i>	3	33.33	33.33	33.33
<i>Durio oblongus</i>	2	0.00	0.00	50.00
<i>Durio oxleyanus</i>	4	50.00	25.00	75.00
<i>Durio testudinarius</i>	3	66.67	66.67	66.67
<i>Durio zibethinus</i>	17	47.06	29.41	70.59
<i>Ficus androchaete</i>	2	0.00	0.00	50.00
<i>Ficus aurata</i>	5	40.00	40.00	80.00
<i>Ficus aureocordata</i>	2	50.00	50.00	50.00
<i>Ficus auricoma</i>	1	0.00	0.00	100.00
<i>Ficus brunneoaurata</i>	4	75.00	50.00	25.00
<i>Ficus chartacea</i>	5	0.00	0.00	40.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Ficus deltoidea</i>	10	80.00	40.00	50.00
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	10	40.00	20.00	80.00
<i>Ficus fulva</i>	11	54.55	18.18	36.36
<i>Ficus glabristipulata</i>	1	0.00	0.00	100.00
<i>Ficus glandulifera</i>	16	50.00	37.50	31.25
<i>Ficus grossularioides</i>	16	68.75	50.00	75.00
<i>Ficus halmaherae</i>	1	0.00	0.00	100.00
<i>Ficus hirta</i>	11	54.55	9.09	72.73
<i>Ficus hirta</i> subsp. <i>dumosa</i>	1	0.00	0.00	100.00
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	2	50.00	50.00	100.00
<i>Ficus inaequipetiolata</i>	1	0.00	0.00	100.00
<i>Ficus kofmaniae</i>	2	0.00	0.00	50.00
<i>Ficus lamponga</i>	5	40.00	40.00	20.00
<i>Ficus litseifolia</i>	3	66.67	66.67	100.00
<i>Ficus oleifolia</i>	14	28.57	28.57	35.71
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	3	66.67	33.33	33.33
<i>Ficus padana</i>	14	71.43	64.29	64.29
<i>Ficus pedunculosa</i>	8	12.50	12.50	25.00
<i>Ficus ruficaulis</i>	6	33.33	16.67	16.67
<i>Ficus schefferiana</i>	5	40.00	40.00	60.00
<i>Ficus setiflora</i>	2	0.00	0.00	50.00
<i>Ficus subfulva</i>	2	50.00	50.00	50.00
<i>Ficus subglabritepala</i>	1	0.00	0.00	100.00
<i>Ficus tricolor</i>	10	30.00	20.00	40.00
<i>Ficus tricolor</i> var. <i>serroh</i>	4	25.00	25.00	25.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Garcinia celebica</i>	21	71.43	47.62	38.10
<i>Garcinia diospyrifolia</i>	4	25.00	25.00	50.00
<i>Garcinia mangostana</i>	7	57.14	42.86	71.43
<i>Garcinia nitida</i>	2	50.00	50.00	50.00
<i>Garcinia opaca</i>	1	0.00	0.00	100.00
<i>Garcinia penangiana</i>	5	40.00	40.00	40.00
<i>Garcinia rigida</i>	7	42.86	42.86	42.86
<i>Gnetum costatum</i>	2	0.00	0.00	50.00
<i>Gnetum gnemon</i>	22	59.09	40.91	40.91
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	4	25.00	25.00	25.00
<i>Gnetum gnemon</i> var. <i>gracile</i>	2	0.00	0.00	100.00
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	8	0.00	0.00	50.00
<i>Gnetum gnemon</i> var. <i>tenerum</i>	2	50.00	50.00	100.00
<i>Ipomoea aquatica</i>	16	37.50	18.75	50.00
<i>Ipomoea asarifolia</i>	2	0.00	0.00	50.00
<i>Ipomoea coptica</i>	1	0.00	0.00	100.00
<i>Ipomoea graminea</i>	1	0.00	0.00	100.00
<i>Ipomoea imperati</i>	2	0.00	0.00	50.00
<i>Ipomoea littoralis</i>	13	38.46	30.77	30.77
<i>Ipomoea obscura</i>	14	28.57	14.29	35.71
<i>Ipomoea pes-caprae</i>	20	30.00	15.00	45.00
<i>Ipomoea sagittifolia</i>	11	18.18	9.09	18.18
<i>Ipomoea stibaropoda</i>	1	0.00	0.00	100.00
<i>Lablab purpureus</i>	15	20.00	20.00	33.33
<i>Lansium domesticum</i>	15	46.67	33.33	46.67

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Mangifera altissima</i>	5	60.00	60.00	20.00
<i>Mangifera applanata</i>	8	37.50	25.00	62.50
<i>Mangifera casturi</i>	5	0.00	0.00	60.00
<i>Mangifera dewildei</i>	2	50.00	50.00	50.00
<i>Mangifera gedebe</i>	10	40.00	10.00	10.00
<i>Mangifera gracilipes</i>	4	0.00	0.00	25.00
<i>Mangifera griffithii</i>	7	57.14	57.14	57.14
<i>Mangifera lalijiwa</i>	7	14.29	14.29	28.57
<i>Mangifera laurina</i>	15	60.00	40.00	73.33
<i>Mangifera longipetiolata</i>	3	66.67	33.33	66.67
<i>Mangifera magnifica</i>	5	60.00	60.00	60.00
<i>Mangifera microphylla</i>	1	0.00	0.00	100.00
<i>Mangifera minor</i>	19	15.79	5.26	42.11
<i>Mangifera mucronulata</i>	8	25.00	25.00	25.00
<i>Mangifera oblongifolia</i>	2	0.00	0.00	50.00
<i>Mangifera orophila</i>	3	33.33	33.33	33.33
<i>Mangifera paludosa</i>	4	25.00	25.00	25.00
<i>Mangifera parvifolia</i>	5	40.00	20.00	40.00
<i>Mangifera pedicellata</i>	7	0.00	0.00	14.29
<i>Mangifera quadrifida</i>	12	50.00	41.67	50.00
<i>Mangifera rigida</i>	2	0.00	0.00	50.00
<i>Mangifera rubropetala</i>	2	50.00	50.00	50.00
<i>Mangifera rufocostata</i>	5	60.00	40.00	40.00
<i>Mangifera similis</i>	5	20.00	20.00	20.00
<i>Mangifera sulavesiana</i>	4	0.00	0.00	50.00

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Mangifera sumbawaensis</i>	4	25.00	25.00	25.00
<i>Mangifera swintonioides</i>	5	40.00	40.00	20.00
<i>Mangifera timorensis</i>	6	16.67	16.67	66.67
<i>Mangifera torquenda</i>	5	40.00	20.00	40.00
<i>Metroxylon sagu</i>	12	33.33	8.33	16.67
<i>Momordica charantia</i>	17	29.41	23.53	58.82
<i>Musa acuminata</i>	18	38.89	33.33	61.11
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	6	33.33	16.67	33.33
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	9	22.22	11.11	55.56
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	1	0.00	0.00	100.00
<i>Musa acuminata</i> var. <i>sumatrana</i>	6	50.00	50.00	66.67
<i>Musa acuminata</i> var. <i>tomentosa</i>	10	10.00	10.00	10.00
<i>Musa balbisiana</i>	7	28.57	14.29	28.57
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	1	0.00	0.00	100.00
<i>Musa celebica</i>	3	33.33	33.33	33.33
<i>Musa lanceolata</i>	1	0.00	0.00	100.00
<i>Musa schizocarpa</i>	3	33.33	66.67	33.33
<i>Nephelium lappaceum</i>	13	38.46	30.77	46.15
<i>Ocimum americanum</i>	8	0.00	0.00	50.00
<i>Oryza longiglumis</i>	1	0.00	0.00	100.00
<i>Oryza meyeriana</i>	14	57.14	14.29	14.29
<i>Oryza minuta</i>	12	16.67	8.33	16.67
<i>Oryza officinalis</i>	13	30.77	38.46	46.15
<i>Oryza ridleyi</i>	7	42.86	28.57	28.57
<i>Oryza rufipogon</i>	12	8.33	8.33	41.67

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Oryza schlechteri</i>	2	0.00	0.00	50.00
<i>Parkia singularis</i>	5	40.00	40.00	20.00
<i>Parkia speciosa</i>	12	41.67	25.00	41.67
<i>Parkia sumatrana</i>	6	33.33	16.67	33.33
<i>Parkia timoriana</i>	10	40.00	30.00	30.00
<i>Parkia versteeghii</i>	2	100.00	100.00	50.00
<i>Pometia pinnata</i>	21	80.95	52.38	57.14
<i>Rubus acuminatissimus</i>	4	50.00	50.00	75.00
<i>Rubus alpestris</i>	6	50.00	66.67	50.00
<i>Rubus banghamii</i>	2	50.00	50.00	50.00
<i>Rubus ferdinandimuelleri</i>	3	100.00	66.67	66.67
<i>Rubus fraxinifolius</i>	14	50.00	21.43	42.86
<i>Rubus lineatus</i>	8	75.00	50.00	50.00
<i>Rubus lorentzianus</i>	2	100.00	100.00	50.00
<i>Rubus macgregorii</i>	3	0.00	0.00	66.67
<i>Rubus niveus</i>	6	16.67	16.67	16.67
<i>Rubus papuanus</i>	2	50.00	50.00	50.00
<i>Rubus rosifolius</i>	19	47.37	15.79	26.32
<i>Rubus sumatranus</i>	7	28.57	28.57	42.86
<i>Saccharum officinarum</i>	17	29.41	17.65	35.29
<i>Saccharum robustum</i>	7	0.00	0.00	28.57
<i>Saccharum spontaneum</i>	21	57.14	33.33	57.14
<i>Salacca zalacca</i>	8	50.00	25.00	50.00
<i>Solanum melongena</i>	18	27.78	5.56	33.33
<i>Sorghum nitidum</i>	19	36.84	21.05	31.58

Appendix 22 Percentage of ecogeographic diversity in protected area network, complementary PA, and complementary grids based on ELC generalist map (contd.)

Taxon	Total ELC category diversity based on the generalist ELC map	Percentage of ELC generalist category diversity in PA network (%)	Percentage of ELC generalist category in complementary PA (%)	Percentage of ELC generalist category in complementary Grid (%)
<i>Sorghum plumosum</i>	6	0.00	0.00	16.67
<i>Sorghum propinquum</i>	17	35.29	11.76	35.29
<i>Sorghum timorense</i>	5	0.00	0.00	40.00
<i>Syzygium aqueum</i>	15	33.33	26.67	46.67
<i>Syzygium cumini</i>	16	43.75	31.25	25.00
<i>Syzygium malaccense</i>	15	26.67	26.67	26.67
<i>Vigna minima</i>	11	45.45	27.27	36.36
<i>Vigna radiata</i>	19	15.79	10.53	57.89
<i>Vigna trilobata</i>	10	10.00	10.00	30.00
<i>Vigna umbellata</i>	13	0.00	0.00	15.38

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Amaranthus tricolor</i>	45	47	9	16	66	15	14	55	10	13	49	8	16
<i>Archidendron borneense</i>	45	30	51	131	47	41	67	34	47	133	3	7	59
<i>Archidendron bubalinum</i>	45	75	18	19	20	8	17	11	12	12	63	31	11
<i>Archidendron clypearia</i>	45	20	0	15	16	2	11	76	24	56	84	1	40
<i>Archidendron cockburnii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron contortum</i>	45	26	3	36	83	33	91	83	11	88	46	10	88
<i>Archidendron crateradenum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron ellipticum</i>	45	50	32	8	55	13	29	3	13	0	11	23	9
<i>Archidendron fagifolium</i>	45	25	15	76	12	9	15	28	16	24	0	0	26
<i>Archidendron globosum</i>	45	35	47	23	17	30	25	23	46	30	35	109	79
<i>Archidendron havilandii</i>	45	112	54	13	109	61	16	55	11	0	58	46	11
<i>Archidendron jiringa</i>	45	128	20	27	46	7	0	22	17	4	26	2	0
<i>Archidendron kunstleri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron microcarpum</i>	45	2	4	24	4	16	83	1	3	24	14	11	88
<i>Archidendron minahassae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron oppositum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron palauense</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron pauciflorum</i>	45	18	0	1	26	7	6	20	6	1	22	2	0
<i>Archidendron trichophyllum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron triplinervium</i>	45	15	6	28	30	6	26	15	4	18	17	28	110
<i>Arenga pinnata</i>	47	70	29	35	30	13	62	15	0	19	38	5	15
<i>Artocarpus altilis</i>	47	42	15	11	65	10	27	45	16	67	34	14	16
<i>Artocarpus anisophyllus</i>	47	45	17	118	13	11	64	43	19	111	52	9	55
<i>Artocarpus brevipedunculatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus camansi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Artocarpus elasticus</i>	47	3	7	59	6	13	49	5	121	1	2	46	2
<i>Artocarpus horridus</i>	47	2	47	5	21	114	32	26	129	31	11	88	9
<i>Artocarpus integer</i>	47	19	0	0	40	34	42	76	16	13	127	19	37
<i>Artocarpus kemando</i>	47	57	4	107	7	14	29	32	6	44	1	0	5
<i>Artocarpus lanceifolius</i>	47	31	57	28	9	66	15	5	139	25	4	15	8
<i>Artocarpus lowii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus maingayi</i>	47	8	6	22	13	9	49	8	5	49	21	12	48
<i>Artocarpus odoratissimus</i>	47	36	3	10	41	24	38	33	19	34	54	39	67
<i>Artocarpus rigidus</i>	47	15	19	52	18	19	88	22	19	84	11	9	20
<i>Artocarpus sarawakensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus scortechinii</i>	47	67	9	50	21	42	19	2	41	39	3	20	33
<i>Artocarpus sepicanus</i>	47	8	53	33	16	76	26	8	40	19	3	24	12
<i>Artocarpus sericarpus</i>	47	94	18	7	32	0	8	30	3	15	68	13	8
<i>Artocarpus sumatranus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus tamaran</i>	47	19	67	12	6	62	11	6	58	12	0	27	35
<i>Artocarpus teysmannii</i>	47	12	4	45	11	7	37	11	4	45	13	15	55
<i>Averrhoa bilimbi</i>	47	22	5	0	17	5	2	30	1	3	77	16	0
<i>Averrhoa carambola</i>	47	151	29	35	143	33	36	48	2	9	46	5	7
<i>Cajanus cajan</i>	45	2	21	41	0	48	141	0	16	57	18	50	32
<i>Cajanus goensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cajanus scarabaeoides</i>	45	80	22	29	11	1	0	18	2	2	41	15	29
<i>Citrus hystrix</i>	45	5	1	0	75	36	19	3	10	85	54	2	32
<i>Citrus maxima</i>	45	43	15	13	73	33	16	77	44	20	27	33	12
<i>Cocos nucifera</i>	45	30	7	78	22	1	151	9	2	79	30	6	54
<i>Colocasia esculenta</i>	45	16	38	75	23	45	70	19	52	69	2	15	17

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Colocasia gigantea</i>	45	49	6	15	24	3	3	32	6	9	48	5	14
<i>Cucumis melo</i>	45	8	47	19	12	74	27	5	61	39	43	57	22
<i>Dimocarpus longan</i>	45	11	27	7	7	59	28	12	56	36	24	85	9
<i>Dioscorea alata</i>	45	41	57	3	22	65	6	7	14	1	10	28	1
<i>Dioscorea bancana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea elegans</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea filiformis</i>	45	4	53	23	12	58	56	1	3	51	15	3	28
<i>Dioscorea grata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea havilandii</i>	45	1	7	10	9	13	17	6	9	20	18	40	54
<i>Dioscorea lamprocaula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea madiunensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea nienwenhuisii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea nummularia</i>	45	57	13	18	60	18	19	43	13	13	26	9	54
<i>Dioscorea orbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea platycarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea polyclados</i>	45	41	11	21	22	12	7	54	32	48	27	12	31
<i>Dioscorea prainiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea pubera</i>	45	23	17	2	19	13	2	15	10	2	78	22	3
<i>Dioscorea pyriformis</i>	45	71	11	19	64	7	24	28		15	41	6	29
<i>Dioscorea salicifolia</i>	45	9	63	14	10	79	3	15	96	52	9	27	5
<i>Dioscorea sarasinii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea sexrimata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea tenuifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea vanvuurenii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea vilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Dioscorea warburgiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Diospyros discolor</i>	45	41	22	7	39	25	7	49	37	16	29	55	24
<i>Durio affinis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio beccarianus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio bukitrayaensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio carinatus</i>	45	78	7	8	0	1	3	35	0	12	35	7	42
<i>Durio dulcis</i>	45	19	22	101	23	23	107	11	45	88	8	21	70
<i>Durio graveolens</i>	45	37	2	39	0	2	0	1	36	11	10	90	39
<i>Durio kutejensis</i>	45	24	0	10	21	4	10	77	27	43	82	2	28
<i>Durio lanceolatus</i>	45	17	0	47	31	0	95	3	0	34	56	16	104
<i>Durio lissocarpus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio lowianus</i>	45	61	14	2	94	10	4	54	9	5	73	16	4
<i>Durio macrantha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio malaccensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oblongus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oxleyanus</i>	45	23	2	8	0	59	4	11	18	4	1	2	1
<i>Durio testudinarius</i>	45	11	30	48	0	14	28	2	14	23	5	24	0
<i>Durio zibethinus</i>	45	60	0	0	41	0	1	90	7	75	9	13	83
<i>Ficus androchaete</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus aurata</i>	45	23	19	76	1	4	19	8	1	18	9	2	48
<i>Ficus aureocordata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus auricoma</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus brunneoaurata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus chartacea</i>	45	2	27	51	6	53	59	13	30	42	0	15	44
<i>Ficus deltoidea</i>	45	28	1	60	6	25	84	0	13	51	3	1	20

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	45	44	76	42	22	56	21	22	58	20	32	49	15
<i>Ficus fulva</i>	45	18	7	57	14	3	5	29	51	1	19	18	0
<i>Ficus glabristipulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus glandulifera</i>	45	9	50	20	4	70	38	21	34	34	8	31	26
<i>Ficus grossularioides</i>	45	7	0	0	42	44	43	13	6	10	1	15	1
<i>Ficus halmaherae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i>	45	13	24	27	4	2	9	12	17	33	13	19	41
<i>Ficus hirta</i> subsp. <i>dumosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus inaequipetiolata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus kofmaniae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus lamponga</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus litseifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus oleifolia</i>	45	91	32	9	30	4	17	29	10	12	15	0	2
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	45	32	39	4	91	22	10	91	18	9	25	28	10
<i>Ficus padana</i>	45	14	13	20	14	19	19	8	6	9	8	8	7
<i>Ficus pedunculosa</i>	45	1	1	0	42	30	36	14	5	10	44	91	93
<i>Ficus ruficaulis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus schefferiana</i>	45	26	34	0	23	37	20	39	36	53	6	6	16
<i>Ficus setiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subfulva</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subglabripetala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus tricolor</i>	45	38	37	93	17	3	58	10	9	50	13	1	12
<i>Ficus tricolor</i> var. <i>serroh</i>	45	40	15	10	18	12	5	58	8	10	29	11	6
<i>Garcinia celebica</i>	45	0	0	1	24	58	27	39	20	39	5	13	73

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Garcinia diospyrifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia mangostana</i>	45	59	52	75	34	7	10	119	28	52	1	30	7
<i>Garcinia nitida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia opaca</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia penangiana</i>	45	50	5	82	19	0	34	20	1	32	41	5	42
<i>Garcinia rigida</i>	45	2	24	45	34	69	115	28	62	113	0	14	23
<i>Gnetum costatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i>	45	13	34	12	45	94	28	14	32	8	24	59	42
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>gracile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	45	24	63	4	10	34	99	10	37	25	67	5	10
<i>Gnetum gnemon</i> var. <i>tenerum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea aquatica</i>	45	43	17	34	54	13	35	19	17	7	16	6	15
<i>Ipomoea asarifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea coptica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea graminea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea imperati</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea littoralis</i>	45	60	0	32	55	0	6	62	2	9	8	5	15
<i>Ipomoea obscura</i>	45	83	53	108	34	22	31	90	51	93	15	6	16
<i>Ipomoea pes-caprae</i>	45	12	8	49	51	0	5	11	89	41	24	27	20
<i>Ipomoea sagittifolia</i>	45	7	31	2	25	89	16	12	43	8	29	120	35
<i>Ipomoea stibaropoda</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lablab purpureus</i>	45	60	7	12	24	10	2	31	6	6	80	10	30
<i>Lansium domesticum</i>	45	22	9	3	79	17	12	21	0	0	78	55	12

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Mangifera altissima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera applanata</i>	45	74	51	29	49	16	29	71	39	32	20	10	11
<i>Mangifera casturi</i>	45	20	13	46	64	11	29	20	6	53	3	3	25
<i>Mangifera dewildei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera gedebe</i>	45	86	39	36	47	18	16	52	16	17	51	21	17
<i>Mangifera gracilipes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera griffithii</i>	45	44	31	30	35	22	37	35	31	17	66	41	24
<i>Mangifera lalijiwa</i>	45	30	46	35	14	44	6	4	9	2	9	13	9
<i>Mangifera laurina</i>	45	71	76	23	27	1	20	26	4	20	44	30	39
<i>Mangifera longipetiolata</i>	45	53	15	19	24	8	8	36	16	10	4	1	1
<i>Mangifera magnifica</i>	45	19	17	50	0	2	0	0	0	32	27	87	26
<i>Mangifera microphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera minor</i>	45	23	13	7	25	19	9	65	38	22	15	27	44
<i>Mangifera mucronulata</i>	45	30	38	57	37	19	52	14	14	44	6	10	20
<i>Mangifera oblongifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera orophila</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera paludosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera parvifolia</i>	45	12	108	148	2	26	37	12	134	154	0	16	57
<i>Mangifera pedicellata</i>	45	7	0	34	27	3	41	15	3	20	1	0	7
<i>Mangifera quadrifida</i>	45	9	26	15	26	37	44	11	27	10	37	35	21
<i>Mangifera rigida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rubropetala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rufocostata</i>	45	18	38	22	34	37	15	47	46	13	59	62	24
<i>Mangifera similis</i>	45	7	37	3	9	73	11	10	69	14	35	58	5
<i>Mangifera sulavesiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Mangifera sumbawaensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera swintonioides</i>	45	14	17	28	20	14	22	22	0	54	44	0	63
<i>Mangifera timorensis</i>	45	16	8	24	15	15	25	13	23	44	23	15	45
<i>Mangifera torquenda</i>	45	16	25	20	7	33	3	32	85	24	0	1	0
<i>Metroxylon sagu</i>	45	13	3	21	111	28	153	96	41	139	30	43	57
<i>Momordica charantia</i>	45	69	0	8	25	2	4	45	3	9	29	0	4
<i>Musa acuminata</i>	45	1	0	1	29	49	14	28	8	9	65	3	76
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	36	6	90	51	2	39	29	7	86	54	6	34	23
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	45	12	39	1	14	49	1	35	36	3	35	78	10
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa acuminata</i> var. <i>sumatrana</i>	45	8	9	32	7	30	107	8	31	105	5	10	29
<i>Musa acuminata</i> var. <i>tomentosa</i>	45	80	60	20	88	30	16	49	9	10	8	2	2
<i>Musa balbisiana</i>	45	9	13	21	9	14	49	13	10	28	14	48	12
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa celebica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa lanceolata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa schizocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Nephelium lappaceum</i>	45	20	10	35	31	4	139	15	9	47	3	1	3
<i>Ocimum americanum</i>	45	93	10	54	15	10	10	23	6	14	34	4	9
<i>Oryza longiglumis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oryza meyeriana</i>	45	45	12	13	55	12	20	36	6	16	61	38	11
<i>Oryza minuta</i>	45	47	61	0	13	28	20	32	0	23	49	5	20

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Oryza officinalis</i>	45	3	2	7	44	11	60	4	0	9	53	33	43
<i>Oryza ridleyi</i>	45	13	182	82	15	168	70	2	42	21	0	0	1
<i>Oryza rufipogon</i>	45	6	4	4	44	24	58	8	1	18	20	71	19
<i>Oryza schlechteri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Parkia singularis</i>	45	18	2	6	16	3	74	4	47	33	17	29	56
<i>Parkia speciosa</i>	45	9	51	13	13	73	42	10	63	29	30	112	34
<i>Parkia sumatrana</i>	45	53	18	23	27	1	21	29	4	23	27	1	17
<i>Parkia timoriana</i>	45	8	1	5	65	3	54	5	5	42	10	34	56
<i>Parkia versteeghii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pometia pinnata</i>	45	29	96	71	0	56	48	7	64	44	4	11	11
<i>Rubus acuminatissimus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus alpestris</i>	45	6	50	14	2	43	24	6	56	51	24	97	20
<i>Rubus banghamii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus ferdinandimuelleri</i>	45	34	7	1	42	13	10	50	22	10	82	19	3
<i>Rubus fraxinifolius</i>	45	11	31	88	3	36	53	9	15	65	6	10	17
<i>Rubus lineatus</i>	45	43	56	21	8	0	6	66	6	46	20	2	116
<i>Rubus lorentzianus</i>	36	69	34	50	80	30	47	40	43	28	29	19	37
<i>Rubus macgregorii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus niveus</i>	45	38	123	0	20	58	15	71	5	5	14	0	5
<i>Rubus papuanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus rosifolius</i>	45	85	64	96	82	72	91	38	18	24	25	31	33
<i>Rubus sumatranus</i>	45	3	33	5	14	59	8	11	55	6	7	73	7
<i>Saccharum officinarum</i>	45	26	4	95	8	7	58	2	13	48	14	2	62
<i>Saccharum robustum</i>	45	44	2	16	123	14	28	114	13	66	56	1	14
<i>Saccharum spontaneum</i>	45	17	9	62	25	5	53	26	9	63	27	28	87

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone												
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Zone 13
<i>Salacca zalacca</i>	45	13	60	36	1	12	8	0	10	14	5	38	15
<i>Solanum melongena</i>	45	12	27	80	12	44	75	3	26	70	2	34	71
<i>Sorghum nitidum</i>	45	2	70	13	4	64	19	19	79	23	0	45	15
<i>Sorghum plumosum</i>	45	1	0	113	4	1	44	2	0	109	3	5	30
<i>Sorghum propinquum</i>	45	78	4	109	48	26	49	49	11	56	5	5	28
<i>Sorghum timorense</i>	45	7	52	23	13	17	7	17	39	13	3	41	25
<i>Syzygium aqueum</i>	45	39	19	39	30	10	18	27	13	16	59	24	41
<i>Syzygium cumini</i>	45	17	35	118	17	23	55	18	15	54	6	0	10
<i>Syzygium malaccense</i>	45	98	19	11	56	15	2	74	22	7	37	6	4
<i>Vigna minima</i>	45	51	80	9	19	49	13	43	2	18	37	6	44
<i>Vigna radiata</i>	45	1	0	19	20	1	84	8	0	57	12	13	64
<i>Vigna trilobata</i>	45	13	41	11	16	42	16	85	61	24	2	16	0
<i>Vigna umbellata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Amaranthus tricolor</i>	119	23	34	113	25	31	44	2	12	51	7	6	45	5	3
<i>Archidendron borneense</i>	33	26	64	10	7	55	6	1	29	19	4	33	5	2	26
<i>Archidendron bubalinum</i>	44	23	14	51	83	33	7	2	9	55	23	48	4	13	11
<i>Archidendron clypearia</i>	72	11	69	39	3	29	24	1	25	20	3	29	9	0	12
<i>Archidendron cockburnii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron contortum</i>	12	0	29	25	6	34	19	11	53	0	0	1	0	1	-
<i>Archidendron crateradenum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron ellipticum</i>	21	32	15	4	7	3	24	50	7	15	34	6	56	128	2
<i>Archidendron fagifolium</i>	50	15	21	6	2	26	23	68	10	48	38	23	37	58	-
<i>Archidendron globosum</i>	15	55	30	35	100	63	7	20	10	11	22	28	6	21	14
<i>Archidendron havilandii</i>	55	60	10	56	23	3	21	8	2	22	8	3	46	11	1
<i>Archidendron jiringa</i>	77	17	1	61	63	9	9	7	37	14	1	30	17	3	-
<i>Archidendron kunstleri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron microcarpum</i>	3	10	53	0	13	79	13	9	50	12	20	59	3	31	76
<i>Archidendron minahassae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron oppositum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron palauense</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron pauciflorum</i>	73	3	12	64	12	9	121	13	33	56	13	10	67	29	6
<i>Archidendron trichophyllum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Archidendron triplinervium</i>	10	4	24	19	29	115	14	13	58	59	17	75	19	14	60
<i>Arenga pinnata</i>	29	6	41	66	12	95	24	3	15	27	2	20	16	0	15
<i>Artocarpus altilis</i>	78	16	21	51	12	35	56	44	26	8	4	1	5	11	5
<i>Artocarpus anisophyllus</i>	27	15	44	67	12	57	14	0	21	11	8	15	17	1	22

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Artocarpus brevipedunculatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus camansi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus elasticus</i>	2	20	0	27	0	4	80	8	16	101	1	48	-	-	-
<i>Artocarpus horridus</i>	4	47	6	6	42	8	0	61	14	64	9	0	61	8	-
<i>Artocarpus integer</i>	36	12	14	47	12	9	18	7	6	39	15	13	34	12	7
<i>Artocarpus kemando</i>	25	11	31	30	5	23	4	2	31	41	20	68	17	3	37
<i>Artocarpus lanceifolius</i>	5	48	17	14	1	9	31	48	1	46	18	0	20	2	-
<i>Artocarpus lowii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus maingayi</i>	45	23	95	46	20	98	74	20	68	36	11	49	11	5	38
<i>Artocarpus odoratissimus</i>	61	58	64	60	69	69	24	6	33	25	16	29	26	14	33
<i>Artocarpus rigidus</i>	26	7	56	23	8	65	46	66	58	11	18	27	18	29	35
<i>Artocarpus sarawakensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus scortechinii</i>	0	99	31	0	56	15	2	20	4	13	12	0	18	-	-
<i>Artocarpus sepicanus</i>	10	37	9	3	18	8	25	112	79	14	93	53	28	87	66
<i>Artocarpus sericicarpus</i>	53	2	18	77	11	79	16	1	81	0	19	12	5	-	-
<i>Artocarpus sumatranus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Artocarpus tamaran</i>	11	48	35	9	53	16	2	56	48	24	109	50	19	103	-
<i>Artocarpus teysmannii</i>	14	10	72	13	16	65	47	23	138	8	6	50	46	20	120
<i>Averrhoa bilimbi</i>	69	12	6	24	2	59	18	2	76	15	8	92	41	27	-
<i>Averrhoa carambola</i>	43	5	6	22	0	4	66	16	5	64	19	6	82	6	7
<i>Cajanus cajan</i>	2	6	5	9	30	1	26	30	0	8	1	28	72	-	-
<i>Cajanus goensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cajanus scarabaeoides</i>	99	46	74	75	40	56	51	13	15	60	7	24	87	17	27
<i>Citrus hystrix</i>	26	0	8	13	4	39	31	0	41	34	27	76	94	-	-
<i>Citrus maxima</i>	39	43	10	30	28	27	75	26	25	9	1	1	10	1	2

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Cocos nucifera</i>	0	0	16	11	0	72	7	2	26	5	0	23	6	0	32
<i>Colocasia esculenta</i>	15	51	73	12	53	78	7	1	27	34	25	50	27	27	43
<i>Colocasia gigantea</i>	103	19	30	40	1	9	57	7	10	23	3	8	77	18	25
<i>Cucumis melo</i>	10	11	1	8	4	4	14	27	8	9	69	25	18	34	50
<i>Dimocarpus longan</i>	1	17	2	4	17	1	14	51	13	50	125	38	45	133	47
<i>Dioscorea alata</i>	6	21	2	11	85	12	10	53	2	16	69	6	5	74	4
<i>Dioscorea bancana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea elegans</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea filiformis</i>	14	5	79	14	1	34	15	6	29	19	11	81	14	0	-
<i>Dioscorea grata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea havilandii</i>	18	43	40	16	34	88	24	40	65	16	46	32	8	20	34
<i>Dioscorea lamprocaula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea madiunensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea niewenhuisii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea nummularia</i>	32	4	40	20	10	21	94	21	54	98	25	47	44	11	14
<i>Dioscorea orbiculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea platycarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea polyclados</i>	19	4	16	38	11	36	28	24	26	59	61	29	14	1	5
<i>Dioscorea prainiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea pubera</i>	82	48	26	72	47	19	70	41	9	72	47	12	56	47	9
<i>Dioscorea pyrifolia</i>	44	6	33	46	52	118	25	30	107	21	31	50	2	19	-
<i>Dioscorea salicifolia</i>	31	82	1	2	33	8	15	81	11	14	0	0	1	19	6
<i>Dioscorea sarasinii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea sexrimata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea tenuifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea vanvuurenii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Dioscorea vilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dioscorea warburgiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Diospyros discolor</i>	31	53	21	17	24	20	58	74	46	57	69	53	46	38	69
<i>Durio affinis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio beccarianus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio bukitrayaensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio carinatus</i>	33	19	80	39	2	49	20	2	16	20	8	57	31	0	27
<i>Durio dulcis</i>	10	18	74	2	13	21	24	40	23	36	0	39	41	-	-
<i>Durio graveolens</i>	48	119	4	67	79	7	47	35	4	31	30	0	9	-	-
<i>Durio kutejensis</i>	99	14	57	50	1	12	51	0	21	26	2	13	24	1	3
<i>Durio lanceolatus</i>	21	2	38	44	36	106	0	0	2	16	2	59	0	1	-
<i>Durio lissocarpus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio lowianus</i>	61	12	1	73	39	7	21	12	5	21	3	1	37	7	5
<i>Durio macrantha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio malaccensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oblongus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Durio oxleyanus</i>	43	11	12	1	23	2	7	5	51	8	19	9	65	10	18
<i>Durio testudinarius</i>	46	70	0	16	25	17	46	59	2	28	48	12	59	80	-
<i>Durio zibethinus</i>	13	18	30	0	7	116	22	29	122	27	28	62	2	8	-
<i>Ficus androchaete</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus aurata</i>	1	2	39	27	12	111	8	2	33	24	32	107	9	2	39
<i>Ficus aureocordata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus auricoma</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus brunneoaurata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus chartacea</i>	7	28	44	4	6	24	0	13	36	3	10	21	17	34	70
<i>Ficus deltoidea</i>	4	7	33	0	5	105	7	2	61	8	24	70	2	12	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	49	105	23	57	103	21	20	22	8	13	22	5	10	19	5
<i>Ficus fulva</i>	17	13	0	22	18	4	38	48	0	114	57	46	31	-	-
<i>Ficus glabristipulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus glandulifera</i>	0	76	33	6	19	18	6	14	30	6	2	24	19	54	-
<i>Ficus grossularioides</i>	8	27	9	39	66	19	46	109	36	8	39	12	18	43	14
<i>Ficus halmaherae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i>	20	28	39	22	36	38	14	38	22	30	48	58	19	36	30
<i>Ficus hirta</i> subsp. <i>dumosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus inaequipetiolata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus kofmaniae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus lamponga</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus litseifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus oleifolia</i>	11	1	14	73	17	26	49	10	9	53	14	81	43	7	16
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	20	6	4	28	11	2	46	79	14	86	32	14	85	28	14
<i>Ficus padana</i>	15	9	10	61	42	48	53	79	36	72	39	35	40	15	32
<i>Ficus pedunculosa</i>	35	43	44	52	87	74	13	15	24	16	26	29	10	20	23
<i>Ficus ruficaulis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus schefferiana</i>	1	7	22	1	13	79	8	47	139	4	45	144	5	-	-
<i>Ficus setiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subfulva</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus subglabritepala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ficus tricolor</i>	10	8	49	3	59	13	5	21	42	1	81	16	1	28	-
<i>Ficus tricolor</i> var. <i>serroh</i>	26	44	26	2	1	2	62	23	9	43	35	19	94	13	32

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Garcinia celebica</i>	9	10	21	13	6	24	14	15	90	7	32	43	19	23	58
<i>Garcinia diospyrifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia mangostana</i>	40	0	0	0	16	20	28	66	20	60	23	4	12	-	-
<i>Garcinia nitida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia opaca</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Garcinia penangiana</i>	77	12	81	67	13	91	19	4	29	47	5	55	42	7	60
<i>Garcinia rigida</i>	6	22	56	6	22	53	0	64	55	0	35	9	0	36	13
<i>Gnetum costatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i>	0	13	6	5	4	9	12	40	15	10	38	4	54	87	19
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>gracile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	13	34	2	3	23	42	2	14	14	29	2	1	44	80	20
<i>Gnetum gnemon</i> var. <i>tenerum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea aquatica</i>	62	15	30	12	7	10	26	22	21	20	4	2	38	74	29
<i>Ipomoea asarifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea coptica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea graminea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea imperati</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ipomoea littoralis</i>	4	27	31	17	31	79	33	43	1	38	32	2	17	-	-
<i>Ipomoea obscura</i>	13	12	13	12	6	12	27	21	64	17	19	69	27	11	68
<i>Ipomoea pes-caprae</i>	0	28	17	2	45	14	4	47	22	2	91	63	11	-	-
<i>Ipomoea sagittifolia</i>	3	43	4	19	127	15	1	0	0	25	47	13	1	1	-
<i>Ipomoea stibaropoda</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Lablab purpureus</i>	119	37	15	54	9	12	23	0	8	1	1	85	4	15	-
<i>Lansium domesticum</i>	50	9	11	100	5	28	32	13	2	28	10	5	50	3	16
<i>Mangifera altissima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera applanata</i>	17	5	11	21	12	9	86	61	38	48	25	39	90	55	40
<i>Mangifera casturi</i>	14	1	24	22	11	74	35	13	95	36	13	31	24	6	57
<i>Mangifera dewildei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera gedebe</i>	0	0	0	1	0	0	28	20	18	147	86	87	129	66	88
<i>Mangifera gracilipes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera griffithii</i>	21	15	15	32	36	14	4	8	2	16	27	48	10	33	9
<i>Mangifera lalijiwa</i>	19	38	7	15	76	18	29	45	24	20	48	8	23	55	32
<i>Mangifera laurina</i>	1	90	49	11	9	9	59	47	1	18	2	1	-	-	-
<i>Mangifera longipetiolata</i>	54	11	38	38	8	16	96	43	22	59	20	22	83	25	17
<i>Mangifera magnifica</i>	8	53	26	13	45	19	12	29	70	77	125	82	81	138	-
<i>Mangifera microphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera minor</i>	20	23	33	15	11	13	78	107	64	75	107	53	28	40	19
<i>Mangifera mucronulata</i>	7	9	24	6	3	25	33	34	96	24	15	48	49	43	111
<i>Mangifera oblongifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera orophila</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera paludosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera parvifolia</i>	0	43	93	0	21	54	0	1	29	52	0	0	-	-	-
<i>Mangifera pedicellata</i>	18	2	18	64	16	36	49	4	119	24	8	73	17	10	46
<i>Mangifera quadrifida</i>	58	37	31	18	35	12	58	110	19	16	38	16	55	102	29
<i>Mangifera rigida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rubropetala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera rufocostata</i>	29	21	8	74	23	15	11	5	0	70	45	24	9	3	1
<i>Mangifera similis</i>	5	10	1	7	16	2	23	76	7	16	124	13	20	115	16

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Mangifera sulavesiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera sumbawaensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mangifera swintonioides</i>	22	0	57	45	25	135	45	12	82	41	32	151	-	-	-
<i>Mangifera timorensis</i>	38	27	79	41	37	78	46	14	28	53	23	72	35	17	58
<i>Mangifera torquenda</i>	1	0	21	53	13	49	66	76	64	98	41	14	33	17	-
<i>Metroxylon sagu</i>	30	26	49	31	24	47	14	38	28	2	3	5	2	3	4
<i>Momordica charantia</i>	25	3	5	107	25	17	61	7	5	97	31	19	17	-	-
<i>Musa acuminata</i>	6	8	14	17	3	18	37	9	36	36	32	48	57	24	52
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	13	62	76	10	30	32	5	54	40	2	18	17	4	52	43
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	29	76	11	66	65	36	39	97	9	41	93	6	14	25	7
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa acuminata</i> var. <i>sumatrana</i>	2	10	52	3	9	52	26	57	87	6	16	40	6	17	46
<i>Musa acuminata</i> var. <i>tomentosa</i>	14	1	0	91	15	18	33	18	2	59	13	11	41	14	5
<i>Musa balbisiana</i>	2	2	8	25	10	13	16	45	46	9	34	99	30	27	58
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa celebica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa lanceolata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Musa schizocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Nephelium lappaceum</i>	3	0	14	28	7	73	69	40	48	1	0	15	13	8	28
<i>Ocimum americanum</i>	62	32	38	46	10	17	16	6	19	1	38	43	7	46	-
<i>Oryza longiglumis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oryza meyeriana</i>	49	20	4	45	10	14	85	34	27	97	36	29	64	11	17

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Oryza minuta</i>	82	9	23	79	8	38	77	10	15	104	22	28	120	31	-
<i>Oryza officinalis</i>	25	7	17	1	0	17	18	15	52	23	10	49	57	4	119
<i>Oryza ridleyi</i>	0	59	21	0	50	21	0	65	16	0	100	39	-	-	-
<i>Oryza rufipogon</i>	10	9	2	0	0	4	8	29	50	15	24	46	43	50	107
<i>Oryza schlechteri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Parkia singularis</i>	2	75	27	8	23	61	25	50	52	2	42	35	2	29	-
<i>Parkia speciosa</i>	8	46	14	28	116	40	4	27	1	17	64	30	3	36	3
<i>Parkia sumatrana</i>	13	6	31	51	11	37	49	16	45	51	3	60	39	3	34
<i>Parkia timoriana</i>	10	50	33	1	45	49	18	71	17	1	18	61	3	79	-
<i>Parkia versteeghii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pometia pinnata</i>	1	19	16	4	25	19	0	1	1	8	64	18	5	32	6
<i>Rubus acuminatissimus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus alpestris</i>	0	39	24	9	18	60	12	0	0	61	40	2	5	-	-
<i>Rubus banghamii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus ferdinandmuelleri</i>	20	11	1	22	1	56	10	12	83	26	38	79	37	23	-
<i>Rubus fraxinifolius</i>	9	50	36	0	0	1	3	8	26	1	13	28	26	33	77
<i>Rubus lineatus</i>	25	0	57	39	7	30	13	0	37	10	0	20	13	2	-
<i>Rubus lorentzianus</i>	29	18	31	14	30	31	31	12	29	28	19	26	21	50	13
<i>Rubus macgregorii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus niveus</i>	28	0	7	26	1	3	25	9	77	5	2	57	17	-	-
<i>Rubus papuanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rubus rosifolius</i>	27	30	32	14	22	17	13	2	18	19	5	25	48	19	56
<i>Rubus sumatranus</i>	41	123	20	34	126	24	0	37	9	10	47	6	11	63	8
<i>Saccharum officinarum</i>	9	5	51	4	9	31	0	0	6	13	11	48	13	31	64
<i>Saccharum robustum</i>	2	0	1	0	96	1	26	52	2	10	33	4	-	-	-
<i>Saccharum spontaneum</i>	6	6	22	9	8	27	4	0	2	59	17	37	39	33	54

Appendix 23 Representativeness of ELC categories on the existing PAs network based on species-specific ELC maps (*contd.*)

Taxon	Number of protected area containing ELC zone														
	Zone 14	Zone 15	Zone 16	Zone 17	Zone 18	Zone 19	Zone 20	Zone 21	Zone 22	Zone 23	Zone 24	Zone 25	Zone 26	Zone 27	Zone 28
<i>Salacca zalacca</i>	6	47	11	14	59	23	10	54	23	9	95	33	20	72	34
<i>Solanum melongena</i>	2	30	72	0	10	20	2	24	74	2	24	81	1	17	58
<i>Sorghum nitidum</i>	9	53	20	1	0	0	47	12	2	34	6	9	64	17	-
<i>Sorghum plumosum</i>	8	19	96	2	8	28	11	0	87	24	0	72	10	2	69
<i>Sorghum propinquum</i>	14	52	13	11	8	15	3	2	9	50	6	69	-	-	-
<i>Sorghum timorense</i>	63	42	12	20	26	12	11	58	11	34	36	6	17	59	15
<i>Syzygium aqueum</i>	72	26	51	40	15	34	20	0	5	14	10	1	67	23	27
<i>Syzygium cumini</i>	3	2	4	45	12	64	9	10	25	35	39	50	21	4	27
<i>Syzygium malaccense</i>	34	13	1	59	29	3	27	3	77	14	1	26	-	-	-
<i>Vigna minima</i>	90	0	17	30	0	13	14	1	11	15	49	49	1	-	-
<i>Vigna radiata</i>	13	2	27	5	1	28	14	19	84	15	1	56	12	4	85
<i>Vigna trilobata</i>	27	71	17	10	11	2	8	94	43	14	30	11	16	23	6
<i>Vigna umbellata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 24 Complementary grids of priority CWR taxa in Indonesia

Complementary Grid rank	Additional_taxa	Total taxa	Province	District/Municipality	Protected area	ELC generalist category
1	54	54	Banten, Jakarta Raya, West Java	Kota Tangerang, Tangerang, Jakarta Barat, Jakarta Pusat, Jakarta Selatan, Jakarta Timur, Bekasi, Bogor, Depok, Kota Bekasi, Kota Bogor	Gunung Pancar NRP, Pancoran Mas GFP	1, 3, 4, 10, 16, 19, 22
2	30	46	East Kalimantan	Balikpapan, Kutai Kartanegara, Penajam Paser Utara	Bukit Soeharto GFP	1, 3, 4, 6
3	17	31	North Sulawesi	Bitung, Manado, Minahasa Selatan, Minahasa Utara, Minahasa, Tomohon	Gunung Lokon NR, Gunung Manembo-nembo WR, Gunung Tumpa (Haveworang) GFP	0, 3, 6, 9, 10, 12, 13, 15, 18
4	12	46	West Java	Bogor, Cianjur, Kota Bogor, Kota Sukabumi, Sukabumi	Cadas Malang NR, Gunung Halimun - Salak NP, Gunung Gede - Pangrango NP, Takokak NR, Telaga Warna NR	1, 4, 6, 10, 12, 13, 15, 16, 18
5	11	27	Riau	Indragiri Hulu	Bukit Tiga Puluh NP	1, 3, 4, 6
6	8	25	West Kalimantan	Ketapang	Gunung Palung NP	1, 3, 4, 6, 7
7	7	30	Aceh	Aceh Tengah, Aceh Timur, Gayo Lues	Gunung Leuser NP	10, 12, 13, 15, 16, 18
8	5	26	Riau, West Sumatra	Kampar, Agam, Lima Puluh Koto, Payakumbuh, Sawahlunto, Tanah Datar	Air NRP, Lembah Harau NR, Bukit Rimbang Bukit Baling WR, Gunung Marapi NRP, Gunung Sago Malintang NRP, Lembah Harau NRP	1, 4, 10, 12, 13, 15, 16, 18, 22
9	5	22	South Sulawesi, South East Sulawesi	Luwu Timur, Kolaka Utara	Faruhumpenai NR, Danau Matano NRP, Pegunungan Faruhumpenai NR	0, 1, 4, 7, 16

Appendix 24 Complementary grids of priority CWR taxa in Indonesia (*contd.*)

Complementary Grid rank	Additional_taxa	Total taxa	Province	District/Municipality	Protected area	ELC generalist category
10	5	19	South Kalimantan	Banjar Baru, Banjar, Tanah Laut	Sultan Adam GFP	3, 4, 6, 13, 16, 19, 21, 22, 24
11	5	13	East Nusa Tenggara	Kupang	Danau Tuadale WR, Perhatu WR, Baumata NRP, Prof. Ir. Herman Johannes GFP, Bipolo NRP, Teluk Kupang NRP, KKPN LAUT SAWU MNP, Teluk Pelikan NR	0, 19, 21, 24
12	4	22	South Sulawesi	Gowa, Makassar, Maros, Takalar	Lorentz NP	0, 6, 21, 22, 24
13	4	6	Papua	Mimika, Paniai, Puncak Jaya	Enarotali NR, Lorentz NP	17, 18
14	3	21	North Sumatra	Asahan, Labuhan Batu, Simalungun, Toba Samosir	Dolok Surungan WR	1, 4, 13, 19, 22
15	3	19	East Java	Jember, Lumajang, Pasuruan, Probolinggo	Bromo Tengger Semeru NP	18, 19, 21, 22, 24, 25, 27
16	3	13	North Moluccas	Halmahera Utara	NA	0, 1, 3, 4, 6, 7, 9
17	3	10	West Papua	Manokwari	Pegunungan Tamrau Selatan NR	1, 2, 4, 7, 8, 16, 17
18	3	8	West Kalimantan	Kapuas Hulu, Sintang	Bukit Kelam NRP, Baning NRP	1, 3, 4, 6
19	2	41	North Sumatera	Deli Serdang, Karo, Langkat, Serdang Bedagai, Simalungun	Lau Debuk Debuk NRP, Tinggi Raja NR, Sibolangit NR, Sibolangit NRP, Gunung Leuser NP	1, 3, 4, 6, 10, 12, 13, 15, 18
20	2	29	Moluccas	Ambon, Central Moluccas, Seram Bagian Barat	Gunung Sahuwai KSA, Pulau Kasa WR, Pulau Pombo NRP, Pombo NR, Pulau Kasa NRP	0, 1, 2, 3, 4, 5, 8, 19, 25
21	2	28	Aceh, North Sumatra	Aceh Tenggara, Gayo Lues, Langkat	Gunung Leuser NP	1, 4, 10, 12, 13, 16

Appendix 24 Complementary grids of priority CWR taxa in Indonesia (*contd.*)

Complementary Grid rank	Additional_taxa	Total taxa	Province	District/Municipality	Protected area	ELC generalist category
22	2	17	West Kalimantan, Central Kalimantan	Melawi, Sintang, Katingan	Bukit Baka - Bukit Raya NP	1, 4, 7, 16
23	2	16	North Sumatera	Dairi, Karo, Lake Toba, Pakpak Bharat, Samosir, Simalungun	Martelu Purba NR	0, 10, 12, 13, 15, 16
24	2	14	North Sulawesi	Bolaang Mongondow, Minahasa Selatan	Gunung Ambang NR	0, 1, 3, 4, 6, 7, 10, 13, 16
25	2	12	East Nusa Tenggara	Manggarai, Ngada	Ruteng NRP	0, 18, 19, 21, 22, 24, 25, 27
26	2	10	East Kalimantan, North Kalimantan	Berau, Kutai Timur, Malinau	NA	1, 4, 7, 13, 16
27	2	5	West Papua	Sorong, Kota Sorong	NA	0, 1, 2, 5
28	1	32	East Kalimantan	Kutai Kartanegara, Samarinda	Bukit Soeharto GFP	1, 3, 4, 6
29a	1	22	East Kalimantan	Berau	NA	1, 3, 4, 6, 9
29b	1	22	South Kalimantan, East Kalimantan	Balangan, Tabalong, Pasir	NA	1, 4, 7, 13, 16
30a	1	16	West Kalimantan	Sanggau, Sintang	NA	0, 1, 3, 4, 6
30b	1	16	South East Sulawesi	Kendari, Konawe Selatan, Kota Kendari	Murhum (Nipa-Nipa) GFP, Teluk Lasolo NRP	19, 22
31	1	14	North Sumatra	Labuhan Batu, Tapanuli Selatan	NA	1, 4
32a	1	12	Central Kalimantan, East Kalimantan	Murung Raya, Kutai Barat	Bukit Sapat Hawung NR	1, 4, 7, 10, 13, 16
32b	1	12	Bengkulu, South Sumatra	Seluma, Lahat, Pagar Alam	Gumai Pasemah WR	1, 4, 7, 10, 12, 13, 15, 16, 18

Appendix 24 Complementary grids of priority CWR taxa in Indonesia (*contd.*)

Complementary Grid rank	Additional_taxa	Total taxa	Province	District/Municipality	Protected area	ELC generalist category
33	1	11	West Sumatra	Agam, Bukittinggi, Lima Puluh Koto, Padang Pariaman, Pasaman, Tanah Datar	Batang Palupuh NR, Malampah Alahan Panjang WR, Maninjau NR, Gunung Marapi NRP, Singgalang Tandikat NRP	0, 1, 3, 4, 6, 10, 12, 13, 15, 16, 18
34a	1	10	West Kalimantan	Bengkayang, Sambas	Gunung Melintang NRP	0, 1, 3, 4, 6
34b	1	10	Bangka-Belitung	Bangka Selatan, Bangka Tengah	NA	0, 1, 3, 4, 6
35a	1	9	Bangka-Belitung	Bangka Tengah, Bangka, Pangkal Pinang	Gunung Mangkol GFP	0, 1, 3, 4, 6
35b	1	9	South Sulawesi	Barru, Enrekang, Pare-Pare, Pinrang, Sidenreng Rappang, Soppeng, Wajo	Sidrap NRP	0, 1, 3, 4, 6, 12, 15, 21, 24
36a	1	8	East Kalimantan	Berau	NA	1, 3, 4, 6, 7
36b	1	8	Central Kalimantan	Katingan, Kotawaringin Timur	NA	1, 4, 7
36c	1	8	South Kalimantan, Central Kalimantan	Tabalong, Barito Timur	NA	1, 4
36d	1	8	Central Kalimantan	Kotawaringin Timur, Seruyan	NA	1, 4
37a	1	7	West Kalimantan	Landak, Pontianak	Mandor NR	1, 3, 4, 6
37b	1	7	Papua	Jayapura, Keerom	Memberamo Foja WR	2, 5, 8
37c	1	7	Lampung	Lampung Selatan, Tanggamus	Bukit Barisan Selatan NP, Wan Abdul Rahman GFP	1, 3, 4, 6, 12, 15, 16, 18, 22
38a	1	6	Central Kalimantan	Barito Utara	Pararawen I-II NR	1, 4
38b	1	6	West Sulawesi	Majene, Polewali Mamasa	Kab.Polewali Mandar LMMA	3, 4, 5, 6, 15, 18, 20, 21, 23, 24

Appendix 24 Complementary grids of priority CWR taxa in Indonesia (*contd.*)

Complementary Grid rank	Additional_taxa	Total taxa	Province	District/Municipality	Protected area	ELC generalist category
38c	1	6	East Java	Sumenep	NA	0, 1, 3, 19, 21, 22, 24
39	1	5	East Java	Banyuwangi, Jember	Alas Purwo NP, Meru Betiri NP	19, 21, 22, 24, 25
40a	1	4	Bangka-Belitung	Bangka, Bangka Barat	KKPD Kab. Bangka Barat LMMA	0, 1, 3, 4, 6
40b	1	4	Lampung	Lampung Tengah, Tulang Bawang	Rawa Kandis KPA	1, 3, 4, 6
40c	1	4	Papua	Asmat, Jayawijaya, Yahukimo	Lorentz NP	1, 2, 4, 5, 8
41a	1	3	Aceh	Aceh Barat Daya, Aceh Selatan, Aceh Tenggara, Gayo Lues	Gunung Leuser NP	1, 4, 10, 12, 13, 15, 16, 18
41b	1	3	Aceh	Aceh Selatan, Aceh Singkil	Rawa Singkil WR	1, 4
41c	1	3	Papua	Biak Numfor	Biak Utara NR	5
41d	1	3	Papua	Nabire	Pegunungan Wayland NR	0, 1, 2, 4, 5, 8, 17
41e	1	3	South Sulawesi	Selayar	NA	20, 21, 23, 24
41f	1	3	Papua	Merauke	NA	20, 23, 24
42	1	2	Central Sulawesi	Tojo Una-Una	Tanjung Api NR	0, 1, 3, 4, 6, 7, 9, 16, 18

Appendix 25 Complementarity PA network that conserve all priority CWR taxa in Indonesia

Complementary PA rank	Additional taxa	Total taxa	Cumulative unique taxa	Protected area	Province	District/Municipality
1	48	48	48	Gunung Leuser NP	Aceh, North Sumatra	Aceh Barat Daya, Aceh Selatan, Aceh Tamiang, Aceh Tenggara, Gayo Lues, Dairi, Deli Serdang, Karo, Langkat, Simalungun
2	19	30	67	Gunung Palung NP	West Kalimantan	Ketapang
3	13	27	80	Gunung Gede - Pangrango NP	West Java	Bogor, Cianjur, Sukabumi
4	8	17	88	Lore Lindu NP	Central Sulawesi	Donggala, Poso
5	7	23	95	Kerinci Seblat NP	Bengkulu, Jambi, West Sumatra, South Sumatra	Bengkulu Utara, Lebong, Mukomuko, Rejang Lebong, Bungo, Kerinci, Merangin, Sarolangun, Dharmasraya, Pesisir Selatan, Solok Selatan, Solok, Lubuk Linggau, Musi Rawas
6	7	22	102	Bukit Baka - Bukit Raya NP	West Kalimantan, Central Kalimantan	Sintang, Katingan
7	6	12	108	Kutai NP	East Kalimantan	Bontang, Kutai Kartanegara, Kutai Timur
8	5	13	113	Memberamo Foja WR	Papua	Jayapura, Jayawijaya, Keerom, Puncak Jaya, Sarmi, Tolikara, Waropen, Yahukimo
9	5	10	118	Bantimurung NRP	South Sulawesi	Bone, Maros, Pangkajene Kepulauan
10	4	12	122	P. Bawean WR	East Java	Gresik

Appendix 25 Complementarity PA network that conserve all priority CWR taxa in Indonesia (*contd.*)

Complementary PA rank	Additional taxa	Total taxa	Cumulative unique taxa	Protected area	Province	District/Municipality
11a	3	10	125	Gunung Rinjani NP	West Nusa Tenggara	Lombok Barat, Lombok Tengah, Lombok Timur
11b	3	10	128	Sultan Adam GFP	South Kalimantan	Banjar, Banjar Baru, Tanah Bumbu, Tanah Laut
11c	3	10	131	Karimunjawa NR	Central Java	Jepara
12	3	8	134	Lorentz NP	Papua	Asmat, Jayawijaya, Mimika, Paniai, Puncak Jaya, Yahukimo
13	3	7	137	Sembilang NP	Jambi, South Sumatra	Muaro Jambi, Tanjung Jabung Timur, Banyuasin, Musi Banyu Asin
14	3	6	140	Bukit Kelam NRP	West Kalimantan	Sintang
15a	2	9	142	Gunung Nyiut Penrissen NR	West Kalimantan	Bengkayang, Landak, Sanggau
15b	2	9	144	Ruteng NRP	East Nusa Tenggara	Manggarai
16	2	8	146	Pegunungan Cycloops NR	Papua	Jayapura, Kota Jayapura
17a	2	4	148	Teluk Cendrawasih MNP	Irian Jaya Barat, Papua	Manokwari, Teluk Wondama, Nabire
17b	2	4	150	Kepulauan Karimata MNR	West Kalimantan	Ketapang
18	1	21	151	Ujung Kulon NP	Banten	Pandeglang
19	1	13	152	Sebangau NP	Central Kalimantan	Katingan, Palangka Raya, Pulang Pisau
20	1	12	153	Gunung Sago Malintang NRP	West Sumatra	Lima Puluh Koto, Tanah Datar
21	1	11	154	Bukit Soeharto GFP	East Kalimantan	Kutai Kartanegara, Penajam Paser Utara
22	1	10	155	Kepulauan Krakatau NR	Lampung	Lampung Selatan

Appendix 25 Complementarity PA network that conserve all priority CWR taxa in Indonesia (*contd.*)

Complementary PA rank	Additional taxa	Total taxa	Cumulative unique taxa	Protected area	Province	District/Municipality
23	1	9	156	Rawa Aopa Watumohai NP	South East Sulawesi	Bombana, Kendari, Kolaka, Konawe Selatan
24	1	8	157	Gunung Merapi NP	Central Java, Yogyakarta	Boyolali, Klaten, Magelang, Sleman
25	1	7	158	Pulau Batanta Barat NR	West Papua	Raja Ampat
26a	1	6	159	Gunung Ambang NRP	North Sulawesi	Bolaang Mongondow, Minahasa Selatan
26b	1	6	160	Gunung Baung NRP	East Java	Pasuruan
26c	1	6	161	R. Soeryo GFP	East Java	Batu, Jombang, Kediri, Malang, Mojokerto, Pasuruan
27	1	5	162	Berbak NP	Jambi	Muaro Jambi, Tanjung Jabung Timur
28a	1	4	163	Kaimana LMMA	Irian Jaya Barat, Papua	Fak-Fak, Kaimana, Teluk Bintuni, Mimika
28b	1	4	164	Sungai Liku NRP	West Kalimantan	Sambas
29a	1	3	165	Ir. H. Juanda GFP	West Java	Bandung, Kota Bandung
29b	1	3	166	Betung Kerihun NP	West Kalimantan, Central Kalimantan, East Kalimantan	Kapuas Hulu, Murung Raya, Kutai Barat
29c	1	3	167	Mega Mendung NRP	West Sumatra	Padang Pariaman, Tanah Datar
30a	1	1	168	Danau Matano NRP	South Sulawesi	Luwu Timur
30b	1	1	169	Air Putih NRP	Riau, West Sumatra	Kampar, Lima Puluh Koto, Sawahlunto, Tanah Datar

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Amaranthus tricolor</i>	5	1, 3, 7, 16, 41f	1	17a
<i>Archidendron borneense</i>	6	2, 28, 29a, 31, 34a, 37a	1	2
<i>Archidendron bubalinum</i>	4	5, 8, 14, 31	1	30b
<i>Archidendron clypearia</i>	18	1, 2, 3, 4, 5, 8, 9, 12, 15, 20, 28, 29a, 34b, 35a, 36b, 36d, 38a, 41b	6	3, 4, 5, 18, 20, 24
<i>Archidendron cockburnii</i>	2	2, 28	NA	NA
<i>Archidendron contortum</i>	3	5, 14, 31	1	1
<i>Archidendron crateradenum</i>	1	1	NA	NA
<i>Archidendron ellipticum</i>	10	1, 2, 4, 7, 15, 19, 21, 28, 29a, 35a	7	1, 5, 15a, 17b, 18, 23, 26c
<i>Archidendron fagifolium</i>	6	1, 4, 30a, 32a, 33, 39	2	3, 18
<i>Archidendron globosum</i>	3	2, 4, 19	1	7
<i>Archidendron havilandii</i>	2	2, 26	2	15a, 21
<i>Archidendron jiringa</i>	14	1, 2, 4, 7, 10, 14, 19, 23, 28, 29a, 30a, 31, 32b, 38a	5	1, 3, 18, 21, 25
<i>Archidendron kunstleri</i>	4	6, 32a, 34a, 36d	2	2, 19
<i>Archidendron microcarpum</i>	10	2, 6, 10, 14, 19, 28, 29a, 35a, 36a, 40a	5	2, 7, 11b, 19, 21
<i>Archidendron minahassae</i>	1	3	NA	NA
<i>Archidendron oppositum</i>	1	28	1	17b
<i>Archidendron palauense</i>	2	16, 25	1	9
<i>Archidendron pauciflorum</i>	3	3, 12, 30b	3	4, 9, 23
<i>Archidendron trichophyllum</i>	1	23	NA	NA
<i>Archidendron triplinervium</i>	3	2, 6, 22	2	2, 6
<i>Arenga pinnata</i>	11	1, 3, 4, 11, 12, 20, 23, 29b, 30a, 32b, 36c	8	1, 3, 4, 7, 9, 18, 19, 26a

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Artocarpus altilis</i>	8	1, 2, 4, 9, 16, 17, 40b, 41d	6	3, 8, 9, 15a, 25, 28a
<i>Artocarpus anisophyllus</i>	6	2, 5, 22, 29a, 30a, 34b	5	2, 5, 6, 7, 21
<i>Artocarpus brevipedunculatus</i>	1	22	1	6
<i>Artocarpus camansi</i>	2	12, 17	1	25
<i>Artocarpus elasticus</i>	22	1, 2, 4, 5, 7, 8, 10, 14, 15, 19, 21, 22, 23, 25, 28, 29a, 29b, 30b, 32b, 37b, 38c, 39	11	1, 3, 5, 6, 10, 11a, 15a, 15b, 18, 22, 26b
<i>Artocarpus horridus</i>	1	16	NA	NA
<i>Artocarpus integer</i>	16	1, 2, 4, 5, 8, 9, 10, 14, 20, 23, 27, 29a, 29b, 30a, 35a, 36c	6	1, 6, 10, 13, 21, 23
<i>Artocarpus kemando</i>	9	2, 6, 7, 14, 21, 28, 30a, 34b, 37a	5	1, 2, 6, 19, 28b
<i>Artocarpus lanceifolius</i>	8	2, 19, 26, 28, 29a, 29b, 32a, 36a	2	1, 15a
<i>Artocarpus lowii</i>	1	14	NA	NA
<i>Artocarpus maingayi</i>	2	7, 14	NA	NA
<i>Artocarpus odoratissimus</i>	6	6, 22, 29a, 32a, 36a, 38a	2	2, 6
<i>Artocarpus rigidus</i>	12	1, 2, 5, 6, 14, 21, 28, 29a, 32b, 34b, 37b, 40a	5	1, 2, 5, 6, 11b
<i>Artocarpus sarawakensis</i>	1	5	NA	NA
<i>Artocarpus scortechinii</i>	2	5, 1	1	1
<i>Artocarpus sepicanus</i>	1	27	NA	NA
<i>Artocarpus sericicarpus</i>	4	3, 9, 10, 29a	1	10
<i>Artocarpus sumatranus</i>	1	37b	NA	NA
<i>Artocarpus tamaran</i>	2	2, 29b	NA	NA
<i>Artocarpus teysmannii</i>	9	3, 9, 20, 29a, 29b, 31, 35b, 36d, 41b	1	4

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Averrhoa bilimbi</i>	9	1, 9, 10, 12, 20, 21, 24, 29a, 30a	4	1, 5, 10, 18
<i>Averrhoa carambola</i>	3	1, 7, 28	2	4, 11a
<i>Cajanus cajan</i>	6	1, 4, 11, 19, 23, 33	1	11a
<i>Cajanus goensis</i>	1	4	1	3
<i>Cajanus scarabaeoides</i>	3	11, 24, 42	NA	NA
<i>Citrus hystrix</i>	6	1, 7, 12, 21, 24, 28	1	11c
<i>Citrus maxima</i>	6	1, 2, 8, 11, 12, 19	2	9, 11a
<i>Cocos nucifera</i>	7	1, 3, 11, 12, 19, 20, 24	1	22
<i>Colocasia esculenta</i>	7	1, 4, 13, 15, 16, 19, 40c	5	1, 3, 4, 8, 12
<i>Colocasia gigantea</i>	5	1, 4, 15, 19, 29b	4	1, 3, 5, 18
<i>Cucumis melo</i>	2	11, 30b	1	26b
<i>Dimocarpus longan</i>	10	2, 28, 32a, 34a, 36a, 36b, 36c, 37b, 38a	1	6
<i>Dioscorea alata</i>	7	1, 2, 15, 16, 19, 38c	1	11c
<i>Dioscorea bancana</i>	1	35a	NA	NA
<i>Dioscorea elegans</i>	1	41c	NA	NA
<i>Dioscorea filiformis</i>	4	1, 4, 19, 21	2	1, 3
<i>Dioscorea grata</i>	1	41d	NA	NA
<i>Dioscorea havilandii</i>	5	2, 21, 26, 29a, 34a	1	21
<i>Dioscorea lamprocaula</i>	1	19	1	1
<i>Dioscorea madiunensis</i>	1	4	1	3
<i>Dioscorea nienwenhuisii</i>	1	32a	NA	NA
<i>Dioscorea nummularia</i>	8	2, 3, 16, 20, 24, 30b, 40c, 41c	1	16
<i>Dioscorea orbiculata</i>	1	31	NA	NA
<i>Dioscorea platycarpa</i>	1	39	NA	NA

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Dioscorea polyclados</i>	2	1, 19	NA	NA
<i>Dioscorea prainiana</i>	3	7, 9, 19	1	1
<i>Dioscorea pubera</i>	1	1	1	29a
<i>Dioscorea pyrifolia</i>	5	1, 4, 6, 29a, 36d	4	2, 16, 18, 23
<i>Dioscorea salicifolia</i>	4	6, 25, 29b, 32a	2	2, 15b
<i>Dioscorea sarasinii</i>	1	3	1	26a
<i>Dioscorea sexrimata</i>	1	30b	NA	NA
<i>Dioscorea tenuifolia</i>	1	34b	NA	NA
<i>Dioscorea vanvuurenii</i>	1	38b	NA	NA
<i>Dioscorea vilis</i>	1	4	1	3
<i>Dioscorea warburgiana</i>	2	3, 29b	NA	NA
<i>Diospyros discolor</i>	1	38a	NA	NA
<i>Durio affinis</i>	1	36a	NA	NA
<i>Durio beccarianus</i>	2	6, 28	2	2, 6
<i>Durio bukitrayaensis</i>	1	36b	NA	NA
<i>Durio carinatus</i>	3	5, 21, 31	4	1, 13, 27, 28b
<i>Durio dulcis</i>	3	2, 28, 29b	NA	NA
<i>Durio graveolens</i>	6	2, 14, 22, 28, 34a, 36a	1	6
<i>Durio kutejensis</i>	6	2, 29b, 30a, 32a, 36b, 36c	1	7
<i>Durio lanceolatus</i>	3	2, 28, 36a	1	13
<i>Durio lissocarpus</i>	1	37a	1	28b
<i>Durio lowianus</i>	1	14	1	1
<i>Durio macrantha</i>	1	41a	1	1
<i>Durio malaccensis</i>	1	5	1	29c
<i>Durio oblongus</i>	1	30a	NA	NA
<i>Durio oxleyanus</i>	5	2, 5, 14, 28, 29b	2	6, 13

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Durio testudinarius</i>	2	6, 36b	2	2, 6
<i>Durio zibethinus</i>	17	1, 2, 3, 4, 10, 12, 14, 15, 19, 20, 21, 23, 24, 30a, 32b, 36c	6	1, 2, 3, 4, 22, 29b
<i>Ficus androchaete</i>	1	29a	NA	NA
<i>Ficus aurata</i>	7	2, 5, 17, 22, 29a, 36b, 36c	2	7, 21
<i>Ficus aureocordata</i>	1	22	1	6
<i>Ficus auricoma</i>	1	36c	NA	NA
<i>Ficus brunneoaurata</i>	1	18	2	6, 14
<i>Ficus chartacea</i>	3	8, 22, 32a	NA	NA
<i>Ficus deltoidea</i>	5	2, 6, 19, 22, 29b	3	2, 6, 19
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	8	2, 6, 8, 10, 22, 29b, 33, 36d	2	2, 19
<i>Ficus fulva</i>	9	1, 4, 5, 8, 19, 22, 23, 29b, 30a	2	5, 22
<i>Ficus glabristipulata</i>	1	33	NA	NA
<i>Ficus glandulifera</i>	8	1, 9, 14, 20, 21, 26, 27, 29a	4	1, 7, 8, 16
<i>Ficus grossularioides</i>	17	1, 2, 4, 5, 7, 8, 10, 18, 19, 21, 23, 29b, 31, 32b, 34b, 35a, 36d	7	1, 2, 3, 11b, 15a, 20, 21
<i>Ficus halmaherae</i>	1	16	NA	NA
<i>Ficus hirta</i>	6	1, 4, 5, 6, 32b, 37c	1	2
<i>Ficus hirta</i> subsp. <i>dumosa</i>	1	32b	NA	NA
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	1	19	1	1
<i>Ficus inaequipetiolata</i>	1	36d	NA	NA
<i>Ficus kofmaniae</i>	1	42	NA	NA
<i>Ficus lamponga</i>	1	3	1	23
<i>Ficus litseifolia</i>	4	7, 8, 32b, 37c	1	20
<i>Ficus oleifolia</i>	6	3, 8, 24, 26, 32a, 33	5	4, 5, 6, 20, 26a
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	3	7, 21, 26	1	6

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Ficus padana</i>	10	1, 4, 5, 7, 8, 14, 19, 31, 32b, 33	6	1, 5, 10, 18, 20, 22
<i>Ficus pedunculosa</i>	2	9, 30b	1	30a
<i>Ficus ruficaulis</i>	1	9	1	9
<i>Ficus schefferiana</i>	3	8, 32b, 33	2	5, 20
<i>Ficus setiflora</i>	1	26	NA	NA
<i>Ficus subfulva</i>	1	18	1	14
<i>Ficus subglabripetala</i>	1	26	NA	NA
<i>Ficus tricolor</i>	3	4, 8, 19	3	3, 20, 26c
<i>Ficus tricolor</i> var. <i>serroh</i>	1	4	1	3
<i>Garcinia celebica</i>	7	3, 7, 9, 20, 21, 25, 37b	9	1, 2, 4, 9, 11c, 15b, 18, 19, 23
<i>Garcinia diospyrifolia</i>	2	10, 29b	1	7
<i>Garcinia mangostana</i>	7	2, 6, 7, 10, 30a, 36b, 37b	4	2, 6, 19, 21
<i>Garcinia nitida</i>	1	6	1	2
<i>Garcinia opaca</i>	1	40a	NA	NA
<i>Garcinia penangiana</i>	1	21	1	19
<i>Garcinia rigida</i>	7	6, 21, 22, 28, 29b, 35a, 37a	3	1, 2, 7
<i>Gnetum costatum</i>	1	17	NA	NA
<i>Gnetum gnemon</i>	13	1, 3, 4, 9, 12, 17, 20, 22, 24, 28, 30a, 30b, 41d	12	4, 8, 10, 11c, 12, 16, 18, 22, 23, 25, 28a, 29a
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	1	34a	2	17b, 23
<i>Gnetum gnemon</i> var. <i>gracile</i>	2	9, 35b	NA	NA
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	3	9, 20, 41e	NA	NA
<i>Gnetum gnemon</i> var. <i>tenerum</i>	2	18, 32a	1	14
<i>Ipomoea aquatica</i>	6	1, 4, 15, 19, 24, 35b	3	11a, 23, 26b
<i>Ipomoea asarifolia</i>	1	20	NA	NA

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Ipomoea coptica</i>	1	27	NA	NA
<i>Ipomoea graminea</i>	1	35b	NA	NA
<i>Ipomoea imperati</i>	1	38c	NA	NA
<i>Ipomoea littoralis</i>	6	3, 16, 20, 23, 40b, 41c	4	8, 11c, 18, 22
<i>Ipomoea obscura</i>	4	1, 4, 8, 23	2	10, 16
<i>Ipomoea pes-caprae</i>	7	1, 3, 19, 30b, 38b, 38c, 41e	4	10, 17b, 18, 22
<i>Ipomoea sagittifolia</i>	4	1, 15, 38c, 39	1	11c
<i>Ipomoea stibaropoda</i>	1	41e	NA	NA
<i>Lablab purpureus</i>	7	1, 4, 15, 20, 31, 35b, 38b	3	4, 11a, 11c
<i>Lansium domesticum</i>	13	1, 2, 6, 7, 8, 9, 17, 19, 20, 29a, 29b, 30a, 37a	5	1, 2, 5, 18, 25
<i>Mangifera altissima</i>	1	25	3	9, 15b, 28a
<i>Mangifera applanata</i>	3	10, 18, 19	1	11b
<i>Mangifera casturi</i>	2	10, 28	NA	NA
<i>Mangifera dewildei</i>	1	21	1	1
<i>Mangifera gedebe</i>	1	10	1	11b
<i>Mangifera gracilipes</i>	1	5	NA	NA
<i>Mangifera griffithii</i>	9	2, 5, 6, 18, 22, 28, 34b, 35a, 37a	2	2, 14
<i>Mangifera lalijiwa</i>	1	12	1	26c
<i>Mangifera laurina</i>	11	2, 4, 6, 7, 8, 10, 12, 19, 25, 28, 31	7	1, 2, 9, 10, 11b, 18, 20
<i>Mangifera longipetiolata</i>	2	14, 34a	1	2
<i>Mangifera magnifica</i>	4	5, 6, 28, 37a	3	1, 2, 13
<i>Mangifera microphylla</i>	1	37c	NA	NA
<i>Mangifera minor</i>	7	3, 9, 12, 20, 25, 27, 38b	1	9
<i>Mangifera mucronulata</i>	1	17	1	28a
<i>Mangifera oblongifolia</i>	2	8, 14	NA	NA

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Mangifera orophila</i>	1	7	1	5
<i>Mangifera paludosa</i>	1	5	1	27
<i>Mangifera parvifolia</i>	3	2, 5, 6	1	2
<i>Mangifera pedicellata</i>	1	12	NA	NA
<i>Mangifera quadrifida</i>	7	2, 6, 9, 10, 12, 28, 35a	5	1, 2, 11b, 19, 27
<i>Mangifera rigida</i>	1	41b	NA	NA
<i>Mangifera rubropetala</i>	1	10	1	11b
<i>Mangifera rufocostata</i>	3	2, 10, 28	2	7, 11b
<i>Mangifera similis</i>	1	2	1	15a
<i>Mangifera sulavesiana</i>	1	9	NA	NA
<i>Mangifera sumbawaensis</i>	1	25	1	15b
<i>Mangifera swintonioides</i>	1	2	1	13
<i>Mangifera timorensis</i>	2	11, 25	1	15b
<i>Mangifera torquenda</i>	4	2, 28, 34b, 36c	1	13
<i>Metroxylon sagu</i>	5	1, 3, 16, 20, 31	2	8, 17a
<i>Momordica charantia</i>	10	1, 7, 11, 15, 19, 24, 30b, 33, 37c, 39	4	1, 11a, 19, 24
<i>Musa acuminata</i>	9	1, 4, 8, 15, 19, 20, 21, 23, 37c	5	1, 3, 10, 15a, 20
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	2	8, 33	1	5
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	3	1, 4, 15	1	3
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	1	29b	NA	NA
<i>Musa acuminata</i> var. <i>sumatrana</i>	2	8, 19	3	1, 5, 29c
<i>Musa acuminata</i> var. <i>tomentosa</i>	1	12	1	4
<i>Musa balbisiana</i>	2	3, 20	1	10
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	1	15	NA	NA
<i>Musa celebica</i>	1	24	1	4
<i>Musa lanceolata</i>	1	24	NA	NA

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Musa schizocarpa</i>	1	17	1	16
<i>Nephelium lappaceum</i>	17	1, 2, 5, 7, 8, 9, 14, 21, 22, 26, 28, 29b, 30a, 34b, 36a, 36d, 37b	5	1, 5, 6, 20, 21
<i>Ocimum americanum</i>	5	1, 3, 7, 19, 31	NA	NA
<i>Oryza longiglumis</i>	1	41f	NA	NA
<i>Oryza meyeriana</i>	2	4, 30b	2	1, 11c
<i>Oryza minuta</i>	2	15, 28	1	18
<i>Oryza officinalis</i>	7	4, 12, 19, 21, 34a, 37c, 40a	2	1, 18
<i>Oryza ridleyi</i>	2	5, 40b	2	8, 29b
<i>Oryza rufipogon</i>	3	1, 4, 41f	1	29b
<i>Oryza schlechteri</i>	1	40c	NA	NA
<i>Parkia singularis</i>	2	6, 29a	2	2, 29c
<i>Parkia speciosa</i>	10	1, 2, 5, 14, 18, 19, 26, 30a, 36b, 38a	3	5, 11b, 14
<i>Parkia sumatrana</i>	3	5, 18, 34a	1	14
<i>Parkia timoriana</i>	3	1, 2, 19	2	1, 26b
<i>Parkia versteeghii</i>	1	40b	1	8
<i>Pometia pinnata</i>	19	1, 2, 3, 4, 5, 6, 7, 9, 10, 16, 17, 20, 21, 22, 24, 28, 29a, 33, 34a	14	1, 2, 3, 5, 6, 7, 8, 16, 17a, 18, 19, 21, 25, 26a
<i>Rubus acuminatissimus</i>	3	4, 7, 21	2	1, 3
<i>Rubus alpestris</i>	5	4, 7, 8, 23, 41a	6	1, 3, 4, 5, 6, 20
<i>Rubus banghamii</i>	1	23	1	5
<i>Rubus ferdinandmuelleri</i>	1	13	1	12
<i>Rubus fraxinifolius</i>	4	1, 3, 4, 20	6	3, 4, 8, 15b, 24, 26a
<i>Rubus lineatus</i>	8	4, 7, 19, 21, 25, 32b, 37c, 41a	7	1, 3, 5, 11a, 15b, 24, 26c
<i>Rubus lorentzianus</i>	1	13	1	12
<i>Rubus macgregorii</i>	1	13	NA	NA

Appendix 26 Complementary grids and complementary protected area where priority CWR recorded (*contd.*)

Taxon	Number of complementary grids	Complementary grids	Number of complementary PA	Complementary PA
<i>Rubus niveus</i>	1	15	3	11a, 24, 26c
<i>Rubus papuanus</i>	1	13	1	12
<i>Rubus rosifolius</i>	4	3, 4, 13, 30b	7	3, 4, 11a, 15b, 24, 26a, 26c
<i>Rubus sumatranus</i>	2	7, 19	2	1, 5
<i>Saccharum officinarum</i>	5	3, 8, 20, 30b, 40c	2	8, 15a
<i>Saccharum robustum</i>	3	20, 30b, 35b	NA	NA
<i>Saccharum spontaneum</i>	12	1, 3, 4, 7, 12, 16, 17, 19, 21, 30b, 35b, 38c	7	1, 3, 8, 12, 18, 22, 26b
<i>Salacca zalacca</i>	3	1, 4, 20	2	3, 18
<i>Solanum melongena</i>	9	1, 3, 4, 12, 15, 21, 23, 25, 32a	1	17a
<i>Sorghum nitidum</i>	6	4, 14, 19, 20, 23, 35b	3	1, 12, 16
<i>Sorghum plumosum</i>	1	11	NA	NA
<i>Sorghum propinquum</i>	7	3, 9, 16, 19, 20, 28, 35b	2	7, 28b
<i>Sorghum timorense</i>	1	11	NA	NA
<i>Syzygium aqueum</i>	8	3, 7, 9, 11, 12, 19, 20, 21	4	1, 11c, 19, 27
<i>Syzygium cumini</i>	4	1, 6, 12, 33	5	1, 4, 10, 26b, 27
<i>Syzygium malaccense</i>	4	7, 15, 20, 30b	4	5, 8, 12, 25
<i>Vigna minima</i>	3	1, 8, 21	5	1, 11c, 20, 22, 24
<i>Vigna radiata</i>	9	1, 4, 7, 8, 11, 12, 21, 30b, 38b	2	3, 29a
<i>Vigna trilobata</i>	4	1, 11, 15, 38b	1	24
<i>Vigna umbellata</i>	2	4, 25	NA	NA

Appendix 27 Representativeness of *ex situ* collection

Taxa with <i>ex situ</i> collections	Representative GeneBank Collection based on specific ELC Map							
<i>Archidendron clypearia</i>	Based on specific ELC Map <i>Archidendron clypearia</i>							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.08	1.04	mid-low	0.73	low	1
	2	0.00	4.30	4.15	mid-high	0.92	mid-low	3
	3	0.00	0.00	0.00	null	0.00	low	13
	4	0.00	2.15	2.07	mid-low	0.59	low	1
	5	0.00	3.23	3.11	mid-high	2.17	mid-low	3
	6	0.00	0.00	0.00	null	0.75	mid-low	13
	7	0.00	5.91	5.70	mid-high	1.89	mid-low	3
	8	0.00	16.67	16.06	high	16.77	high	4
	9	0.00	2.15	2.07	mid-low	5.11	high	2
	10	0.00	12.37	11.92	high	12.78	high	4
	11	14.29	16.13	16.06	high	5.51	high	8
	12	0.00	0.00	0.00	null	0.00	low	13
	13	28.57	5.91	6.74	high	2.74	mid-high	8
Representative GeneBank Collection based on Generalist ELC Map								
Based on Generalist ELC Map								
ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	
1	0.00	2.15	2.07	mid-low	2.90	mid-high		2
2	0.00	23.12	22.28	high	22.71	high		4
3	0.00	0.54	0.52	low	4.44	high		2
4	0.00	7.53	7.25	high	6.72	high		4
5	0.00	16.67	16.06	high	19.09	high		4
6	0.00	2.15	2.07	mid-low	5.19	high		2
7	0.00	5.91	5.70	mid-high	6.18	high		4
8	0.00	0.54	0.52	low	1.78	mid-low		1
9	0.00	0.00	0.00	null	1.40	mid-low		13
10	0.00	0.00	0.00	null	0.16	low		13
11	0.00	4.30	4.15	mid-high	1.58	mid-low		3
12	0.00	0.00	0.00	null	0.04	low		13
13	14.29	1.08	1.55	mid-low	0.65	mid-low		5

	14	42.86	4.84	6.22	mid-high	7.96	high	8	14	0.00	2.15	2.07	mid-low	1.38	mid-low	1
	15	0.00	0.54	0.52	low	1.94	mid-low	1	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	8.60	8.29	high	6.97	high	4	16	14.29	1.61	2.07	mid-low	0.55	low	5
	17	0.00	6.99	6.74	high	5.58	high	4	17	28.57	6.99	7.77	high	4.79	high	8
	18	0.00	0.54	0.52	low	0.33	low	1	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.54	0.52	low	3.95	mid-high	2	19	14.29	18.82	18.65	high	2.14	mid-high	8
	20	14.29	1.08	1.55	mid-low	4.78	mid-high	6	20	0.00	0.54	0.52	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	0.02	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	1.61	1.55	mid-low	3.93	mid-high	2	22	0.00	1.08	1.04	low	2.44	mid-high	2
	23	0.00	1.61	1.55	mid-low	3.87	mid-high	2	23	0.00	1.61	1.55	mid-low	2.99	mid-high	2
	24	0.00	0.54	0.52	low	2.41	mid-low	1	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.54	0.52	low	3.80	mid-high	2	25	0.00	3.23	3.11	mid-high	3.01	mid-high	4
	26	0.00	0.00	0.00	null	1.01	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.54	0.52	low	0.16	low	1	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	2.15	2.07	mid-low	3.34	mid-high	2	28	28.57	0.00	1.04	low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						43.41	0.0734	Distribution GB vs ES						38.51	0.0961
	Distribution GB vs ELC Map						35.56	0.1307	Distribution GB vs ELC Map						170.5	0.009

Appendix 27 Representativeness of *ex situ* collection (contd.)

Archidendron ellipticum	Based on specific ELC Map Archidendron ellipticum								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	5.06	4.94	mid-high	2.90	mid-high	4
	2	0.00	3.80	3.70	mid-low	2.38	mid-high	2	2	0.00	27.85	27.16	high	22.71	high	4
	3	0.00	2.53	2.47	mid-low	2.92	mid-high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	1.27	1.23	low	0.33	mid-low	1	4	50.00	7.59	8.64	high	6.72	high	8
	5	0.00	5.06	4.94	mid-high	7.39	high	4	5	0.00	18.99	18.52	high	19.09	high	4
	6	0.00	6.33	6.17	high	1.80	mid-high	4	6	0.00	1.27	1.23	low	5.19	high	2
	7	0.00	1.27	1.23	low	2.67	mid-high	2	7	0.00	16.46	16.05	high	6.18	high	4
	8	0.00	0.00	0.00	null	0.32	low	13	8	50.00	1.27	2.47	mid-high	1.78	mid-low	7
	9	0.00	0.00	0.00	null	0.72	mid-low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.00	low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	1.81	mid-high	13	11	0.00	5.06	4.94	mid-high	1.58	mid-low	3
	12	0.00	0.00	0.00	null	2.18	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.07	mid-low	13	13	0.00	3.80	3.70	mid-high	0.65	mid-low	3
	14	0.00	1.27	1.23	low	5.90	high	2	14	0.00	1.27	1.23	low	1.38	mid-low	1
	15	0.00	1.27	1.23	low	4.87	high	2	15	0.00	1.27	1.23	low	0.06	low	1

	16	0.00	1.27	1.23	low	0.62	mid-low	1	16	0.00	1.27	1.23	low	0.55	low	1
	17	0.00	0.00	0.00	null	0.04	low	13	17	0.00	1.27	1.23	low	4.79	high	2
	18	0.00	0.00	0.00	null	0.33	low	13	18	0.00	1.27	1.23	low	2.44	mid-high	2
	19	0.00	0.00	0.00	null	0.07	low	13	19	0.00	2.53	2.47	mid-high	2.14	mid-high	4
	20	0.00	3.80	3.70	mid-low	0.84	mid-low	1	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	50.00	2.53	3.70	mid-low	6.83	high	6	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.14	low	13	22	0.00	1.27	1.23	low	2.44	mid-high	2
	23	0.00	5.06	4.94	mid-high	3.97	mid-high	4	23	0.00	1.27	1.23	low	2.99	mid-high	2
	24	0.00	15.19	14.81	high	4.19	high	4	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.33	mid-low	13	25	0.00	1.27	1.23	low	3.01	mid-high	2
	26	50.00	8.86	9.88	high	10.24	high	8	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	40.51	39.51	high	37.09	high	4	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.23	low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						44.08	0.0784	Distribution GB vs ES						44.08	0.0784
	Distribution GB vs ELC Map						33.49	0.2051	Distribution GB vs ELC Map						33.49	0.2051

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Archidendron fagifolium</i>	Based on specific ELC Map <i>Archidendron fagifolium</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	1.61	1.56	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	3.29	mid-high	13	2	0.00	20.97	20.31	high	22.71	high	4
	3	0.00	1.61	1.56	low	4.38	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	19.35	18.75	high	20.79	high	4	4	0.00	1.61	1.56	low	6.72	high	2
	5	0.00	3.23	3.13	mid-low	4.28	mid-high	2	5	0.00	20.97	20.31	high	19.09	high	4
	6	0.00	11.29	10.94	high	3.10	mid-low	3	6	0.00	1.61	1.56	low	5.19	high	2
	7	0.00	14.52	14.06	high	3.34	mid-high	4	7	0.00	4.84	4.69	mid-high	6.18	high	4
	8	0.00	6.45	6.25	mid-high	2.35	mid-low	3	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	4.84	4.69	mid-high	1.31	low	3	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	3.23	3.13	mid-low	3.89	mid-high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.03	low	13	11	0.00	1.61	1.56	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.04	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	6.45	6.25	mid-high	3.65	mid-high	4	13	0.00	3.23	3.13	mid-low	0.65	mid-low	1
	14	100.00	12.90	15.63	high	5.30	high	8	14	0.00	1.61	1.56	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	1.63	mid-low	13	15	0.00	1.61	1.56	low	0.06	low	1

	16	0.00	0.00	0.00	null	0.44	low	13	16	0.00	1.61	1.56	low	0.55	low	1
	17	0.00	0.00	0.00	null	0.16	low	13	17	0.00	3.23	3.13	mid-low	4.79	high	2
	18	0.00	0.00	0.00	null	0.08	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	1.61	1.56	low	4.45	high	2	19	0.00	8.06	7.81	mid-high	2.14	mid-high	4
	20	0.00	0.00	0.00	null	3.16	mid-low	13	20	50.00	6.45	7.81	mid-high	2.86	mid-high	8
	21	0.00	4.84	4.69	mid-high	12.88	high	4	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	1.61	1.56	low	1.69	mid-low	1	22	0.00	9.68	9.38	high	2.44	mid-high	4
	23	0.00	3.23	3.13	mid-low	4.44	high	2	23	0.00	3.23	3.13	mid-low	2.99	mid-high	2
	24	0.00	3.23	3.13	mid-low	4.32	mid-high	2	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	1.61	1.56	low	1.78	mid-low	1	25	50.00	8.06	9.38	high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	1.98	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	6.51	high	13	27	0.00	0.00	0.00	null	0.06	low	13
									28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						13.50	0.4234	Distribution GB vs ES						11.95	0.4531
	Distribution GB vs ELC Map						35.76	0.1396	Distribution GB vs ELC Map						32.10	0.2185

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Archidendron pauciflorum</i>	Based on specific ELC Map <i>Archidendron pauciflorum</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	7.23	high	13	2	0.00	5.88	5.56	low	22.71	high	2
	3	0.00	0.00	0.00	null	0.14	low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.75	mid-low	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	6.44	high	13	5	0.00	5.88	5.56	low	19.09	high	2
	6	0.00	0.00	0.00	null	0.66	mid-low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.44	mid-low	13	7	0.00	11.76	11.11	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	5.87	mid-high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.61	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.01	low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.63	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.15	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.04	low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	22.22	21.05	high	6.00	high	4	14	0.00	11.76	11.11	mid-low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.08	low	13	15	0.00	0.00	0.00	null	0.06	low	13

16	0.00	0.00	0.00	null	0.31	mid-low	13
17	0.00	38.89	36.84	high	8.20	high	4
18	0.00	0.00	0.00	null	1.90	mid-high	13
19	0.00	0.00	0.00	null	0.64	mid-low	13
20	0.00	5.56	5.26	low	29.48	high	2
21	0.00	0.00	0.00	null	2.51	mid-high	13
22	0.00	0.00	0.00	null	6.10	high	13
23	0.00	5.56	5.26	low	4.27	mid-high	2
24	0.00	0.00	0.00	null	0.13	low	13
25	0.00	5.56	5.26	low	0.16	low	1
26	0.00	16.67	15.79	mid-high	9.74	high	4
27	0.00	0.00	0.00	null	2.61	mid-high	13
28	100.00	5.56	10.53	mid-low	0.17	mid-low	5
Comparison						Chi Value	p value
Distribution GB vs ES						17.00	0.2239
Distribution GB vs ELC Map						598.1	0.0102

16	0.00	0.00	0.00	null	0.55	low	13
17	0.00	11.76	11.11	mid-low	4.79	high	2
18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	5.88	5.56	low	2.14	mid-high	2
20	0.00	5.88	5.56	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	17.65	16.67	high	2.44	mid-high	4
23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	100.00	11.76	16.67	high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	11.76	11.11	mid-low	0.52	low	1
Comparison						Chi Value	p value
Distribution GB vs ES						7.50	0.8255
Distribution GB vs ELC Map						32.26	0.3061

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Arenga pinnata</i>	Based on specific ELC Map <i>Arenga pinnata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	5.56	4.90	mid-low	2.90	mid-high	2
	2	16.67	18.89	18.63	high	6.92	high	8	2	0.00	11.11	9.80	high	22.71	high	4
	3	33.33	3.33	6.86	mid-high	5.61	high	12	3	0.00	1.11	0.98	low	4.44	high	2
	4	8.33	8.89	8.82	high	2.69	mid-low	7	4	0.00	4.44	3.92	low	6.72	high	2
	5	0.00	6.67	5.88	mid-high	1.88	mid-low	3	5	0.00	13.33	11.76	high	19.09	high	4
	6	8.33	3.33	3.92	mid-low	0.44	low	5	6	0.00	0.00	0.00	null	5.19	high	13
	7	33.33	7.78	10.78	high	3.83	high	8	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	7.78	6.86	mid-high	1.59	mid-low	3	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.16	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	1.11	0.98	low	2.22	mid-low	1	10	0.00	1.11	0.98	low	0.16	low	1
	11	0.00	3.33	2.94	low	2.96	mid-high	2	11	16.67	4.44	5.88	mid-high	1.58	mid-low	7
	12	0.00	0.00	0.00	null	1.86	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	2.93	mid-high	13	13	0.00	5.56	4.90	mid-low	0.65	mid-low	1
	14	0.00	3.33	2.94	low	1.33	low	1	14	8.33	3.33	3.92	low	1.38	mid-low	5
	15	0.00	0.00	0.00	null	0.14	low	13	15	0.00	0.00	0.00	null	0.06	low	13
16	0.00	4.44	3.92	mid-low	2.88	mid-high	2	16	0.00	4.44	3.92	low	0.55	low	1	

	17	0.00	4.44	3.92	mid-low	14.93	high	2	17	0.00	8.89	7.84	high	4.79	high	4
	18	0.00	5.56	4.90	mid-high	3.61	mid-high	4	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	7.78	6.86	mid-high	21.45	high	4	19	8.33	4.44	4.90	mid-low	2.14	mid-high	6
	20	0.00	5.56	4.90	mid-high	3.29	mid-high	4	20	16.67	4.44	5.88	mid-high	2.86	mid-high	8
	21	0.00	0.00	0.00	null	3.10	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.39	mid-low	13	22	16.67	5.56	6.86	mid-high	2.44	mid-high	8
	23	0.00	3.33	2.94	low	4.17	high	2	23	0.00	5.56	4.90	mid-low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	0.11	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	1.11	0.98	low	3.71	high	2	25	25.00	12.22	13.73	high	3.01	mid-high	8
	26	0.00	2.22	1.96	low	3.39	mid-high	2	26	0.00	1.11	0.98	low	0.51	low	1
	27	0.00	0.00	0.00	null	0.18	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	1.11	0.98	low	1.50	mid-low	1	28	8.33	3.33	3.92	low	0.52	low	5
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						50.35	0.0025	Distribution GB vs ES						22.01	0.176
	Distribution GB vs ELC Map						73.37	0.0366	Distribution GB vs ELC Map						85.44	0.0203

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus altilis</i>									Based on Generalist ELC Map								
Based on specific ELC Map <i>Artocarpus altilis</i>																	
ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	
1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	5.17	4.76	mid-low	2.90	mid-high	2	
2	0.00	1.72	1.59	low	2.69	mid-high	2		2	20.00	12.07	12.70	high	22.71	high	8	
3	0.00	0.00	0.00	null	0.18	low	13		3	0.00	10.34	9.52	high	4.44	high	4	
4	0.00	3.45	3.17	mid-low	0.44	mid-low	1		4	0.00	1.72	1.59	low	6.72	high	2	
5	0.00	6.90	6.35	mid-high	10.31	high	4		5	0.00	24.14	22.22	high	19.09	high	4	
6	0.00	1.72	1.59	low	0.75	mid-low	1		6	0.00	8.62	7.94	mid-high	5.19	high	4	
7	0.00	6.90	6.35	mid-high	4.79	mid-high	4		7	0.00	8.62	7.94	mid-high	6.18	high	4	
8	40.00	12.07	14.29	high	4.80	high	8		8	0.00	0.00	0.00	null	1.78	mid-low	13	
9	20.00	3.45	4.76	mid-low	1.06	mid-low	5		9	20.00	3.45	4.76	mid-low	1.40	mid-low	5	
10	0.00	10.34	9.52	high	6.80	high	4		10	0.00	3.45	3.17	mid-low	0.16	low	1	
11	0.00	1.72	1.59	low	2.79	mid-high	2		11	0.00	0.00	0.00	null	1.58	mid-low	13	
12	0.00	0.00	0.00	null	0.41	mid-low	13		12	0.00	0.00	0.00	null	0.04	low	13	
13	20.00	1.72	3.17	mid-low	0.45	mid-low	5		13	0.00	1.72	1.59	low	0.65	mid-low	1	
14	0.00	8.62	7.94	mid-high	27.70	high	4		14	0.00	0.00	0.00	null	1.38	mid-low	13	
15	0.00	0.00	0.00	null	1.05	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13	
16	0.00	0.00	0.00	null	3.91	mid-high	13		16	0.00	1.72	1.59	low	0.55	low	1	

	17	0.00	20.69	19.05	high	8.01	high	4	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	6.90	6.35	mid-high	1.96	mid-high	4	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	12.07	11.11	high	8.37	high	4	19	20.00	0.00	1.59	low	2.14	mid-high	13
	20	0.00	0.00	0.00	null	6.24	high	13	20	0.00	5.17	4.76	mid-low	2.86	mid-high	2
	21	20.00	0.00	1.59	low	3.78	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	1.53	mid-high	13	22	0.00	5.17	4.76	mid-low	2.44	mid-high	2
	23	0.00	1.72	1.59	low	0.36	low	1	23	20.00	1.72	3.17	mid-low	2.99	mid-high	6
	24	0.00	0.00	0.00	null	0.16	low	13	24	0.00	1.72	1.59	low	2.09	mid-low	1
	25	0.00	0.00	0.00	null	0.01	low	13	25	20.00	5.17	6.35	mid-high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	0.23	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.25	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.26	low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						26.04	0.0807	Distribution GB vs ES						24.65	0.106
	Distribution GB vs ELC Map						80.43	0.0606	Distribution GB vs ELC Map						32.83	0.2031

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus anisophyllus</i>	Based on specific ELC Map <i>Artocarpus anisophyllus</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	12.86	12.68	mid-high	5.36	high	4	2	0.00	44.29	43.66	high	22.71	high	4
	3	0.00	4.29	4.23	mid-high	3.32	mid-high	4	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	40.00	39.44	high	20.28	high	4	4	0.00	14.29	14.08	mid-high	6.72	high	4
	5	0.00	1.43	1.41	low	0.45	low	1	5	100.00	25.71	26.76	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.37	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	2.86	2.82	mid-low	8.56	high	2	7	0.00	12.86	12.68	mid-low	6.18	high	2
	8	0.00	2.86	2.82	mid-low	5.21	high	2	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	7.14	7.04	mid-high	2.53	mid-low	3	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	100.00	27.14	28.17	high	16.27	high	8	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	4.29	high	13	11	0.00	1.43	1.41	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.50	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	1.43	1.41	low	2.91	mid-high	2	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.99	mid-low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.25	low	13	15	0.00	0.00	0.00	null	0.06	low	13

	16	0.00	0.00	0.00	null	3.70	mid-high	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	6.43	high	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.55	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	3.47	mid-high	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	1.73	mid-low	13	20	0.00	1.43	1.41	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	0.05	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.39	mid-low	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	0.89	mid-low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.50	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	2.85	mid-high	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	2.55	mid-high	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	2.82	mid-high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						2.68	0.594741	Distribution GB vs ES						2.89	0.56784
	Distribution GB vs ELC Map						5.15	0.794721	Distribution GB vs ELC Map						4.24	0.77532

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus elasticus</i>	Based on specific ELC Map <i>Artocarpus elasticus</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.48	0.45	low	0.73	mid-high	2		1	0.00	3.35	3.14	mid-low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.02	low	13		2	7.14	27.27	26.01	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.06	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	7.14	3.35	3.59	mid-low	3.56	mid-high	6		4	0.00	4.78	4.48	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	1.40	mid-high	13		5	14.29	16.27	16.14	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.28	mid-low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	7.14	11.00	10.76	high	8.48	high	8		7	0.00	9.09	8.52	high	6.18	high	4
	8	0.00	0.00	0.00	null	0.09	mid-low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	7.14	32.54	30.94	high	34.06	high	8		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.05	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.03	low	13		11	0.00	2.39	2.24	mid-low	1.58	mid-low	1
	12	0.00	4.78	4.48	mid-low	8.13	high	2		12	0.00	0.48	0.45	low	0.04	low	1
	13	0.00	0.48	0.45	low	2.10	mid-high	2		13	0.00	2.87	2.69	mid-low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.06	mid-low	13		14	0.00	1.44	1.35	mid-low	1.38	mid-low	1
	15	0.00	3.35	3.14	mid-low	5.68	mid-high	2		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.02	low	13		16	0.00	0.48	0.45	low	0.55	low	1
	17	0.00	5.26	4.93	mid-high	6.17	mid-high	4		17	21.43	0.96	2.24	mid-low	4.79	high	10

	18	0.00	0.00	0.00	null	0.00	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.08	mid-low	13	19	7.14	7.18	7.17	mid-high	2.14	mid-high	8
	20	14.29	6.70	7.17	mid-high	6.56	high	8	20	0.00	4.78	4.48	mid-high	2.86	mid-high	4
	21	0.00	0.00	0.00	null	1.48	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.96	0.90	low	0.70	mid-low	1	22	28.57	4.31	5.83	mid-high	2.44	mid-high	8
	23	64.29	20.10	22.87	high	11.56	high	8	23	0.00	4.31	4.04	mid-high	2.99	mid-high	4
	24	0.00	0.00	0.00	null	0.12	mid-low	13	24	0.00	0.48	0.45	low	2.09	mid-low	1
	25	0.00	11.00	10.31	mid-high	8.57	high	4	25	21.43	9.09	9.87	high	3.01	mid-high	8
									26	0.00	0.48	0.45	low	0.51	low	1
									27	0.00	0.00	0.00	null	0.06	low	13
									28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						22.06	0.0717	Distribution GB vs ES						89.80	0.0006
	Distribution GB vs ELC Map						43.45	0.0826	Distribution GB vs ELC Map						72.86	0.0281

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus integer</i>	Based on specific ELC Map <i>Artocarpus integer</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	3.96	3.81	mid-high	2.90	mid-high	4
	2	0.00	0.99	0.95	low	0.72	mid-low	1		2	25.00	29.70	29.52	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.01	low	13		3	0.00	3.96	3.81	mid-high	4.44	high	4
	4	0.00	0.00	0.00	null	0.06	low	13		4	0.00	8.91	8.57	high	6.72	high	4
	5	0.00	0.99	0.95	low	3.43	mid-high	2		5	0.00	27.72	26.67	high	19.09	high	4
	6	0.00	0.00	0.00	null	2.89	mid-high	13		6	0.00	0.99	0.95	low	5.19	high	2
	7	25.00	1.98	2.86	mid-low	6.04	high	6		7	0.00	6.93	6.67	high	6.18	high	4
	8	0.00	3.96	3.81	mid-high	6.08	high	4		8	0.00	0.99	0.95	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.99	mid-low	13		9	0.00	0.99	0.95	low	1.40	mid-low	1
	10	50.00	0.00	1.90	mid-low	0.65	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	25.00	42.57	41.90	high	27.45	high	8		11	0.00	1.98	1.90	mid-low	1.58	mid-low	1
	12	0.00	5.94	5.71	high	5.08	mid-high	4		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	2.97	2.86	mid-low	7.31	high	2		13	0.00	0.99	0.95	low	0.65	mid-low	1
	14	0.00	8.91	8.57	high	4.99	mid-high	4		14	0.00	1.98	1.90	mid-low	1.38	mid-low	1
	15	0.00	2.97	2.86	mid-low	0.64	low	1		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.99	0.95	low	2.90	mid-high	2		16	25.00	0.00	0.95	low	0.55	low	13

17	0.00	1.98	1.90	mid-low	3.26	mid-high	2	17	0.00	0.99	0.95	low	4.79	high	2
18	0.00	0.00	0.00	null	0.28	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	0.99	0.95	low	0.26	low	1	19	50.00	0.00	1.90	mid-low	2.14	mid-high	13
20	0.00	9.90	9.52	high	6.85	high	4	20	0.00	3.96	3.81	mid-high	2.86	mid-high	4
21	0.00	0.00	0.00	null	0.72	mid-low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.99	0.95	low	0.82	mid-low	1	22	0.00	0.99	0.95	low	2.44	mid-high	2
23	0.00	7.92	7.62	high	6.14	high	4	23	0.00	1.98	1.90	mid-low	2.99	mid-high	2
24	0.00	2.97	2.86	mid-low	0.50	low	1	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	0.99	0.95	low	4.21	mid-high	2	25	0.00	2.97	2.86	mid-high	3.01	mid-high	4
26	0.00	1.98	1.90	mid-low	6.01	high	2	26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.65	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.32	low	13	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						24.42	0.2442	Distribution GB vs ES						2.37	1
Distribution GB vs ELC Map						155.8	0.0047	Distribution GB vs ELC Map						89.23	0.0174

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus kemando</i>	Based on specific ELC Map <i>Artocarpus kemando</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.70	2.67	mid-low	0.73	mid-low	1	1	0.00	4.05	4.00	mid-low	2.90	mid-high	2
	2	100.00	10.81	12.00	high	9.14	high	8	2	0.00	45.95	45.33	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.06	low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	78.38	77.33	high	34.15	high	4	4	100.00	6.76	8.00	mid-low	6.72	high	6
	5	0.00	0.00	0.00	null	1.82	mid-low	13	5	0.00	27.03	26.67	high	19.09	high	4
	6	0.00	0.00	0.00	null	1.15	mid-low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	3.43	mid-high	13	7	0.00	13.51	13.33	mid-high	6.18	high	4
	8	0.00	0.00	0.00	null	1.87	mid-low	13	8	0.00	1.35	1.33	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.07	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	5.41	5.33	mid-high	6.91	high	4	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.15	low	13	11	0.00	1.35	1.33	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.02	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	1.35	1.33	low	0.73	mid-low	1	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	3.31	mid-high	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	2.75	mid-high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	5.57	high	13	16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	2.80	mid-high	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.09	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	3.02	mid-high	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.62	mid-low	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.12	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	1.35	1.33	low	4.04	high	2	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	4.48	high	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.18	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	7.07	high	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.48	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	3.21	mid-high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						8.25	0.2212	Distribution GB vs ES						13.80	0.1296
	Distribution GB vs ELC Map						9.95	0.6606	Distribution GB vs ELC Map						13.89	0.5896

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus odoratissimus</i>	Based on specific ELC Map <i>Artocarpus odoratissimus</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	4.24	mid-high	13	2	0.00	40.00	38.89	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.08	low	13	3	0.00	2.86	2.78	low	4.44	high	2
	4	0.00	0.00	0.00	null	0.78	low	13	4	0.00	11.43	11.11	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	1.95	mid-low	13	5	100.00	34.29	36.11	high	19.09	high	8
	6	0.00	0.00	0.00	null	1.00	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	2.78	2.70	low	2.09	mid-low	1	7	0.00	5.71	5.56	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	1.56	low	13	8	0.00	2.86	2.78	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	1.38	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.68	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	6.33	high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	2.78	2.70	low	4.64	high	2	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	16.67	16.22	high	10.58	high	4	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	3.31	mid-low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	2.78	2.70	low	3.24	mid-low	1	15	0.00	0.00	0.00	null	0.06	low	13

16	0.00	0.00	0.00	null	3.92	mid-high	13	16	0.00	0.00	0.00	null	0.55	low	13
17	100.00	2.78	5.41	mid-low	3.60	mid-high	6	17	0.00	2.86	2.78	low	4.79	high	2
18	0.00	0.00	0.00	null	4.70	high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	2.78	2.70	low	4.09	mid-high	2	19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	16.67	16.22	high	4.78	high	4	20	0.00	0.00	0.00	null	2.86	mid-high	13
21	0.00	5.56	5.41	mid-low	1.31	low	1	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	36.11	35.14	high	12.73	high	4	22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	0.00	0.00	null	4.83	high	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	3.34	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	2.78	2.70	low	2.63	mid-low	1	25	0.00	0.00	0.00	null	3.01	mid-high	13
26	0.00	0.00	0.00	null	3.90	mid-high	13	26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	3.65	mid-high	13	27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	8.33	8.11	mid-high	2.92	mid-low	3	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						35.00	0.1763	Distribution GB vs ES						1.92	0.5971
Distribution GB vs ELC Map						26.78	0.3153	Distribution GB vs ELC Map						4.24	0.7671

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus rigidus</i>	Based on specific ELC Map <i>Artocarpus rigidus</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0	2.41	2.381	mid-low	0.729	low	1		1	100.00	3.66	4.82	mid-high	2.90	mid-high	8
	2	0	0	0	null	1.017	low	13		2	0.00	36.59	36.14	high	22.71	high	4
	3	0	0	0	null	1.651	mid-low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0	0	0	null	4.624	high	13		4	0.00	10.98	10.84	mid-high	6.72	high	4
	5	0	6.024	5.9524	mid-high	2.029	mid-high	4		5	0.00	29.27	28.92	high	19.09	high	4
	6	0	2.41	2.381	mid-low	1.324	mid-low	1		6	0.00	0.00	0.00	null	5.19	high	13
	7	0	15.66	15.476	high	10.8	high	4		7	0.00	8.54	8.43	mid-high	6.18	high	4
	8	100	1.205	2.381	mid-low	1.776	mid-low	5		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0	1.205	1.1905	low	1.404	mid-low	1		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0	18.07	17.857	high	9.103	high	4		10	0.00	0.00	0.00	null	0.16	low	13
	11	0	0	0	null	0.811	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0	0	0	null	2.989	mid-high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0	1.205	1.1905	low	4.177	mid-high	2		13	0.00	1.22	1.20	low	0.65	mid-low	1
	14	0	6.024	5.9524	mid-high	3.572	mid-high	4		14	0.00	3.66	3.61	mid-low	1.38	mid-low	1
	15	0	0	0	null	0.563	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0	18.07	17.857	high	13.23	high	4		16	0.00	0.00	0.00	null	0.55	low	13

17	0	1.205	1.190 5	low	3.098	mid-high	2
18	0	0	0	null	0.784	low	13
19	0	21.69	21.42 9	high	11.07	high	4
20	0	0	0	null	2.709	mid-high	13
21	0	1.205	1.190 5	low	7.089	high	2
22	0	0	0	null	7.109	high	13
23	0	1.205	1.190 5	low	0.545	low	1
24	0	0	0	null	1.436	mid-low	13
25	0	0	0	null	1.395	mid-low	13
26	0	1.205	1.190 5	low	0.816	low	1
27	0	1.205	1.190 5	low	2.373	mid-high	2
28	0	0	0	null	1.777	mid-low	13
Comparison						Chi Value	p value
Distribution GB vs ES						82.00	0.0949
Distribution GB vs ELC Map						55.30	0.1449

17	0.00	0.00	0.00	null	4.79	high	13
18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	1.22	1.20	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	2.44	2.41	mid-low	2.99	mid-high	2
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	2.44	2.41	mid-low	3.01	mid-high	2
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						26.33	0.1456
Distribution GB vs ELC Map						33.50	0.2543

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus sericicarpus</i>	Based on specific ELC Map <i>Artocarpus sericicarpus</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	7.69	6.67	mid-low	2.90	mid-high	2
	2	25.00	15.38	16.67	mid-high	27.17	high	8	2	50.00	23.08	26.67	high	22.71	high	8
	3	0.00	0.00	0.00	null	3.27	mid-high	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	3.85	3.33	low	0.36	mid-low	1	4	0.00	15.38	13.33	high	6.72	high	4
	5	0.00	0.00	0.00	null	3.57	mid-high	13	5	0.00	11.54	10.00	mid-high	19.09	high	4
	6	0.00	0.00	0.00	null	0.01	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.37	mid-low	13	7	0.00	15.38	13.33	high	6.18	high	4
	8	0.00	3.85	3.33	low	6.73	high	2	8	0.00	3.85	3.33	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	2.97	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	3.85	3.33	low	2.47	mid-high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	25.00	26.92	26.67	high	13.74	high	8	11	0.00	3.85	3.33	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	2.60	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.85	3.33	low	1.00	mid-low	1	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	15.38	13.33	mid-high	3.30	mid-high	4	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.01	low	13	15	0.00	0.00	0.00	null	0.06	low	13

	16	0.00	0.00	0.00	null	0.53	mid-low	13
	17	25.00	19.23	20.00	high	8.27	high	8
	18	0.00	0.00	0.00	null	2.15	mid-high	13
	19	25.00	3.85	6.67	mid-high	8.60	high	8
	20	0.00	0.00	0.00	null	0.88	mid-low	13
	21	0.00	0.00	0.00	null	0.02	low	13
	22	0.00	3.85	3.33	low	9.01	high	2
	23	0.00	0.00	0.00	null	0.00	low	13
	24	0.00	0.00	0.00	null	1.70	mid-low	13
	25	0.00	0.00	0.00	null	0.33	low	13
	26	0.00	0.00	0.00	null	0.23	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						6.35	0.7047
	Distribution GB vs ELC Map						4.67	0.9537
	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	3.85	3.33	low	4.79	high	2
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	7.69	6.67	mid-low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	25.00	3.85	6.67	mid-low	2.44	mid-high	6
	23	25.00	0.00	3.33	low	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	3.85	3.33	low	3.01	mid-high	2
	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						11.44	0.3368
	Distribution GB vs ELC Map						19.02	0.5038

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus tamaran</i>	Based on specific ELC Map <i>Artocarpus tamaran</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	0.45	low	13		2	100.00	38.46	46.67	high	22.71	high	8
	3	0.00	0.00	0.00	null	4.19	mid-high	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	1.22	mid-low	13		4	0.00	15.38	13.33	mid-low	6.72	high	2
	5	0.00	0.00	0.00	null	0.79	low	13		5	0.00	23.08	20.00	mid-high	19.09	high	4
	6	0.00	0.00	0.00	null	4.86	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	1.03	mid-low	13		7	0.00	15.38	13.33	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	0.65	low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	7.69	6.67	low	4.68	mid-high	2		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.59	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.02	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	6.70	high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	5.89	high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	7.69	6.67	low	2.70	mid-low	1		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	15.38	13.33	mid-high	9.28	high	4		15	0.00	0.00	0.00	null	0.06	low	13
	16	50.00	0.00	6.67	low	6.02	high	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	2.46	mid-low	13		17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	30.77	26.67	high	10.29	high	4		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.94	mid-low	13		19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.01	low	13		20	0.00	7.69	6.67	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	5.85	mid-high	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	23.08	20.00	high	4.53	mid-high	4		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	2.34	mid-low	13		23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	8.09	high	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	7.69	6.67	low	4.76	mid-high	2		25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	1.98	mid-low	13		26	0.00	0.00	0.00	null	0.51	low	13
	27	50.00	7.69	13.33	mid-high	8.97	high	8		27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						12.00	0.3112		Distribution GB vs ES						3.20	0.5908
	Distribution GB vs ELC Map						11.88	0.7956		Distribution GB vs ELC Map						6.81	0.9134

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Artocarpus teysmannii</i>	Based on specific ELC Map <i>Artocarpus teysmannii</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	3.23	3.13	low	0.73	mid-low	1	1	0.00	3.23	3.13	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.91	mid-low	13	2	0.00	41.94	40.63	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.13	low	13	3	0.00	4.84	4.69	mid-low	4.44	high	2
	4	0.00	4.84	4.69	mid-low	9.46	high	2	4	0.00	6.45	6.25	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	0.73	mid-low	13	5	0.00	17.74	17.19	high	19.09	high	4
	6	0.00	0.00	0.00	null	1.23	mid-high	13	6	0.00	3.23	3.13	low	5.19	high	2
	7	0.00	0.00	0.00	null	6.54	high	13	7	0.00	3.23	3.13	low	6.18	high	2
	8	0.00	0.00	0.00	null	0.94	mid-low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.21	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	9.68	9.38	mid-high	10.83	high	4	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.99	mid-low	13	11	0.00	1.61	1.56	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.84	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	4.55	mid-high	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.44	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.31	low	13	15	0.00	0.00	0.00	null	0.06	low	13

	16	0.00	0.00	0.00	null	4.99	high	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	1.24	mid-high	13	17	50.00	4.84	6.25	mid-high	4.79	high	8
	18	0.00	0.00	0.00	null	1.43	mid-high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	3.23	3.13	low	5.85	high	2	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	1.61	1.56	low	4.77	mid-high	2	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.53	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	50.00	24.19	25.00	high	17.91	high	8	22	0.00	8.06	7.81	high	2.44	mid-high	4
	23	0.00	0.00	0.00	null	0.30	low	13	23	50.00	3.23	4.69	mid-low	2.99	mid-high	6
	24	0.00	0.00	0.00	null	0.10	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	50.00	6.45	7.81	mid-high	3.75	mid-high	8	25	0.00	1.61	1.56	low	3.01	mid-high	2
	26	0.00	8.06	7.81	mid-high	4.45	mid-high	4	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	3.23	3.13	low	0.73	mid-low	1	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	35.48	34.38	high	15.13	high	4	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						7.82	0.3859	Distribution GB vs ES						23.83	0.1146
	Distribution GB vs ELC Map						14.11	0.4198	Distribution GB vs ELC Map						25.13	0.313

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Averrhoa bilimbi</i>	Based on specific ELC Map <i>Averrhoa bilimbi</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	22.92	22.45	high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	6.51	high	13		2	0.00	10.42	10.20	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.45	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.01	low	13		4	100.00	10.42	12.24	high	6.72	high	8
	5	0.00	2.08	2.04	low	5.66	mid-high	2		5	0.00	12.50	12.24	high	19.09	high	4
	6	0.00	0.00	0.00	null	0.50	low	13		6	0.00	2.08	2.04	low	5.19	high	2
	7	0.00	0.00	0.00	null	2.51	mid-high	13		7	0.00	4.17	4.08	mid-low	6.18	high	2
	8	0.00	2.08	2.04	low	6.75	high	2		8	0.00	2.08	2.04	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.57	mid-low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.39	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	6.25	6.12	mid-low	6.29	high	2		11	0.00	2.08	2.04	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.51	mid-low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.00	low	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	27.08	26.53	high	9.26	high	4		14	0.00	2.08	2.04	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.66	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.26	mid-low	13		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	1.79	mid-high	13		17	0.00	4.17	4.08	mid-low	4.79	high	2

	18	0.00	0.00	0.00	null	0.11	low	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	6.25	6.12	mid-low	3.96	mid-high	2		19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	2.08	2.04	low	0.76	mid-low	1		20	0.00	8.33	8.16	mid-high	2.86	mid-high	4
	21	0.00	0.00	0.00	null	0.00	low	13		21	0.00	2.08	2.04	low	1.32	mid-low	1
	22	0.00	22.92	22.45	mid-high	9.70	high	4		22	0.00	8.33	8.16	mid-high	2.44	mid-high	4
	23	0.00	0.00	0.00	null	0.86	mid-low	13		23	0.00	2.08	2.04	low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	1.33	mid-high	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	100.00	22.92	24.49	high	24.68	high	8		25	0.00	6.25	6.12	mid-high	3.01	mid-high	4
	26	0.00	8.33	8.16	mid-high	9.45	high	4		26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	5.30	mid-high	13		27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						3.36	0.7334		Distribution GB vs ES						8.60	0.6386
	Distribution GB vs ELC Map						3.05	1		Distribution GB vs ELC Map						13.89	0.5787

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Averrhoa carambola</i>	Based on specific ELC Map <i>Averrhoa carambola</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	2.44	2.13	low	2.90	mid-high	2
	2	0.00	7.32	6.38	mid-high	22.52	high	4	2	0.00	19.51	17.02	high	22.71	high	4
	3	0.00	2.44	2.13	low	3.74	mid-high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	2.44	2.13	low	3.28	mid-high	2	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	17.07	14.89	high	16.71	high	4	5	0.00	19.51	17.02	high	19.09	high	4
	6	16.67	0.00	2.13	low	3.50	mid-high	13	6	0.00	2.44	2.13	low	5.19	high	2
	7	0.00	2.44	2.13	low	3.02	mid-high	2	7	16.67	7.32	8.51	mid-high	6.18	high	8
	8	0.00	4.88	4.26	mid-low	2.21	mid-high	2	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.01	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.56	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	7.32	6.38	mid-high	9.30	high	4	11	0.00	2.44	2.13	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	1.21	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.85	mid-low	13	13	0.00	2.44	2.13	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	5.75	high	13	14	0.00	4.88	4.26	mid-low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	1.56	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13
16	0.00	0.00	0.00	null	0.93	mid-low	13	16	0.00	0.00	0.00	null	0.55	low	13	

	17	0.00	0.00	0.00	null	4.25	mid-high	13	17	0.00	4.88	4.26	mid-low	4.79	high	2
	18	0.00	0.00	0.00	null	0.01	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.35	low	13	19	0.00	2.44	2.13	low	2.14	mid-high	2
	20	16.67	12.20	12.77	high	4.73	high	8	20	0.00	7.32	6.38	mid-high	2.86	mid-high	4
	21	0.00	2.44	2.13	low	1.08	mid-low	1	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	7.32	6.38	mid-high	0.32	low	3	22	16.67	7.32	8.51	mid-high	2.44	mid-high	8
	23	33.33	21.95	23.40	high	4.75	high	8	23	0.00	4.88	4.26	mid-low	2.99	mid-high	2
	24	0.00	4.88	4.26	mid-low	1.65	mid-high	2	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	4.88	4.26	mid-low	0.47	low	1	25	33.33	12.20	14.89	high	3.01	mid-high	8
	26	33.33	2.44	6.38	mid-high	5.96	high	12	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.23	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.34	low	13	28	33.33	0.00	4.26	mid-low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						33.08	0.0272	Distribution GB vs ES						11.03	0.5368
	Distribution GB vs ELC Map						27.52	0.2948	Distribution GB vs ELC Map						155.07	0.0109

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Cajanus scarabaeoides</i>	Based on specific ELC Map <i>Cajanus scarabaeoides</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	40.00	42.11	41.03	high	2.90	mid-high	8
	2	0.00	0.00	0.00	null	8.23	high	13	2	5.00	5.26	5.13	low	22.71	high	6
	3	0.00	0.00	0.00	null	1.41	mid-low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.05	mid-high	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.41	low	13	5	0.00	0.00	0.00	null	19.09	high	13
	6	0.00	0.00	0.00	null	0.16	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.12	low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	0.36	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.07	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.07	low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	5.26	2.56	low	2.29	mid-high	2	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.59	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	2.38	mid-high	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	15.77	high	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
15	0.00	0.00	0.00	null	7.94	high	13	15	0.00	0.00	0.00	null	0.06	low	13	

	16	5.00	5.26	5.13	mid-low	12.64	high	6	16	0.00	0.00	0.00	null	0.55	low	13
	17	5.00	5.26	5.13	mid-low	10.09	high	6	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	3.52	mid-high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	8.95	high	13	19	0.00	5.26	2.56	low	2.14	mid-high	2
	20	10.00	5.26	7.69	high	1.71	mid-high	12	20	15.00	15.79	15.38	high	2.86	mid-high	8
	21	0.00	0.00	0.00	null	0.43	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.97	mid-low	13	22	5.00	5.26	5.13	low	2.44	mid-high	6
	23	5.00	0.00	2.56	low	3.51	mid-high	13	23	10.00	10.53	10.26	mid-high	2.99	mid-high	8
	24	0.00	0.00	0.00	null	0.58	mid-low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	5.00	0.00	2.56	low	1.65	mid-low	13	25	15.00	5.26	10.26	mid-high	3.01	mid-high	12
	26	70.00	78.95	74.36	high	8.87	high	8	26	5.00	5.26	5.13	low	0.51	low	5
	27	0.00	0.00	0.00	null	1.15	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	3.36	mid-high	13	28	5.00	5.26	5.13	low	0.52	low	5
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						2.13	0.85914	Distribution GB vs ES						4.70	0.78602
	Distribution GB vs ELC Map						107.5	0.0052	Distribution GB vs ELC Map						149.54	0.0029

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Citrus hystrix</i>	Based on specific ELC Map <i>Citrus hystrix</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.63	1.89	low	0.73	mid-low	1	1	0.00	10.53	7.55	mid-low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.15	low	13	2	6.67	10.53	9.43	mid-high	22.71	high	8
	3	0.00	0.00	0.00	null	0.17	low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.01	low	13	4	6.67	7.89	7.55	mid-low	6.72	high	6
	5	0.00	26.32	18.87	high	8.24	high	4	5	6.67	10.53	9.43	mid-high	19.09	high	8
	6	0.00	2.63	1.89	low	4.13	mid-high	2	6	6.67	0.00	1.89	low	5.19	high	13
	7	0.00	2.63	1.89	low	0.81	mid-low	1	7	13.33	2.63	5.66	mid-low	6.18	high	10
	8	0.00	0.00	0.00	null	0.21	mid-low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.17	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	33.33	26.32	28.30	high	9.92	high	8	10	0.00	26.32	18.87	high	0.16	low	3
	11	26.67	2.63	9.43	high	4.83	mid-high	12	11	0.00	5.26	3.77	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.00	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	2.63	1.89	low	1.20	mid-low	1	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	2.63	1.89	low	0.82	mid-low	1	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.04	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.00	mid-low	13	16	0.00	0.00	0.00	null	0.55	low	13
17	0.00	2.63	1.89	low	1.05	mid-low	1	17	0.00	2.63	1.89	low	4.79	high	2	

18	0.00	0.00	0.00	null	3.00	mid-high	13
19	0.00	2.63	1.89	low	7.88	high	2
20	0.00	0.00	0.00	null	3.63	mid-high	13
21	0.00	0.00	0.00	null	0.01	low	13
22	6.67	5.26	5.66	mid-high	1.80	mid-high	8
23	0.00	0.00	0.00	null	2.29	mid-high	13
24	6.67	0.00	1.89	low	5.56	high	13
25	6.67	18.42	15.09	high	14.73	high	8
26	20.00	2.63	7.55	mid-high	25.62	high	12
Comparison						Chi Value	p value
Distribution GB vs ES						62.39	0.0002
Distribution GB vs ELC Map						31.60	0.1584

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	0.00	0.00	null	2.14	mid-high	13
20	13.33	0.00	3.77	low	2.86	mid-high	13
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	20.00	5.26	9.43	mid-high	2.44	mid-high	12
23	13.33	7.89	9.43	mid-high	2.99	mid-high	8
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	13.33	7.89	9.43	mid-high	3.01	mid-high	8
26	0.00	2.63	1.89	low	0.51	low	1
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						26.00	0.0165
Distribution GB vs ELC Map						43.96	0.0826

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Citrus maxima</i>	Based on specific ELC Map <i>Citrus maxima</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	3.70	0.00	2.27	low	2.90	mid-high	13
	2	7.41	0.00	4.55	mid-low	1.67	mid-low	13	2	14.81	0.00	9.09	mid-high	22.71	high	13
	3	0.00	0.00	0.00	null	0.55	mid-low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.31	low	13	4	0.00	5.88	2.27	low	6.72	high	2
	5	18.52	41.18	27.27	high	10.34	high	8	5	7.41	11.76	9.09	mid-high	19.09	high	8
	6	0.00	0.00	0.00	null	4.63	mid-high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	14.81	11.76	13.64	high	1.11	mid-low	11	7	7.41	0.00	4.55	mid-low	6.18	high	13
	8	14.81	0.00	9.09	high	15.39	high	13	8	0.00	5.88	2.27	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	8.97	high	13	9	3.70	0.00	2.27	low	1.40	mid-low	13
	10	0.00	5.88	2.27	low	6.18	mid-high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.42	mid-high	13	11	3.70	17.65	9.09	mid-high	1.58	mid-low	7
	12	3.70	5.88	4.55	mid-low	2.51	mid-high	6	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.66	mid-low	13	13	3.70	5.88	4.55	mid-low	0.65	mid-low	5
	14	0.00	0.00	0.00	null	7.37	high	13	14	7.41	5.88	6.82	mid-high	1.38	mid-low	11
	15	3.70	0.00	2.27	low	6.81	high	13	15	0.00	0.00	0.00	null	0.06	low	13
16	0.00	0.00	0.00	null	1.06	mid-low	13	16	7.41	0.00	4.55	mid-low	0.55	low	13	

	17	7.41	0.00	4.55	mid-low	6.68	mid-high	13	17	0.00	5.88	2.27	low	4.79	high	2
	18	3.70	0.00	2.27	low	6.93	high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	3.70	0.00	2.27	low	4.27	mid-high	13	19	7.41	17.65	11.36	high	2.14	mid-high	8
	20	3.70	23.53	11.36	high	7.26	high	8	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	11.76	4.55	mid-low	1.73	mid-high	2	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	1.39	mid-low	13	22	14.81	5.88	11.36	high	2.44	mid-high	12
	23	3.70	0.00	2.27	low	0.30	low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.06	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.05	low	13	25	14.81	17.65	15.91	high	3.01	mid-high	12
	26	7.41	0.00	4.55	mid-low	0.36	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	3.70	0.00	2.27	low	0.08	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	3.70	0.00	2.27	low	0.17	low	13	28	3.70	0.00	2.27	low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						8.81	0.1084	Distribution GB vs ES						15.88	0.0761
	Distribution GB vs ELC Map						175.4	0.0006	Distribution GB vs ELC Map						86.51	0.0209

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Cocos nucifera</i>									Based on Generalist ELC Map								
Based on specific ELC Map <i>Cocos nucifera</i>									ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	
	1	0.00	10.34	5.56	mid-low	0.73	mid-low	1	1	16.00	27.59	22.22	high	2.90	mid-high	8	
	2	0.00	10.34	5.56	mid-low	2.16	mid-high	2	2	16.00	10.34	12.96	high	22.71	high	12	
	3	0.00	0.00	0.00	null	1.44	mid-high	13	3	0.00	3.45	1.85	low	4.44	high	2	
	4	12.00	13.79	12.96	mid-high	8.55	high	8	4	12.00	0.00	5.56	mid-high	6.72	high	13	
	5	0.00	0.00	0.00	null	2.70	mid-high	13	5	8.00	24.14	16.67	high	19.09	high	8	
	6	0.00	0.00	0.00	null	0.01	low	13	6	0.00	6.90	3.70	mid-low	5.19	high	2	
	7	48.00	17.24	31.48	high	36.42	high	12	7	12.00	0.00	5.56	mid-high	6.18	high	13	
	8	0.00	0.00	0.00	null	0.14	low	13	8	4.00	0.00	1.85	low	1.78	mid-low	13	
	9	0.00	0.00	0.00	null	0.01	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13	
	10	20.00	10.34	14.81	high	6.86	high	12	10	8.00	6.90	7.41	mid-high	0.16	low	7	
	11	8.00	0.00	3.70	low	3.61	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13	
	12	0.00	0.00	0.00	null	1.36	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13	
	13	8.00	17.24	12.96	mid-high	5.78	high	8	13	4.00	0.00	1.85	low	0.65	mid-low	13	
	14	0.00	0.00	0.00	null	0.20	mid-low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13	
	15	0.00	0.00	0.00	null	0.00	low	13	15	0.00	0.00	0.00	null	0.06	low	13	
	16	4.00	6.90	5.56	mid-low	2.23	mid-high	6	16	4.00	3.45	3.70	mid-low	0.55	low	5	

	17	0.00	0.00	0.00	null	0.31	mid-low	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.00	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	3.45	1.85	low	5.55	high	2	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	3.45	1.85	low	1.07	mid-low	1	20	8.00	0.00	3.70	mid-low	2.86	mid-high	13
	21	0.00	0.00	0.00	null	1.95	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	4.33	mid-high	13	22	0.00	3.45	1.85	low	2.44	mid-high	2
	23	0.00	0.00	0.00	null	0.20	mid-low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.01	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	6.90	3.70	low	5.12	high	2	25	8.00	13.79	11.11	high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	0.16	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.01	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	9.09	high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						28.30	0.0034	Distribution GB vs ES						8.02	0.4039
	Distribution GB vs ELC Map						18.59	0.4611	Distribution GB vs ELC Map						135.7	0.0022

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Colocasia esculenta</i>	Based on specific ELC Map <i>Colocasia esculenta</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.46	1.23	0.54	low	0.73	low	9		1	5.02	6.17	5.15	mid-high	2.90	mid-high	12
	2	0.15	3.70	0.54	low	1.27	mid-low	5		2	13.85	6.17	13.01	high	22.71	high	12
	3	2.44	6.17	2.85	mid-low	2.99	mid-high	10		3	0.76	1.23	0.81	low	4.44	high	10
	4	6.24	16.05	7.32	high	6.60	high	12		4	4.87	4.94	4.88	mid-high	6.72	high	12
	5	0.30	1.23	0.41	low	0.91	mid-low	9		5	13.55	4.94	12.60	high	19.09	high	12
	6	2.74	3.70	2.85	mid-low	2.74	mid-high	10		6	0.76	3.70	1.08	mid-low	5.19	high	10
	7	8.22	6.17	7.99	high	5.21	high	12		7	4.87	6.17	5.01	mid-high	6.18	high	12
	8	0.46	0.00	0.41	low	0.98	mid-low	13		8	1.07	2.47	1.22	mid-low	1.78	mid-low	9
	9	3.65	3.70	3.66	mid-high	3.13	mid-high	12		9	0.46	2.47	0.68	low	1.40	mid-low	9
	10	4.72	6.17	4.88	mid-high	6.01	high	12		10	0.91	2.47	1.08	mid-low	0.16	low	9
	11	0.00	0.00	0.00	null	0.13	low	13		11	1.67	3.70	1.90	mid-low	1.58	mid-low	9
	12	0.00	0.00	0.00	null	0.88	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	1.07	6.17	1.63	mid-low	0.76	low	9		13	0.91	3.70	1.22	mid-low	0.65	mid-low	9
	14	0.46	2.47	0.68	low	3.13	mid-high	10		14	1.07	1.23	1.08	mid-low	1.38	mid-low	9
	15	3.65	6.17	3.93	mid-high	8.14	high	12		15	0.00	0.00	0.00	null	0.06	low	13
	16	10.35	4.94	9.76	high	12.55	high	12		16	2.59	3.70	2.71	mid-high	0.55	low	11

	17	0.91	0.00	0.81	mid-low	3.06	mid-high	13	17	3.35	6.17	3.66	mid-high	4.79	high	12
	18	4.72	6.17	4.88	mid-high	10.61	high	12	18	0.30	4.94	0.81	low	2.44	mid-high	6
	19	9.89	11.11	10.03	high	14.08	high	12	19	4.87	12.35	5.69	high	2.14	mid-high	12
	20	0.46	0.00	0.41	low	0.21	low	13	20	5.33	4.94	5.28	mid-high	2.86	mid-high	12
	21	1.37	0.00	1.22	mid-low	0.12	low	13	21	0.91	0.00	0.81	low	1.32	mid-low	13
	22	2.13	2.47	2.17	mid-low	0.76	low	9	22	9.28	2.47	8.54	high	2.44	mid-high	12
	23	2.28	1.23	2.17	mid-low	2.51	mid-low	9	23	7.76	6.17	7.59	high	2.99	mid-high	12
	24	4.11	4.94	4.20	mid-high	1.92	mid-low	11	24	0.46	1.23	0.54	low	2.09	mid-low	9
	25	12.94	3.70	11.92	high	4.20	mid-high	12	25	12.33	4.94	11.52	high	3.01	mid-high	12
	26	3.20	0.00	2.85	mid-low	1.71	mid-low	13	26	0.61	1.23	0.68	low	0.51	low	9
	27	2.74	1.23	2.57	mid-low	1.48	mid-low	9	27	0.00	0.00	0.00	null	0.06	low	13
	28	10.35	1.23	9.35	high	3.19	mid-high	12	28	2.44	2.47	2.44	mid-high	0.52	low	11
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						844.1	1.00E-04	Distribution GB vs ES						502.9	1.00E-04
	Distribution GB vs ELC Map						470.2	1.00E-04	Distribution GB vs ELC Map						648.3	1.00E-04

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Colocasia gigantea</i>	Based on specific ELC Map <i>Colocasia gigantea</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	5.13	4.65	mid-low	2.90	mid-high	2
	2	0.00	12.82	11.63	mid-high	5.54	high	4		2	25.00	7.69	9.30	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.29	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.59	low	13		4	0.00	5.13	4.65	mid-low	6.72	high	2
	5	0.00	15.38	13.95	high	5.62	high	4		5	0.00	20.51	18.60	high	19.09	high	4
	6	0.00	0.00	0.00	null	1.57	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.35	low	13		7	0.00	5.13	4.65	mid-low	6.18	high	2
	8	25.00	10.26	11.63	mid-high	7.83	high	8		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.43	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.03	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	25.00	2.56	4.65	low	4.09	mid-high	6		11	0.00	2.56	2.33	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.34	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.75	mid-low	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	50.00	20.51	23.26	high	12.56	high	8		14	0.00	2.56	2.33	low	1.38	mid-low	1
	15	0.00	7.69	6.98	mid-low	1.98	mid-high	2		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	5.13	4.65	low	2.75	mid-high	2		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	5.11	mid-high	13	17	0.00	2.56	2.33	low	4.79	high	2
	18	0.00	0.00	0.00	null	0.51	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	1.36	mid-low	13	19	0.00	20.51	18.60	high	2.14	mid-high	4
	20	0.00	10.26	9.30	mid-low	5.54	high	2	20	0.00	2.56	2.33	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	0.57	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.79	mid-low	13	22	0.00	2.56	2.33	low	2.44	mid-high	2
	23	0.00	0.00	0.00	null	4.88	mid-high	13	23	0.00	7.69	6.98	mid-high	2.99	mid-high	4
	24	0.00	0.00	0.00	null	1.35	mid-low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.68	mid-low	13	25	50.00	15.38	18.60	high	3.01	mid-high	8
	26	0.00	10.26	9.30	mid-low	21.16	high	2	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	3.14	mid-high	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	5.13	4.65	low	8.46	high	2	28	25.00	0.00	2.33	low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						13.06	0.1575	Distribution GB vs ES						10.00	0.5282
	Distribution GB vs ELC Map						13.26	0.6549	Distribution GB vs ELC Map						78.87	0.0197

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Dimocarpus longan</i>	Based on specific ELC Map <i>Dimocarpus longan</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	1.85	1.56	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.12	low	13		2	60.00	46.30	48.44	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.69	mid-low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.19	low	13		4	0.00	7.41	6.25	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	0.54	mid-low	13		5	20.00	25.93	25.00	high	19.09	high	8
	6	0.00	5.56	4.69	mid-low	3.18	mid-high	2		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	2.42	mid-high	13		7	0.00	7.41	6.25	mid-high	6.18	high	4
	8	0.00	0.00	0.00	null	0.61	mid-low	13		8	0.00	1.85	1.56	low	1.78	mid-low	1
	9	20.00	0.00	3.13	low	4.36	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	3.94	mid-high	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	1.52	mid-high	13		11	0.00	1.85	1.56	low	1.58	mid-low	1
	12	0.00	5.56	4.69	mid-low	9.13	high	2		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.72	mid-low	13		13	0.00	1.85	1.56	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.07	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.76	mid-high	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.05	low	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	0.08	low	13	17	0.00	1.85	1.56	low	4.79	high	2
	18	0.00	0.00	0.00	null	0.52	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.05	low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	3.70	3.13	low	0.63	mid-low	1	20	0.00	1.85	1.56	low	2.86	mid-high	2
	21	0.00	1.85	1.56	low	5.30	mid-high	2	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.27	low	13	22	0.00	1.85	1.56	low	2.44	mid-high	2
	23	10.00	14.81	14.06	mid-high	7.30	high	8	23	10.00	0.00	1.56	low	2.99	mid-high	13
	24	50.00	37.04	39.06	high	20.91	high	8	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	5.58	high	13	25	10.00	0.00	1.56	low	3.01	mid-high	13
	26	10.00	5.56	6.25	mid-high	6.09	high	8	26	0.00	0.00	0.00	null	0.51	low	13
	27	10.00	25.93	23.44	high	17.89	high	8	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	6.34	high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						4.01	0.7098	Distribution GB vs ES						3.65	0.8784
	Distribution GB vs ELC Map						14.71	0.6361	Distribution GB vs ELC Map						14.61	0.7749

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Dioscorea alata</i>	Based on specific ELC Map <i>Dioscorea alata</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	5.56	2.90	mid-low	0.73	mid-low	1		1	9.09	13.89	11.59	high	2.90	mid-high	8
	2	6.06	0.00	2.90	mid-low	1.91	mid-high	13		2	0.00	2.78	1.45	low	22.71	high	2
	3	3.03	0.00	1.45	low	5.25	high	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.07	low	13		4	3.03	2.78	2.90	mid-low	6.72	high	6
	5	21.21	13.89	17.39	high	1.96	mid-high	12		5	6.06	13.89	10.14	mid-high	19.09	high	8
	6	54.55	38.89	46.38	high	8.20	high	12		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	2.78	1.45	low	0.94	mid-low	1		7	6.06	2.78	4.35	mid-high	6.18	high	12
	8	3.03	2.78	2.90	mid-low	0.31	low	5		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	1.48	mid-high	13		9	0.00	2.78	1.45	low	1.40	mid-low	1
	10	0.00	0.00	0.00	null	0.24	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.48	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	4.69	mid-high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.05	low	13		13	0.00	2.78	1.45	low	0.65	mid-low	1
	14	0.00	11.11	5.80	high	0.78	mid-low	3		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	8.33	4.35	mid-high	8.70	high	4		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.83	mid-high	13		16	0.00	2.78	1.45	low	0.55	low	1

	17	0.00	2.78	1.45	low	0.56	mid-low	1	17	0.00	2.78	1.45	low	4.79	high	2
	18	6.06	2.78	4.35	mid-high	26.24	high	12	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.21	mid-high	13	19	6.06	0.00	2.90	mid-low	2.14	mid-high	13
	20	0.00	2.78	1.45	low	0.52	mid-low	1	20	6.06	5.56	5.80	mid-high	2.86	mid-high	8
	21	0.00	2.78	1.45	low	5.50	high	2	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.01	low	13	22	21.21	19.44	20.29	high	2.44	mid-high	8
	23	0.00	0.00	0.00	null	1.35	mid-high	13	23	9.09	11.11	10.14	mid-high	2.99	mid-high	8
	24	0.00	0.00	0.00	null	7.51	high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.47	low	13	25	30.30	16.67	23.19	high	3.01	mid-high	12
	26	3.03	2.78	2.90	mid-low	0.73	mid-low	5	26	0.00	0.00	0.00	null	0.51	low	13
	27	3.03	2.78	2.90	mid-low	16.21	high	6	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	1.05	mid-low	13	28	3.03	0.00	1.45	low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						17.93	0.1265	Distribution GB vs ES						12.62	0.3744
	Distribution GB vs ELC Map						183.7	0.005	Distribution GB vs ELC Map						166.1	0.0006

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Diospyros discolor</i>	Based on specific ELC Map <i>Diospyros discolor</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	2.06	mid-low	13		2	0.00	0.00	0.00	null	22.71	high	13
	3	0.00	0.00	0.00	null	1.30	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.10	low	13		4	0.00	33.33	30.00	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	1.91	mid-low	13		5	0.00	33.33	30.00	mid-high	19.09	high	4
	6	0.00	0.00	0.00	null	1.06	low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.12	low	13		7	0.00	22.22	20.00	low	6.18	high	2
	8	0.00	0.00	0.00	null	3.91	mid-high	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.02	mid-low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.60	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.81	mid-low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	11.11	10.00	low	8.79	high	2		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.82	low	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	2.61	mid-low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	22.22	20.00	mid-high	7.55	high	4		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.91	mid-low	13		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	3.65	mid-high	13		17	0.00	0.00	0.00	null	4.79	high	13

	18	0.00	0.00	0.00	null	3.43	mid-high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	6.13	high	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	4.83	mid-high	13	20	100	11.11	20.00	low	2.86	mid-high	6
	21	0.00	11.11	10.00	low	7.57	high	2	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	11.11	10.00	low	3.90	mid-high	2	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	11.11	10.00	low	5.35	high	2	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	22.22	20.00	mid-high	6.95	high	4	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	4.66	mid-high	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	100.00	11.11	20.00	mid-high	4.70	mid-high	8	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	2.09	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	7.47	high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						8.00	0.5608	Distribution GB vs ES						8.00	0.1067
	Distribution GB vs ELC Map						20.26	0.4592	Distribution GB vs ELC Map						33.94	0.2139

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Durio dulcis</i>	Based on specific ELC Map <i>Durio dulcis</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	1.52	mid-low	13		2	50.00	26.92	28.57	high	22.71	high	8
	3	0.00	0.00	0.00	null	1.78	mid-low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	100.00	38.46	42.86	high	12.05	high	8		4	50.00	23.08	25.00	mid-low	6.72	high	6
	5	0.00	0.00	0.00	null	1.91	mid-low	13		5	0.00	23.08	21.43	low	19.09	high	2
	6	0.00	7.69	7.14	mid-low	1.98	mid-low	1		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	42.31	39.29	mid-high	11.88	high	4		7	0.00	26.92	25.00	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	2.16	mid-high	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	3.95	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	9.72	high	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	1.27	mid-low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.59	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.85	3.57	low	12.96	high	2		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	1.40	mid-low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.58	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	7.69	7.14	mid-low	11.65	high	2		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	2.70	mid-high	13
	18	0.00	0.00	0.00	null	1.71	mid-low	13
	19	0.00	0.00	0.00	null	5.61	high	13
	20	0.00	0.00	0.00	null	0.92	low	13
	21	0.00	0.00	0.00	null	2.46	mid-high	13
	22	0.00	0.00	0.00	null	0.89	low	13
	23	0.00	0.00	0.00	null	2.21	mid-high	13
	24	0.00	0.00	0.00	null	0.00	low	13
	25	0.00	0.00	0.00	null	4.11	mid-high	13
	26	0.00	0.00	0.00	null	3.24	mid-high	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						3.20	0.4953
	Distribution GB vs ELC Map						14.60	0.5900
	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						2.02	0.8573
	Distribution GB vs ELC Map						7.65	0.8706

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Durio kutejensis</i>	Based on specific ELC Map <i>Durio kutejensis</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	100	3.70	7.14	low	2.90	mid-high	6
	2	0.00	0.00	0.00	null	1.16	mid-low	13		2	0	37.04	35.71	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.00	low	13		3	0	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.27	low	13		4	0	11.11	10.71	mid-low	6.72	high	2
	5	0.00	0.00	0.00	null	2.77	mid-high	13		5	0	29.63	28.57	high	19.09	high	4
	6	0.00	0.00	0.00	null	0.64	mid-low	13		6	0	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.87	mid-low	13		7	0	14.81	14.29	mid-high	6.18	high	4
	8	100.00	30.77	33.33	high	18.42	high	8		8	0	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	5.52	mid-high	13		9	0	0.00	0.00	null	1.40	mid-low	13
	10	0.00	23.08	22.22	high	9.99	high	4		10	0	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	7.07	high	13		11	0	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.00	low	13		12	0	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.07	mid-low	13		13	0	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	11.24	high	13		14	0	3.70	3.57	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	2.76	mid-high	13		15	0	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	4.09	mid-high	13		16	0	0.00	0.00	null	0.55	low	13

	17	0.00	15.38	14.81	mid-high	7.06	high	4		17	0	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.19	low	13		18	0	0.00	0.00	null	2.44	mid-high	13
	19	0.00	11.54	11.11	mid-low	2.00	mid-high	2		19	0	0.00	0.00	null	2.14	mid-high	13
	20	0.00	3.85	3.70	low	6.97	high	2		20	0	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.02	low	13		21	0	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	1.93	mid-low	13		22	0	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	5.76	high	13		23	0	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.55	mid-high	13		24	0	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	1.08	mid-low	13		25	0	0.00	0.00	null	3.01	mid-high	13
	26	0.00	11.54	11.11	mid-low	5.25	mid-high	2		26	0	0.00	0.00	null	0.51	low	13
	27	0.00	3.85	3.70	low	0.26	low	1		27	0	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.33	low	13		28	0	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						2.25	1		Distribution GB vs ES						26	0.0751
	Distribution GB vs ELC Map						4.43	1		Distribution GB vs ELC Map						33.50	0.2446

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Durio macrantha</i>	Based on specific ELC Map <i>Durio macrantha</i>	Based on Generalist ELC Map				
NA		ELC CAT	GB (%)	class	ELC map (%)	Quart Class. ELC map
		1	0.00	null	2.90	mid-high
		2	0.00	null	22.71	high
		3	0.00	null	4.44	high
		4	0.00	null	6.72	high
		5	0.00	null	19.09	high
		6	0.00	null	5.19	high
		7	0.00	null	6.18	high
		8	0.00	null	1.78	mid-low
		9	0.00	null	1.40	mid-low
		10	0.00	null	0.16	low
		11	0.00	null	1.58	mid-low
		12	0.00	null	0.04	low
		13	0.00	null	0.65	mid-low
		14	100.00	low	1.38	mid-low
		15	0.00	null	0.06	low
		16	0.00	null	0.55	low
		17	0.00	null	4.79	high
		18	0.00	null	2.44	mid-high
		19	0.00	null	2.14	mid-high

			20	0.00	null	2.86	mid-high
			21	0.00	null	1.32	mid-low
			22	0.00	null	2.44	mid-high
			23	0.00	null	2.99	mid-high
			24	0.00	null	2.09	mid-low
			25	0.00	null	3.01	mid-high
			26	0.00	null	0.51	low
			27	0.00	nula	0.06	low
			28	0.00	nula	0.52	low
			Comparison			Chi Value	p value
			Distribution GB vs ELC Map			71.33	0.0532

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Durio oxleyanus</i>	Based on specific ELC Map <i>Durio oxleyanus</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	0.79	mid-low	13		2	0.00	37.50	33.33	mid-high	22.71	high	4
	3	0.00	0.00	0.00	null	0.07	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.17	low	13		3	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.01	low	13		4	100.00	33.33	40.74	high	19.09	high	8
	6	0.00	0.00	0.00	null	5.84	high	13		5	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	1.26	mid-high	13		6	0.00	25.00	22.22	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	1.15	mid-low	13		7	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.06	mid-high	13		8	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.23	low	13		9	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.10	low	13		10	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.60	mid-low	13		11	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.04	low	13		12	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	7.12	high	13		13	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.50	mid-low	13		14	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.62	mid-low	13		15	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.03	low	13		16	0.00	0.00	0.00	null	4.79	high	13

18	0.00	0.00	0.00	null	5.90	high	13
19	0.00	0.00	0.00	null	0.35	mid-low	13
20	0.00	0.00	0.00	null	1.33	mid-high	13
21	0.00	0.00	0.00	null	2.84	mid-high	13
22	33.33	20.83	22.22	mid-high	12.85	high	8
23	0.00	0.00	0.00	null	2.13	mid-high	13
24	0.00	12.50	11.11	low	5.84	high	2
25	0.00	0.00	0.00	null	1.59	mid-high	13
26	0.00	0.00	0.00	null	7.62	high	13
27	0.00	0.00	0.00	null	0.32	low	13
28	0.00	0.00	0.00	null	1.12	mid-low	13
Comparison						Chi Value	p value
Distribution GB vs ES						5.00	0.2882
Distribution GB vs ELC Map						11.28	0.8227

17	0.00	0.00	0.00	null	2.44	mid-high	13
18	0.00	0.00	0.00	null	2.14	mid-high	13
19	0.00	0.00	0.00	null	2.86	mid-high	13
20	0.00	0.00	0.00	null	1.32	mid-low	13
21	0.00	0.00	0.00	null	2.44	mid-high	13
22	0.00	4.17	3.70	low	2.99	mid-high	2
23	0.00	0.00	0.00	null	2.09	mid-low	13
24	0.00	0.00	0.00	null	3.01	mid-high	13
25	0.00	0.00	0.00	null	0.51	low	13
26	0.00	0.00	0.00	null	0.06	low	13
27	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						6.00	0.1663
Distribution GB vs ELC Map						12.72	0.6903

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Durio zibethinus</i>	Based on specific ELC Map <i>Durio zibethinus</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	3.85	6.25	5.17	mid-high	2.90	mid-high	8
	2	5.77	4.69	5.17	mid-high	5.32	high	8		2	13.46	26.56	20.69	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.00	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.19	low	13		4	9.62	9.38	9.48	high	6.72	high	8
	5	1.92	7.81	5.17	mid-high	2.45	mid-high	8		5	11.54	18.75	15.52	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.00	low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	1.92	1.56	1.72	low	0.07	low	5		7	13.46	3.13	7.76	mid-high	6.18	high	12
	8	7.69	7.81	7.76	mid-high	7.88	high	8		8	5.77	1.56	3.45	mid-low	1.78	mid-low	9
	9	0.00	0.00	0.00	null	0.38	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	13.46	17.19	15.52	high	10.27	high	8		10	3.85	0.00	1.72	low	0.16	low	13
	11	1.92	0.00	0.86	low	2.81	mid-high	13		11	1.92	0.00	0.86	low	1.58	mid-low	13
	12	3.85	1.56	2.59	mid-low	2.47	mid-high	10		12	0.00	0.00	0.00	null	0.04	low	13
	13	5.77	25.00	16.38	high	17.72	high	8		13	1.92	6.25	4.31	mid-high	0.65	mid-low	7
	14	0.00	0.00	0.00	null	2.15	mid-low	13		14	1.92	1.56	1.72	low	1.38	mid-low	5
	15	0.00	1.56	0.86	low	1.93	mid-low	1		15	0.00	0.00	0.00	null	0.06	low	13
	16	1.92	6.25	4.31	mid-high	5.40	high	8		16	5.77	7.81	6.90	mid-high	0.55	low	7
	17	0.00	0.00	0.00	null	0.01	low	13		17	1.92	3.13	2.59	mid-low	4.79	high	6

18	0.00	0.00	0.00	null	0.41	mid-low	13
19	11.54	6.25	8.62	high	10.66	high	12
20	0.00	0.00	0.00	null	2.49	mid-high	13
21	3.85	0.00	1.72	low	2.32	mid-low	13
22	26.92	15.63	20.69	high	14.31	high	12
23	0.00	0.00	0.00	null	3.26	mid-high	13
24	3.85	3.13	3.45	mid-low	1.85	mid-low	5
25	5.77	1.56	3.45	mid-low	4.35	mid-high	10
26	0.00	0.00	0.00	null	0.01	low	13
27	3.85	0.00	1.72	low	0.54	mid-low	13
Comparison						Chi Value	p value
Distribution GB vs ES						29.62	0.0107
Distribution GB vs ELC Map						55.75	0.0219

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	1.92	0.00	0.86	low	2.14	mid-high	13
20	0.00	3.13	1.72	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	3.85	1.56	2.59	mid-low	2.44	mid-high	10
23	13.46	6.25	9.48	high	2.99	mid-high	12
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	5.77	4.69	5.17	mid-high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						41.80	0.0006
Distribution GB vs ELC Map						115.9	0.0018

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Ficus deltoidea</i>	Based on specific ELC Map <i>Ficus deltoidea</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	3.85	3.23	low	2.22	mid-high	2		2	0.00	26.92	22.58	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.01	low	13		3	0.00	3.85	3.23	low	4.44	high	2
	4	0.00	0.00	0.00	null	6.75	high	13		4	0.00	7.69	6.45	mid-low	6.72	high	2
	5	0.00	0.00	0.00	null	1.66	mid-high	13		5	0.00	26.92	22.58	high	19.09	high	4
	6	0.00	0.00	0.00	null	2.25	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	60.00	11.54	19.35	high	5.95	high	8		7	0.00	7.69	6.45	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	0.00	low	13		8	0.00	7.69	6.45	mid-low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.76	mid-low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	50.00	41.94	high	18.92	high	4		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.72	mid-low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.07	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	7.38	high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	3.23	mid-high	13		14	0.00	3.85	3.23	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.39	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	40.00	7.69	12.90	mid-low	6.51	high	6		16	20.00	3.85	6.45	mid-low	0.55	low	5

	17	0.00	0.00	0.00	null	0.02	low	13	17	20.00	7.69	9.68	mid-high	4.79	high	8
	18	0.00	0.00	0.00	null	0.46	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	19.23	16.13	mid-high	24.76	high	4	19	60.00	3.85	12.90	mid-high	2.14	mid-high	12
	20	0.00	0.00	0.00	null	1.79	mid-high	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.18	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	7.24	high	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	1.14	mid-low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.91	mid-low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	3.85	3.23	low	5.57	mid-high	2	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.04	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	3.85	3.23	low	0.31	low	1	27	0.00	0.00	0.00	null	0.06	low	13
									28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						21.00	0.0175	Distribution GB vs ES						49.60	0.0006
	Distribution GB vs ELC Map						37.54	0.1315	Distribution GB vs ELC Map						119.7	0.0173

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Ficus grossularioides</i>	Based on specific ELC Map <i>Ficus grossularioides</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.56	1.55	mid-low	0.73	mid-low	1		1	0.00	2.34	2.33	mid-low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.06	low	13		2	0.00	30.47	30.23	high	22.71	high	4
	3	0.00	0.78	0.78	low	0.57	mid-low	1		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.02	low	13		4	0.00	6.25	6.20	mid-high	6.72	high	4
	5	0.00	1.56	1.55	mid-low	6.52	high	2		5	0.00	21.88	21.71	high	19.09	high	4
	6	0.00	1.56	1.55	mid-low	4.28	mid-high	2		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	3.36	mid-high	13		7	0.00	9.38	9.30	high	6.18	high	4
	8	0.00	0.00	0.00	null	0.38	mid-low	13		8	0.00	0.78	0.78	low	1.78	mid-low	1
	9	0.00	0.78	0.78	low	0.14	low	1		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.15	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.06	low	13		11	0.00	8.59	8.53	high	1.58	mid-low	3
	12	0.00	1.56	1.55	mid-low	1.11	mid-low	1		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.13	low	13		13	0.00	1.56	1.55	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	3.16	mid-high	13		14	0.00	3.13	3.10	mid-high	1.38	mid-low	3
	15	0.00	0.00	0.00	null	4.22	mid-high	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.54	mid-low	13		16	0.00	2.34	2.33	mid-low	0.55	low	1

	17	100	10.16	10.85	high	2.98	mid-high	8	17	100	3.13	3.88	mid-high	4.79	high	8
	18	0.00	4.69	4.65	mid-high	7.12	high	4	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	1.64	mid-high	13	19	0.00	5.47	5.43	mid-high	2.14	mid-high	4
	20	0.00	7.81	7.75	mid-high	8.89	high	4	20	0.00	1.56	1.55	low	2.86	mid-high	2
	21	0.00	45.31	44.96	high	31.65	high	4	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	11.72	11.63	high	6.54	high	4	22	0.00	0.78	0.78	low	2.44	mid-high	2
	23	0.00	0.78	0.78	low	3.69	mid-high	2	23	0.00	1.56	1.55	low	2.99	mid-high	2
	24	0.00	8.59	8.53	high	5.57	high	4	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.41	mid-low	13	25	0.00	0.78	0.78	low	3.01	mid-high	2
	26	0.00	1.56	1.55	mid-low	0.70	mid-low	1	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.78	0.78	low	5.21	high	2	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.78	0.78	low	0.17	low	1	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						8.85	0.4226	Distribution GB vs ES						31.00	0.1809
	Distribution GB vs ELC Map						32.59	0.1011	Distribution GB vs ELC Map						19.86	0.399

Appendix 27 Representativeness of *ex situ* collection (*contd.*)

<i>Ficus hirta</i>	Based on specific ELC Map <i>Ficus hirta</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	1.15	low	13	2	0.00	22.64	21.43	high	22.71	high	4
	3	33.33	1.89	3.57	mid-high	2.85	mid-low	7	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	3.77	3.57	mid-high	4.99	mid-high	4	4	33.33	1.89	3.57	mid-low	6.72	high	6
	5	0.00	0.00	0.00	null	0.54	low	13	5	0.00	47.17	44.64	high	19.09	high	4
	6	0.00	0.00	0.00	null	0.41	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	3.33	mid-low	13	7	0.00	3.77	3.57	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	1.45	mid-low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	5.53	high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	3.87	mid-high	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.65	low	13	11	0.00	5.66	5.36	mid-high	1.58	mid-low	3
	12	0.00	0.00	0.00	null	1.05	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	1.89	1.79	low	4.41	mid-high	2	13	0.00	1.89	1.79	low	0.65	mid-low	1
	14	0.00	1.89	1.79	low	3.79	mid-high	2	14	0.00	1.89	1.79	low	1.38	mid-low	1
	15	0.00	1.89	1.79	low	5.12	high	2	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	5.55	high	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	1.46	mid-low	13	17	33.33	5.66	7.14	mid-high	4.79	high	8

18	0.00	0.00	0.00	null	3.79	mid-high	13
19	0.00	1.89	1.79	low	3.51	mid-high	2
20	0.00	0.00	0.00	null	0.40	low	13
21	0.00	7.55	7.14	mid-high	1.65	mid-low	3
22	33.33	0.00	1.79	low	1.35	mid-low	13
23	0.00	11.32	10.71	high	9.76	high	4
24	33.33	1.89	3.57	mid-high	6.73	high	8
25	0.00	18.87	17.86	high	13.80	high	4
26	0.00	0.00	0.00	null	2.40	mid-low	13
27	0.00	1.89	1.79	low	6.21	high	2
28	0.00	45.28	42.86	high	3.52	mid-high	4
Comparison						Chi Value	p value
Distribution GB vs ES						51.00	0.0211
Distribution GB vs ELC Map						38.39	0.1665

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	33.33	5.66	7.14	mid-high	2.14	mid-high	8
20	0.00	1.89	1.79	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	1.89	1.79	low	3.01	mid-high	2
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						26.44	0.0429
Distribution GB vs ELC Map						24.51	0.3357

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Ficus oleifolia</i>	Based on specific ELC Map <i>Ficus oleifolia</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.75	1.72	low	0.73	mid-low	1	1	0.00	1.75	1.72	low	2.90	mid-high	2
	2	0.00	10.53	10.34	high	29.04	high	4	2	0.00	10.53	10.34	high	22.71	high	4
	3	0.00	1.75	1.72	low	6.74	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	1.75	1.72	low	0.98	mid-low	1	4	0.00	1.75	1.72	low	6.72	high	2
	5	0.00	0.00	0.00	null	8.36	high	13	5	0.00	7.02	6.90	high	19.09	high	4
	6	0.00	0.00	0.00	null	0.10	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	6.40	high	13	7	0.00	1.75	1.72	low	6.18	high	2
	8	0.00	1.75	1.72	low	4.51	mid-high	2	8	0.00	1.75	1.72	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.10	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.50	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.74	mid-low	13	11	0.00	3.51	3.45	mid-high	1.58	mid-low	3
	12	0.00	0.00	0.00	null	0.05	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.01	low	13	13	0.00	1.75	1.72	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.45	low	13	14	0.00	3.51	3.45	mid-high	1.38	mid-low	3
	15	0.00	0.00	0.00	null	0.20	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.25	mid-high	13	16	0.00	1.75	1.72	low	0.55	low	1
	17	100.00	61.40	62.07	high	7.63	high	8	17	100.00	54.39	55.17	high	4.79	high	8
	18	0.00	1.75	1.72	low	0.82	mid-low	1	18	0.00	0.00	0.00	null	2.44	mid-high	13

19	0.00	0.00	0.00	null	1.42	mid-high	13
20	0.00	3.51	3.45	high	7.96	high	4
21	0.00	1.75	1.72	low	1.74	mid-high	2
22	0.00	0.00	0.00	null	1.76	mid-high	13
23	0.00	1.75	1.72	low	4.85	mid-high	2
24	0.00	1.75	1.72	low	0.67	mid-low	1
25	0.00	0.00	0.00	null	9.46	high	13
26	0.00	7.02	6.90	high	2.70	mid-high	4
27	0.00	1.75	1.72	low	0.28	low	1
28	0.00	1.75	1.72	low	0.54	mid-low	1
Comparison						Chi Value	p value
Distribution GB vs ES						0.63	1
Distribution GB vs ELC Map						12.10	0.4546

19	0.00	5.26	5.17	high	2.14	mid-high	4
20	0.00	3.51	3.45	mid-high	2.86	mid-high	4
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	1.75	1.72	low	2.99	mid-high	2
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	0.00	0.00	null	3.01	mid-high	13
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						0.84	1
Distribution GB vs ELC Map						19.86	0.4029

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Ficus padana</i>	Based on specific ELC Map <i>Ficus padana</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.22	2.08	mid-low	0.73	low	1	1	0.00	3.33	3.13	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	2.31	mid-low	13	2	16.67	17.78	17.71	high	22.71	high	8
	3	0.00	2.22	2.08	mid-low	4.01	high	2	3	0.00	1.11	1.04	low	4.44	high	2
	4	0.00	0.00	0.00	null	2.75	mid-high	13	4	0.00	6.67	6.25	mid-high	6.72	high	4
	5	0.00	1.11	1.04	low	2.91	mid-high	2	5	0.00	17.78	16.67	high	19.09	high	4
	6	0.00	1.11	1.04	low	1.59	mid-low	1	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	2.86	mid-high	13	7	0.00	5.56	5.21	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	0.61	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.63	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	2.73	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	1.11	1.04	low	1.34	mid-low	1	11	0.00	10.00	9.38	high	1.58	mid-low	3
	12	0.00	4.44	4.17	mid-low	2.07	mid-low	1	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	7.78	7.29	mid-high	1.15	low	3	13	0.00	4.44	4.17	mid-low	0.65	mid-low	1
	14	0.00	8.89	8.33	high	0.74	low	3	14	0.00	3.33	3.13	low	1.38	mid-low	1
	15	0.00	1.11	1.04	low	0.12	low	1	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	1.11	1.04	low	0.60	low	1	16	0.00	6.67	6.25	mid-high	0.55	low	3

	17	0.00	12.22	11.46	high	14.62	high	4	17	16.67	6.67	7.29	mid-high	4.79	high	8
	18	0.00	1.11	1.04	low	7.52	high	2	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	17.78	16.67	high	12.01	high	4	19	33.33	15.56	16.67	high	2.14	mid-high	8
	20	16.67	2.22	3.13	mid-low	5.02	high	6	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	9.43	high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	5.56	5.21	mid-high	3.66	mid-high	4	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	15.56	14.58	high	5.40	high	4	23	16.67	1.11	2.08	low	2.99	mid-high	6
	24	50.00	2.22	5.21	mid-high	1.58	mid-low	11	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	33.33	2.22	4.17	mid-low	2.69	mid-low	5	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	10.00	9.38	high	3.87	mid-high	4	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	3.55	mid-high	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	3.49	mid-high	13	28	16.67	0.00	1.04	low	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						99.00	1.00E-04	Distribution GB vs ES						22.27	0.1163
	Distribution GB vs ELC Map						116.9	0.01	Distribution GB vs ELC Map						67.31	0.0286

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Garcinia celebica</i>	Based on specific ELC Map <i>Garcinia celebica</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	3.61	3.13	mid-high	0.73	low	3		1	0.00	15.66	13.54	high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	0.02	low	13		2	0.00	20.48	17.71	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.00	low	13		3	0.00	3.61	3.13	mid-low	4.44	high	2
	4	0.00	1.20	1.04	low	0.21	low	1		4	7.69	6.02	6.25	mid-high	6.72	high	8
	5	23.08	1.20	4.17	mid-high	1.33	mid-low	11		5	0.00	12.05	10.42	high	19.09	high	4
	6	23.08	13.25	14.58	high	7.46	high	8		6	0.00	1.20	1.04	low	5.19	high	2
	7	0.00	4.82	4.17	mid-high	4.50	high	4		7	0.00	6.02	5.21	mid-high	6.18	high	4
	8	0.00	2.41	2.08	mid-low	2.17	mid-high	2		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	7.69	3.61	4.17	mid-high	1.65	mid-low	7		9	0.00	2.41	2.08	mid-low	1.40	mid-low	1
	10	7.69	1.20	2.08	mid-low	1.73	mid-high	6		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	1.20	1.04	low	0.52	low	1		11	7.69	1.20	2.08	mid-low	1.58	mid-low	5
	12	0.00	7.23	6.25	mid-high	3.03	mid-high	4		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	14.46	12.50	high	23.94	high	4		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	1.20	1.04	low	1.69	mid-low	1		14	0.00	1.20	1.04	low	1.38	mid-low	1
	15	0.00	4.82	4.17	mid-high	1.87	mid-high	4		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	7.23	6.25	mid-high	6.30	high	4		16	7.69	0.00	1.04	low	0.55	low	13

	17	7.69	0.00	1.04	low	0.76	mid-low	13	17	7.69	1.20	2.08	mid-low	4.79	high	6
	18	0.00	0.00	0.00	null	0.29	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	1.20	1.04	low	1.37	mid-low	1	19	7.69	4.82	5.21	mid-high	2.14	mid-high	8
	20	0.00	0.00	0.00	null	1.15	mid-low	13	20	0.00	2.41	2.08	mid-low	2.86	mid-high	2
	21	0.00	2.41	2.08	mid-low	3.42	mid-high	2	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	12.05	10.42	high	16.74	high	4	22	7.69	4.82	5.21	mid-high	2.44	mid-high	8
	23	0.00	1.20	1.04	low	1.27	mid-low	1	23	7.69	6.02	6.25	mid-high	2.99	mid-high	8
	24	7.69	7.23	7.29	high	2.50	mid-high	8	24	0.00	1.20	1.04	low	2.09	mid-low	1
	25	0.00	2.41	2.08	mid-low	4.82	high	2	25	15.38	6.02	7.29	high	3.01	mid-high	8
	26	7.69	0.00	1.04	low	1.69	mid-high	13	26	7.69	0.00	1.04	low	0.51	low	13
	27	0.00	1.20	1.04	low	0.70	low	1	27	0.00	0.00	0.00	null	0.06	low	13
	28	15.38	4.82	6.25	mid-high	8.12	high	8	28	23.08	3.61	6.25	mid-high	0.52	low	7
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						81.95	0.0007	Distribution GB vs ES						39.55	0.0206
	Distribution GB vs ELC Map						78.87	0.0072	Distribution GB vs ELC Map						177.5	0.0054

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Garcinia mangostana</i>	Based on specific ELC Map <i>Garcinia mangostana</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	3.13	2.86	low	6.70	high	2	2	33.33	46.88	45.71	high	22.71	high	8
	3	0.00	3.13	2.86	low	9.25	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	33.33	3.13	5.71	mid-high	11.28	high	8	4	0.00	9.38	8.57	mid-low	6.72	high	2
	5	0.00	0.00	0.00	null	0.75	mid-low	13	5	33.33	18.75	20.00	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.12	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.10	low	13	7	0.00	9.38	8.57	mid-low	6.18	high	2
	8	66.67	65.63	65.71	high	32.68	high	8	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	3.13	2.86	low	4.54	mid-high	2	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	15.63	14.29	high	8.21	high	4	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.01	low	13	11	0.00	3.13	2.86	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	1.78	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.21	mid-low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	2.94	mid-high	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.01	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.02	low	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.00	low	13	17	0.00	0.00	0.00	null	4.79	high	13
18	0.00	0.00	0.00	null	1.21	mid-high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13	

19	0.00	0.00	0.00	null	1.13	mid-low	13
20	0.00	0.00	0.00	null	2.17	mid-high	13
21	0.00	3.13	2.86	low	8.79	high	2
22	0.00	0.00	0.00	null	1.05	mid-low	13
23	0.00	0.00	0.00	null	2.75	mid-high	13
24	0.00	3.13	2.86	low	2.59	mid-high	2
25	0.00	0.00	0.00	null	0.34	mid-low	13
26	0.00	0.00	0.00	null	0.63	mid-low	13
Comparison						Chi Value	p value
Distribution GB vs ES						9.70	0.4653
Distribution GB vs ELC Map						4.03	1

19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	3.13	2.86	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	33.33	9.38	11.43	mid-high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						3.04	0.878
Distribution GB vs ELC Map						11.30	0.7494

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Garcinia rigida</i>	Based on specific ELC Map <i>Garcinia rigida</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	3.03	2.94	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.01	low	13		2	0.00	42.42	41.18	high	22.71	high	4
	3	0.00	0.00	0.00	null	0.70	mid-low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	100.00	12.50	15.15	mid-high	2.90	mid-high	8		4	0.00	12.12	11.76	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	3.98	mid-high	13		5	0.00	30.30	29.41	high	19.09	high	4
	6	0.00	0.00	0.00	null	5.95	high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	25.00	24.24	high	15.04	high	4		7	0.00	6.06	5.88	mid-low	6.18	high	2
	8	0.00	0.00	0.00	null	3.35	mid-high	13		8	100.00	3.03	5.88	mid-low	1.78	mid-low	5
	9	0.00	9.38	9.09	mid-high	5.45	high	4		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	31.25	30.30	high	16.87	high	4		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.01	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	3.13	3.03	low	0.94	mid-low	1		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	6.25	6.06	mid-high	3.55	mid-high	4		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	3.13	3.03	low	2.10	mid-low	1		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	2.47	mid-high	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	3.13	3.03	low	6.83	high	2		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	1.58	mid-low	13		17	0.00	0.00	0.00	null	4.79	high	13

	18	0.00	0.00	0.00	null	2.33	mid-low	13
	19	0.00	3.13	3.03	low	8.40	high	2
	20	0.00	0.00	0.00	null	0.00	low	13
	21	0.00	0.00	0.00	null	5.28	high	13
	22	0.00	3.13	3.03	low	5.19	mid-high	2
	23	0.00	0.00	0.00	null	0.01	low	13
	24	0.00	0.00	0.00	null	3.12	mid-high	13
	25	0.00	0.00	0.00	null	0.40	low	13
	26	0.00	0.00	0.00	null	0.00	low	13
	27	0.00	0.00	0.00	null	2.30	mid-low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						7.00	0.444
	Distribution GB vs ELC Map						33.45	0.1708
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	3.03	2.94	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						32.00	0.091
	Distribution GB vs ELC Map						55.09	0.0966

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Gnetum gnemon</i>	Based on specific ELC Map <i>Gnetum gnemon</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.62	0.60	low	0.73	mid-low	1	1	0.00	10.49	10.18	high	2.90	mid-high	4
	2	0.00	0.62	0.60	low	0.22	low	1	2	0.00	20.37	19.76	high	22.71	high	4
	3	0.00	3.09	2.99	mid-low	2.49	mid-high	2	3	0.00	4.94	4.79	mid-high	4.44	high	4
	4	0.00	0.62	0.60	low	0.30	low	1	4	0.00	4.32	4.19	mid-high	6.72	high	4
	5	0.00	3.09	2.99	mid-low	9.86	high	2	5	20.00	16.05	16.17	high	19.09	high	8
	6	0.00	9.88	9.58	high	27.40	high	4	6	20.00	6.17	6.59	high	5.19	high	8
	7	0.00	2.47	2.40	mid-low	2.95	mid-high	2	7	0.00	3.70	3.59	mid-high	6.18	high	4
	8	20.00	8.02	8.38	mid-high	5.17	mid-high	8	8	0.00	5.56	5.39	high	1.78	mid-low	3
	9	0.00	9.88	9.58	high	5.98	high	4	9	0.00	1.23	1.20	low	1.40	mid-low	1
	10	0.00	3.09	2.99	mid-low	1.47	mid-low	1	10	20.00	1.85	2.40	mid-low	0.16	low	5
	11	0.00	0.00	0.00	null	1.67	mid-high	13	11	0.00	0.62	0.60	low	1.58	mid-low	1
	12	0.00	1.85	1.80	mid-low	7.34	high	2	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	3.42	mid-high	13	13	0.00	1.23	1.20	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.01	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.71	mid-low	13	15	0.00	0.62	0.60	low	0.06	low	1
	16	0.00	0.62	0.60	low	0.35	mid-low	1	16	0.00	1.85	1.80	mid-low	0.55	low	1

	17	0.00	0.62	0.60	low	0.13	low	1	17	0.00	2.47	2.40	mid-low	4.79	high	2
	18	0.00	0.00	0.00	null	0.20	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.15	low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	20.00	4.32	4.79	mid-high	0.35	mid-low	7	20	20.00	2.47	2.99	mid-low	2.86	mid-high	6
	21	0.00	11.11	10.78	high	2.54	mid-high	4	21	0.00	1.23	1.20	low	1.32	mid-low	1
	22	0.00	0.00	0.00	null	0.18	low	13	22	20.00	2.47	2.99	mid-low	2.44	mid-high	6
	23	0.00	1.85	1.80	mid-low	1.76	mid-high	2	23	0.00	3.70	3.59	mid-high	2.99	mid-high	4
	24	20.00	8.02	8.38	mid-high	5.62	high	8	24	0.00	1.85	1.80	mid-low	2.09	mid-low	1
	25	0.00	0.00	0.00	null	0.37	mid-low	13	25	0.00	6.17	5.99	high	3.01	mid-high	4
	26	20.00	10.49	10.78	high	7.34	high	8	26	0.00	0.62	0.60	low	0.51	low	1
	27	20.00	18.52	18.56	high	9.64	high	8	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	1.23	1.20	mid-low	1.66	mid-low	1	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						7.60	0.9085	Distribution GB vs ES						26.49	0.233
	Distribution GB vs ELC Map						65.18	0.0864	Distribution GB vs ELC Map						136.6	0.012

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Ipomoea aquatica</i>	Based on specific ELC Map <i>Ipomoea aquatica</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.78	2.74	mid-low	0.73	low	1		1	0.00	8.33	8.22	mid-high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	5.85	high	13		2	0.00	6.94	6.85	mid-high	22.71	high	4
	3	0.00	0.00	0.00	null	1.39	mid-low	13		3	0.00	6.94	6.85	mid-high	4.44	high	4
	4	0.00	1.39	1.37	low	3.19	mid-high	2		4	0.00	5.56	5.48	mid-low	6.72	high	2
	5	0.00	12.50	12.33	high	11.34	high	4		5	0.00	11.11	10.96	high	19.09	high	4
	6	0.00	2.78	2.74	mid-low	2.85	mid-high	2		6	0.00	1.39	1.37	low	5.19	high	2
	7	0.00	4.17	4.11	mid-high	5.22	high	4		7	0.00	6.94	6.85	mid-high	6.18	high	4
	8	0.00	2.78	2.74	mid-low	2.82	mid-low	1		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	2.78	2.74	mid-low	1.87	mid-low	1		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.43	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.17	mid-low	13		11	0.00	1.39	1.37	low	1.58	mid-low	1
	12	0.00	1.39	1.37	low	0.28	low	1		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	1.39	1.37	low	0.57	low	1		13	0.00	1.39	1.37	low	0.65	mid-low	1
	14	0.00	4.17	4.11	mid-high	19.32	high	4		14	0.00	1.39	1.37	low	1.38	mid-low	1
	15	0.00	2.78	2.74	mid-low	3.22	mid-high	2		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	4.17	4.11	mid-high	4.58	high	4		16	0.00	2.78	2.74	mid-low	0.55	low	1

	17	0.00	9.72	9.59	high	3.02	mid-high	4	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	6.94	6.85	high	3.87	mid-high	4	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	1.39	1.37	low	1.11	mid-low	1	19	0.00	2.78	2.74	mid-low	2.14	mid-high	2
	20	0.00	0.00	0.00	null	3.48	mid-high	13	20	0.00	9.72	9.59	high	2.86	mid-high	4
	21	0.00	0.00	0.00	null	0.92	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	1.39	1.37	low	0.65	low	1	22	0.00	9.72	9.59	high	2.44	mid-high	4
	23	0.00	2.78	2.74	mid-low	1.93	mid-low	1	23	0.00	5.56	5.48	mid-low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	0.44	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.13	low	13	25	100.0 0	18.06	19.18	high	3.01	mid-high	8
	26	0.00	5.56	5.48	mid-high	4.73	high	4	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	19.44	19.18	high	9.84	high	4	27	0.00	0.00	0.00	null	0.06	low	13
	28	100.0 0	9.72	10.96	high	3.06	mid-high	8	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						9.29	0.685	Distribution GB vs ES						4.54	1
	Distribution GB vs ELC Map						31.73	0.2543	Distribution GB vs ELC Map						32.26	0.3119

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Lansium domesticum</i>	Based on specific ELC Map <i>Lansium domesticum</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	1.47	1.35	low	1.23	mid-high	2	2	33.33	32.35	32.43	high	22.71	high	8
	3	0.00	2.94	2.70	low	1.42	mid-high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	1.47	1.35	low	0.34	mid-low	1	4	16.67	7.35	8.11	high	6.72	high	8
	5	0.00	2.94	2.70	low	6.96	high	2	5	33.33	17.65	18.92	high	19.09	high	8
	6	0.00	0.00	0.00	null	1.37	mid-high	13	6	0.00	1.47	1.35	low	5.19	high	2
	7	0.00	2.94	2.70	low	0.31	low	1	7	0.00	10.29	9.46	high	6.18	high	4
	8	0.00	4.41	4.05	mid-high	1.11	mid-low	3	8	0.00	4.41	4.05	mid-high	1.78	mid-low	3
	9	0.00	0.00	0.00	null	0.01	low	13	9	0.00	1.47	1.35	low	1.40	mid-low	1
	10	0.00	0.00	0.00	null	0.04	low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	2.94	2.70	low	7.62	high	2	11	0.00	2.94	2.70	low	1.58	mid-low	1
	12	16.67	1.47	2.70	low	6.79	high	6	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.60	mid-low	13	13	0.00	1.47	1.35	low	0.65	mid-low	1
	14	0.00	2.94	2.70	low	3.65	mid-high	2	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.15	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	2.94	2.70	low	0.35	mid-low	1	16	0.00	2.94	2.70	low	0.55	low	1
17	16.67	26.47	25.68	high	24.08	high	8	17	0.00	0.00	0.00	null	4.79	high	13	

18	0.00	0.00	0.00	null	0.54	mid-low	13
19	0.00	5.88	5.41	high	6.37	high	4
20	16.67	11.76	12.16	high	8.55	high	8
21	0.00	2.94	2.70	low	5.15	mid-high	2
22	0.00	0.00	0.00	null	0.04	low	13
23	0.00	4.41	4.05	mid-high	5.34	mid-high	4
24	0.00	0.00	0.00	null	0.34	mid-low	13
25	0.00	0.00	0.00	null	0.03	low	13
26	50.00	17.65	20.27	high	14.53	high	8
27	0.00	0.00	0.00	null	0.22	low	13
28	0.00	4.41	4.05	mid-high	2.13	mid-high	4
Comparison						Chi Value	p value
Distribution GB vs ES						15.88	0.4064
Distribution GB vs ELC Map						9.42	0.762

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	2.94	2.70	low	2.14	mid-high	2
20	0.00	5.88	5.41	mid-high	2.86	mid-high	4
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	2.94	2.70	low	2.44	mid-high	2
23	0.00	2.94	2.70	low	2.99	mid-high	2
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	16.67	2.94	4.05	mid-high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						7.77	0.815
Distribution GB vs ELC Map						8.45	0.956

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera applanata</i>	Based on specific ELC Map <i>Mangifera applanata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	33.33	9.52	12.50	high	5.73	high	8	2	0.00	28.57	25.00	high	22.71	high	4
	3	0.00	4.76	4.17	low	3.50	mid-high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	3.04	mid-high	13	4	33.33	23.81	25.00	high	6.72	high	8
	5	0.00	4.76	4.17	low	3.94	mid-high	2	5	33.33	9.52	12.50	mid-high	19.09	high	8
	6	0.00	0.00	0.00	null	0.56	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	4.76	4.17	low	1.29	low	1	7	0.00	9.52	8.33	mid-low	6.18	high	2
	8	0.00	14.29	12.50	high	5.74	high	4	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	4.76	4.17	low	3.02	mid-low	1	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	4.76	4.17	low	2.16	mid-low	1	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	4.15	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	4.76	4.17	low	0.88	low	1	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.79	mid-low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	2.28	mid-low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	1.41	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.51	mid-low	13	16	0.00	4.76	4.17	low	0.55	low	1

	17	0.00	4.76	4.17	low	4.64	mid-high	2	17	0.00	4.76	4.17	low	4.79	high	2
	18	0.00	4.76	4.17	low	1.10	low	1	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	1.21	low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	11.22	high	13	20	0.00	9.52	8.33	mid-low	2.86	mid-high	2
	21	33.33	4.76	8.33	mid-high	4.79	high	8	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	4.76	4.17	low	4.78	mid-high	2	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	5.16	high	13	23	33.33	9.52	12.50	mid-high	2.99	mid-high	8
	24	0.00	0.00	0.00	null	1.04	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	1.40	mid-low	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	33.33	9.52	12.50	high	13.14	high	8	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	9.52	8.33	mid-high	5.19	high	4	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	9.52	8.33	mid-high	4.61	mid-high	4	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						11.00	0.7536	Distribution GB vs ES						5.40	0.5426
	Distribution GB vs ELC Map						12.31	0.9157	Distribution GB vs ELC Map						14.84	0.6332

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera casturi</i>	Based on specific ELC Map <i>Mangifera casturi</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	25.00	0.00	7.14	low	3.01	mid-high	13		2	75.00	40.00	50.00	high	22.71	high	8
	3	0.00	40.00	28.57	high	2.77	mid-high	4		3	0.00	0.00	0.00	null	4.44	high	13
	4	25.00	10.00	14.29	mid-low	8.73	high	6		4	25.00	0.00	7.14	low	6.72	high	13
	5	0.00	0.00	0.00	null	9.48	high	13		5	0.00	20.00	14.29	mid-low	19.09	high	2
	6	25.00	0.00	7.14	low	1.45	mid-low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	2.64	mid-high	13		7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	0.56	low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.22	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	2.22	mid-high	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.07	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.24	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.73	mid-high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.70	mid-low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.06	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.74	mid-low	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	0.97	mid-low	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.61	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	7.52	high	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	7.54	high	13	20	0.00	20.00	14.29	mid-low	2.86	mid-high	2
	21	0.00	30.00	21.43	high	1.26	mid-low	3	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	20.00	14.29	mid-low	23.35	high	2	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	7.59	high	13	23	0.00	20.00	14.29	mid-low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	3.27	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	5.02	mid-high	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	1.19	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.62	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	25.00	0.00	7.14	low	5.71	high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						9.00	0.1	Distribution GB vs ES						4.50	0.3728
	Distribution GB vs ELC Map						28.76	0.2896	Distribution GB vs ELC Map						9.63	0.876

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera gedebe</i>	Based on specific ELC Map <i>Mangifera gedebe</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	4.55	4.17	low	0.73	mid-low	1	1	0.00	4.55	4.17	low	2.90	mid-high	2
	2	50.00	0.00	4.17	low	7.17	high	13	2	0.00	22.73	20.83	high	22.71	high	4
	3	0.00	0.00	0.00	null	1.51	mid-high	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	3.61	mid-high	13	4	0.00	22.73	20.83	high	6.72	high	4
	5	0.00	0.00	0.00	null	2.02	mid-high	13	5	0.00	18.18	16.67	mid-high	19.09	high	4
	6	0.00	0.00	0.00	null	0.86	mid-low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.89	mid-low	13	7	50.00	9.09	12.50	mid-high	6.18	high	8
	8	0.00	0.00	0.00	null	2.09	mid-high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.65	mid-low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.20	mid-high	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	3.19	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	1.45	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.39	mid-low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.01	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.00	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.00	low	13	16	50.00	0.00	4.17	low	0.55	low	13
17	0.00	0.00	0.00	null	0.04	low	13	17	0.00	0.00	0.00	null	4.79	high	13	

	18	0.00	0.00	0.00	null	0.00	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.00	low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.64	mid-low	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.23	low	13	21	0.00	9.09	8.33	mid-high	1.32	mid-low	3
	22	0.00	0.00	0.00	null	0.40	mid-low	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	50.00	22.73	25.00	high	17.35	high	8	23	0.00	4.55	4.17	low	2.99	mid-high	2
	24	0.00	9.09	8.33	mid-low	6.70	high	2	24	0.00	4.55	4.17	low	2.09	mid-low	1
	25	0.00	13.64	12.50	mid-high	12.07	high	4	25	0.00	4.55	4.17	low	3.01	mid-high	2
	26	0.00	22.73	20.83	mid-high	17.16	high	4	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	22.73	20.83	mid-high	7.44	high	4	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	4.55	4.17	low	12.21	high	2	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						3.40	1	Distribution GB vs ES						10.00	0.3641
	Distribution GB vs ELC Map						7.85	0.6901	Distribution GB vs ELC Map						96.76	0.0358

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera gracilipes</i>	Based on specific ELC Map <i>Mangifera gracilipes</i>	Based on Generalist ELC Map							
	NA	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
		1	0.00	0.00	0.00	null	2.90	mid-high	13
		2	0.00	28.57	20.00	mid-high	22.71	high	4
		3	0.00	0.00	0.00	null	4.44	high	13
		4	0.00	14.29	10.00	low	6.72	high	2
		5	100.00	42.86	60.00	high	19.09	high	8
		6	0.00	0.00	0.00	null	5.19	high	13
		7	0.00	14.29	10.00	low	6.18	high	2
		8	0.00	0.00	0.00	null	1.78	mid-low	13
		9	0.00	0.00	0.00	null	1.40	mid-low	13
		10	0.00	0.00	0.00	null	0.16	low	13
		11	0.00	0.00	0.00	null	1.58	mid-low	13
		12	0.00	0.00	0.00	null	0.04	low	13
		13	0.00	0.00	0.00	null	0.65	mid-low	13
		14	0.00	0.00	0.00	null	1.38	mid-low	13
		15	0.00	0.00	0.00	null	0.06	low	13
		16	0.00	0.00	0.00	null	0.55	low	13
		17	0.00	0.00	0.00	null	4.79	high	13
		18	0.00	0.00	0.00	null	2.44	mid-high	13
		19	0.00	0.00	0.00	null	2.14	mid-high	13

	20	0.00	0.00	0.00	null	2.86	mid-high	13	
	21	0.00	0.00	0.00	null	1.32	mid-low	13	
	22	0.00	0.00	0.00	null	2.44	mid-high	13	
	23	0.00	0.00	0.00	null	2.99	mid-high	13	
	24	0.00	0.00	0.00	null	2.09	mid-low	13	
	25	0.00	0.00	0.00	null	3.01	mid-high	13	
	26	0.00	0.00	0.00	null	0.51	low	13	
	27	0.00	0.00	0.00	null	0.06	low	13	
	28	0.00	0.00	0.00	null	0.52	low	13	
	Comparison							Chi Value	p value
	Distribution GB vs ES							4.00	0.28
	Distribution GB vs ELC Map							12.72	0.6911

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera griffithii</i>	Based on specific ELC Map <i>Mangifera griffithii</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.00	1.92	low	0.73	low	1	1	0.00	2.00	1.92	low	2.90	mid-high	2
	2	0.00	14.00	13.46	mid-high	7.20	high	4	2	0.00	38.00	36.54	high	22.71	high	4
	3	0.00	24.00	23.08	high	4.87	high	4	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	12.00	11.54	mid-high	4.51	mid-high	4	4	50.00	24.00	25.00	high	6.72	high	8
	5	0.00	0.00	0.00	null	2.58	mid-low	13	5	0.00	16.00	15.38	mid-low	19.09	high	2
	6	0.00	0.00	0.00	null	2.11	mid-low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	2.84	mid-low	13	7	50.00	16.00	17.31	mid-high	6.18	high	8
	8	0.00	2.00	1.92	low	2.56	mid-low	1	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	3.56	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.65	low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	20.00	19.23	mid-high	18.74	high	4	11	0.00	2.00	1.92	low	1.58	mid-low	1
	12	0.00	20.00	19.23	mid-high	6.81	high	4	12	0.00	0.00	0.00	null	0.04	low	13
	13	50.00	6.00	7.69	mid-low	4.83	mid-high	6	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	4.63	mid-high	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	3.32	mid-high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	5.11	high	13	16	0.00	2.00	1.92	low	0.55	low	1

	17	0.00	0.00	0.00	null	4.33	mid-high	13
	18	0.00	0.00	0.00	null	5.45	high	13
	19	0.00	0.00	0.00	null	0.68	low	13
	20	0.00	0.00	0.00	null	0.90	mid-low	13
	21	0.00	0.00	0.00	null	0.61	low	13
	22	50.00	0.00	1.92	low	0.55	low	13
	23	0.00	0.00	0.00	null	2.90	mid-high	13
	24	0.00	0.00	0.00	null	2.54	mid-low	13
	25	0.00	0.00	0.00	null	5.71	high	13
	26	0.00	0.00	0.00	null	0.20	low	13
	27	0.00	0.00	0.00	null	0.84	mid-low	13
	28	0.00	0.00	0.00	null	0.22	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						15.67	0.0999
	Distribution GB vs ELC Map						98.83	0.016
	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						3.21	0.5711
	Distribution GB vs ELC Map						13.54	0.5918

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera laurina</i>	Based on specific ELC Map <i>Mangifera laurina</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.22	1.14	low	0.73	mid-low	1		1	0.00	3.66	3.41	mid-low	2.90	mid-high	2
	2	16.67	10.98	11.36	high	14.41	high	8		2	16.67	20.73	20.45	high	22.71	high	8
	3	0.00	24.39	22.73	high	23.87	high	4		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	1.03	mid-low	13		4	16.67	12.20	12.50	high	6.72	high	8
	5	0.00	0.00	0.00	null	3.45	mid-high	13		5	0.00	18.29	17.05	high	19.09	high	4
	6	0.00	0.00	0.00	null	0.02	low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	2.44	2.27	low	5.38	high	2		7	0.00	1.22	1.14	low	6.18	high	2
	8	16.67	3.66	4.55	mid-low	4.88	mid-high	6		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	3.09	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	4.88	4.55	mid-low	3.98	mid-high	2		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	4.88	4.55	mid-low	5.90	high	2		11	16.67	2.44	3.41	mid-low	1.58	mid-low	5
	12	0.00	1.22	1.14	low	0.74	mid-low	1		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	3.10	mid-high	13		13	16.67	1.22	2.27	low	0.65	mid-low	5
	14	0.00	0.00	0.00	null	0.00	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	28.05	26.14	high	9.49	high	4		15	0.00	0.00	0.00	null	0.06	low	13
	16	16.67	3.66	4.55	mid-low	5.43	high	6		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	1.80	mid-low	13		17	0.00	2.44	2.27	low	4.79	high	2

	18	0.00	0.00	0.00	null	0.46	mid-low	13
	19	0.00	0.00	0.00	null	0.41	low	13
	20	16.67	9.76	10.23	mid-high	5.01	mid-high	8
	21	16.67	1.22	2.27	low	5.10	mid-high	6
	22	0.00	0.00	0.00	null	0.05	low	13
	23	16.67	3.66	4.55	mid-low	1.39	mid-low	5
	24	0.00	0.00	0.00	null	0.22	low	13
	25	0.00	0.00	0.00	null	0.05	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						24.56	0.0551
	Distribution GB vs ELC Map						20.21	0.3267

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	4.88	4.55	mid-high	2.14	mid-high	4
20	16.67	2.44	3.41	mid-low	2.86	mid-high	6
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	7.32	6.82	mid-high	2.44	mid-high	4
23	0.00	4.88	4.55	mid-high	2.99	mid-high	4
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	16.67	14.63	14.77	high	3.01	mid-high	8
26	0.00	1.22	1.14	low	0.51	low	1
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	2.44	2.27	low	0.52	low	1
Comparison						Chi Value	p value
Distribution GB vs ES						24.64	0.0886
Distribution GB vs ELC Map						44.91	0.0856

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera oblongifolia</i>	Based on specific ELC Map <i>Mangifera oblongifolia</i>	Based on Generalist ELC Map							
		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	NA	1	0.00	0.00	0.00	null	2.90	mid-high	13
		2	0.00	60.00	50.00	low	22.71	high	2
		3	0.00	0.00	0.00	null	4.44	high	13
		4	0.00	0.00	0.00	null	6.72	high	13
		5	100.00	40.00	50.00	low	19.09	high	6
		6	0.00	0.00	0.00	null	5.19	high	13
		7	0.00	0.00	0.00	null	6.18	high	13
		8	0.00	0.00	0.00	null	1.78	mid-low	13
		9	0.00	0.00	0.00	null	1.40	mid-low	13
		10	0.00	0.00	0.00	null	0.16	low	13
		11	0.00	0.00	0.00	null	1.58	mid-low	13
		12	0.00	0.00	0.00	null	0.04	low	13
		13	0.00	0.00	0.00	null	0.65	mid-low	13
		14	0.00	0.00	0.00	null	1.38	mid-low	13
		15	0.00	0.00	0.00	null	0.06	low	13

	16	0.00	0.00	0.00	null	0.55	low	13	
	17	0.00	0.00	0.00	null	4.79	high	13	
	18	0.00	0.00	0.00	null	2.44	mid-high	13	
	19	0.00	0.00	0.00	null	2.14	mid-high	13	
	20	0.00	0.00	0.00	null	2.86	mid-high	13	
	21	0.00	0.00	0.00	null	1.32	mid-low	13	
	22	0.00	0.00	0.00	null	2.44	mid-high	13	
	23	0.00	0.00	0.00	null	2.99	mid-high	13	
	24	0.00	0.00	0.00	null	2.09	mid-low	13	
	25	0.00	0.00	0.00	null	3.01	mid-high	13	
	26	0.00	0.00	0.00	null	0.51	low	13	
	27	0.00	0.00	0.00	null	0.06	low	13	
	28	0.00	0.00	0.00	null	0.52	low	13	
	Comparison							Chi Value	p value
	Distribution GB vs ES							1.50	0.3982
Distribution GB vs ELC Map							4.24	0.7758	

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera parvifolia</i>	Based on specific ELC Map <i>Mangifera parvifolia</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	3.13	3.03	low	0.73	mid-low	1	1	0.00	6.25	6.06	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	2.17	mid-high	13	2	100.00	28.13	30.30	mid-high	22.71	high	8
	3	100.00	43.75	45.45	high	14.81	high	8	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	9.38	9.09	mid-low	19.63	high	2	4	0.00	21.88	21.21	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	0.01	low	13	5	0.00	12.50	12.12	mid-low	19.09	high	2
	6	0.00	0.00	0.00	null	0.36	mid-low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	1.14	mid-high	13	7	0.00	31.25	30.30	mid-high	6.18	high	4
	8	0.00	0.00	0.00	null	3.52	high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	34.38	33.33	mid-high	14.27	high	4	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	9.38	9.09	mid-low	18.24	high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.00	low	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.94	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	3.06	mid-high	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.01	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	1.84	mid-high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	10.30	high	13	16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	0.01	low	13		17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	1.13	mid-low	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.67	mid-high	13		19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.00	low	13		20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.04	mid-low	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	1.79	mid-high	13		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	3.30	mid-high	13		23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.00	low	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.01	low	13		25	0.00	0.00	0.00	null	3.01	mid-high	13
										26	0.00	0.00	0.00	null	0.51	low	13
										27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						1.29	1		Distribution GB vs ES						2.56	0.685
	Distribution GB vs ELC Map						5.75	0.614		Distribution GB vs ELC Map						3.40	1

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera pedicellata</i>	Based on specific ELC Map <i>Mangifera pedicellata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	7.69	7.14	low	0.73	mid-low	1	1	0.00	7.69	7.14	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	1.00	mid-high	13	2	100.00	23.08	28.57	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.04	low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	7.54	high	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.79	mid-low	13	5	0.00	0.00	0.00	null	19.09	high	13
	6	0.00	0.00	0.00	null	0.04	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	7.35	high	13	7	0.00	7.69	7.14	low	6.18	high	2
	8	0.00	0.00	0.00	null	4.41	mid-high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.08	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	7.69	7.14	low	4.71	mid-high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.06	low	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.01	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.55	mid-low	13	13	0.00	7.69	7.14	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.36	mid-low	13	14	0.00	7.69	7.14	low	1.38	mid-low	1
15	0.00	0.00	0.00	null	0.01	low	13	15	0.00	0.00	0.00	null	0.06	low	13	

16	0.00	7.69	7.14	low	0.96	mid-high	2	16	0.00	0.00	0.00	null	0.55	low	13
17	0.00	7.69	7.14	low	8.82	high	2	17	0.00	7.69	7.14	low	4.79	high	2
18	0.00	0.00	0.00	null	0.58	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	7.69	7.14	low	4.69	mid-high	2	19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	0.00	0.00	null	8.36	high	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
21	0.00	0.00	0.00	null	0.18	mid-low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	100.00	7.69	14.29	mid-high	31.29	high	8	22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	0.00	0.00	null	1.30	mid-high	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	0.12	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	7.69	7.14	low	7.55	high	2	25	0.00	38.46	35.71	high	3.01	mid-high	4
26	0.00	15.38	14.29	mid-high	2.79	mid-high	4	26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.39	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	30.77	28.57	high	5.27	high	4	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						12.00	0.542	Distribution GB vs ES						3.33	0.6164
Distribution GB vs ELC Map						2.20	1	Distribution GB vs ELC Map						3.40	1

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera quadrifida</i>	Based on specific ELC Map <i>Mangifera quadrifida</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.41	1.25	low	0.73	low	1		1	0.00	1.41	1.25	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.31	low	13		2	22.22	40.85	38.75	high	22.71	high	8
	3	0.00	0.00	0.00	null	1.19	mid-low	13		3	0.00	2.82	2.50	mid-low	4.44	high	2
	4	0.00	0.00	0.00	null	0.30	low	13		4	22.22	4.23	6.25	mid-high	6.72	high	8
	5	0.00	0.00	0.00	null	2.32	mid-high	13		5	22.22	22.54	22.50	high	19.09	high	8
	6	0.00	0.00	0.00	null	3.69	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	2.72	mid-high	13		7	11.11	4.23	5.00	mid-low	6.18	high	6
	8	0.00	0.00	0.00	null	0.51	low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.40	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.45	low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.45	mid-high	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	22.22	2.82	5.00	mid-high	1.78	mid-low	7		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	9.86	8.75	high	1.23	mid-low	3		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	2.82	2.50	mid-low	7.76	high	2		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	3.78	high	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	2.82	2.50	mid-low	1.94	mid-low	1		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	2.82	2.50	mid-low	1.38	mid-low	1	17	0.00	1.41	1.25	low	4.79	high	2
	18	0.00	7.04	6.25	high	1.55	mid-low	3	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	1.41	1.25	low	0.76	low	1	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	22.22	2.82	5.00	mid-high	6.82	high	8	20	0.00	2.82	2.50	mid-low	2.86	mid-high	2
	21	11.11	26.76	25.00	high	15.76	high	8	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	1.41	1.25	low	2.17	mid-low	1	22	0.00	5.63	5.00	mid-low	2.44	mid-high	2
	23	0.00	0.00	0.00	null	6.16	high	13	23	22.22	2.82	5.00	mid-low	2.99	mid-high	6
	24	0.00	1.41	1.25	low	2.96	mid-high	2	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.48	low	13	25	0.00	9.86	8.75	high	3.01	mid-high	4
	26	0.00	5.63	5.00	mid-high	6.25	high	4	26	0.00	0.00	0.00	null	0.51	low	13
	27	22.22	29.58	28.75	high	19.80	high	8	27	0.00	0.00	0.00	null	0.06	low	13
	28	22.22	1.41	3.75	mid-low	2.33	mid-high	10	28	0.00	1.41	1.25	low	0.52	low	1
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						56.03	0.002	Distribution GB vs ES						22.99	0.0524
	Distribution GB vs ELC Map						44.49	0.124	Distribution GB vs ELC Map						18.55	0.576

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera rufocostata</i>	Based on specific ELC Map <i>Mangifera rufocostata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	66.67	6.67	16.67	mid-high	3.98	mid-high	12	2	33.33	20.00	22.22	mid-high	22.71	high	8
	3	0.00	33.33	27.78	high	8.61	high	4	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	13.33	11.11	low	3.18	mid-high	2	4	0.00	6.67	5.56	low	6.72	high	2
	5	0.00	0.00	0.00	null	1.68	mid-high	13	5	33.33	53.33	50.00	high	19.09	high	8
	6	0.00	0.00	0.00	null	3.15	mid-high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.61	mid-low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	9.07	high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	5.83	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.13	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	10.93	high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	26.67	22.22	high	15.16	high	4	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	13.33	11.11	low	6.40	high	2	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.77	mid-low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
15	0.00	0.00	0.00	null	0.63	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13	

	16	0.00	0.00	0.00	null	0.20	low	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	11.00	high	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	33.33	6.67	11.11	low	3.40	mid-high	6	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.89	mid-low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.42	low	13	20	0.00	6.67	5.56	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	0.31	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.04	low	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	6.75	high	13	23	33.33	13.33	16.67	mid-high	2.99	mid-high	8
	24	0.00	0.00	0.00	null	3.25	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	1.45	mid-low	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.27	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.08	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.08	low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						22.00	0.002	Distribution GB vs ES						1.79	0.8278
	Distribution GB vs ELC Map						40.34	0.1538	Distribution GB vs ELC Map						11.35	0.7274

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera similis</i>	Based on specific ELC Map <i>Mangifera similis</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	0.94	low	13	2	33.33	63.64	57.14	high	22.71	high	8
	3	0.00	0.00	0.00	null	5.59	high	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.07	mid-high	13	4	0.00	18.18	14.29	mid-high	6.72	high	4
	5	0.00	9.09	7.14	low	1.26	mid-low	1	5	0.00	18.18	14.29	mid-high	19.09	high	4
	6	33.33	18.18	21.43	high	13.82	high	8	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	1.48	mid-high	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	1.20	mid-low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	9.09	7.14	low	12.70	high	2	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.70	mid-high	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.91	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	4.57	high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	1.23	mid-low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.40	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.84	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.02	low	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.52	low	13	17	0.00	0.00	0.00	null	4.79	high	13
18	0.00	0.00	0.00	null	1.28	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13	

19	0.00	0.00	0.00	null	0.03	low	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	0.00	0.00	null	1.93	mid-high	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
21	0.00	0.00	0.00	null	13.23	high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	0.00	0.00	null	1.54	mid-high	13	22	33.33	0.00	7.14	low	2.44	mid-high	13
23	0.00	9.09	7.14	low	1.14	mid-low	1	23	33.33	0.00	7.14	low	2.99	mid-high	13
24	33.33	45.45	42.86	high	13.03	high	8	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	0.00	0.00	null	1.19	mid-low	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
26	0.00	0.00	0.00	null	1.01	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
27	33.33	9.09	14.29	mid-high	12.15	high	8	27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	1.50	mid-high	13	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						3.23	0.8832	Distribution GB vs ES						0.57	1
Distribution GB vs ELC Map						4.71	0.9293	Distribution GB vs ELC Map						23.28	0.379

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Mangifera torquenda</i>	Based on specific ELC Map <i>Mangifera torquenda</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	1.42	mid-high	13		2	25.00	45.83	42.86	mid-high	22.71	high	8
	3	0.00	0.00	0.00	null	1.47	mid-high	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	1.23	mid-high	13		4	0.00	4.17	3.57	low	6.72	high	2
	5	0.00	4.17	3.57	low	0.20	low	1		5	75.00	37.50	42.86	mid-high	19.09	high	8
	6	0.00	0.00	0.00	null	3.30	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.18	low	13		7	0.00	4.17	3.57	low	6.18	high	2
	8	0.00	0.00	0.00	null	1.41	mid-high	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	9.75	high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	1.14	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.01	low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.00	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.00	low	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.01	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.07	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.15	mid-low	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	3.11	mid-high	13		17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.71	mid-low	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	4.59	high	13		19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	9.50	high	13		20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	13.52	high	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	25.00	37.50	35.71	mid-low	15.66	high	6		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	75.00	58.33	60.71	high	22.02	high	8		23	0.00	8.33	7.14	mid-high	2.99	mid-high	4
	24	0.00	0.00	0.00	null	7.60	high	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.26	mid-low	13		25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.71	mid-low	13		26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.24	mid-low	13		27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						0.52	0.7123		Distribution GB vs ES						2.55	0.5408
	Distribution GB vs ELC Map						7.82	0.7419		Distribution GB vs ELC Map						8.89	0.8936

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Metroxylon sagu</i>	Based on specific ELC Map <i>Metroxylon sagu</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	11.76	10.81	high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	0.12	low	13		2	33.33	5.88	8.11	mid-high	22.71	high	8
	3	0.00	0.00	0.00	null	0.06	low	13		3	0.00	20.59	18.92	high	4.44	high	4
	4	0.00	0.00	0.00	null	0.29	mid-low	13		4	0.00	2.94	2.70	low	6.72	high	2
	5	0.00	8.82	8.11	mid-low	12.26	high	2		5	0.00	35.29	32.43	high	19.09	high	4
	6	33.33	2.94	5.41	mid-low	3.13	mid-high	6		6	0.00	8.82	8.11	mid-high	5.19	high	4
	7	0.00	38.24	35.14	high	20.25	high	4		7	0.00	0.00	0.00	null	6.18	high	13
	8	33.33	23.53	24.32	high	11.16	high	8		8	0.00	2.94	2.70	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	2.89	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	33.33	11.76	13.51	mid-high	22.91	high	8		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	1.35	mid-high	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	1.85	mid-high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	2.94	2.70	low	5.49	high	2		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	2.94	2.70	low	1.32	mid-high	2		14	0.00	2.94	2.70	low	1.38	mid-low	1
	15	0.00	8.82	8.11	mid-low	1.14	mid-low	1		15	0.00	2.94	2.70	low	0.06	low	1
	16	0.00	0.00	0.00	null	3.33	high	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	1.23	mid-low	13	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	1.25	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	3.92	high	13	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	0.73	mid-low	13	20	33.33	2.94	5.41	mid-high	2.86	mid-high	8
	21	0.00	0.00	0.00	null	2.38	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	1.72	mid-high	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	0.03	low	13	23	0.00	2.94	2.70	low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	0.06	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.14	mid-low	13	25	33.33	0.00	2.70	low	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.05	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.08	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.14	low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						12.58	0.1709	Distribution GB vs ES						23.50	0.0584
	Distribution GB vs ELC Map						12.09	0.5353	Distribution GB vs ELC Map						21.20	0.4161

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Musa acuminata</i>	Based on specific ELC Map <i>Musa acuminata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	4.44	2.78	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.26	low	13	2	3.70	11.11	8.33	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.05	low	13	3	7.41	0.00	2.78	low	4.44	high	13
	4	0.00	0.00	0.00	null	0.30	low	13	4	3.70	6.67	5.56	mid-high	6.72	high	8
	5	3.70	2.22	2.78	low	2.87	mid-high	6	5	14.81	15.56	15.28	high	19.09	high	8
	6	7.41	6.67	6.94	mid-high	6.17	high	8	6	0.00	2.22	1.39	low	5.19	high	2
	7	7.41	2.22	4.17	mid-low	1.67	mid-low	9	7	11.11	2.22	5.56	mid-high	6.18	high	12
	8	0.00	13.33	8.33	high	0.76	mid-low	3	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.23	low	13	9	3.70	0.00	1.39	low	1.40	mid-low	13
	10	0.00	2.22	1.39	low	0.18	low	1	10	0.00	0.00	0.00	null	0.16	low	13
	11	3.70	4.44	4.17	mid-low	15.34	high	6	11	0.00	11.11	6.94	mid-high	1.58	mid-low	3
	12	7.41	0.00	2.78	low	0.52	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	3.70	0.00	1.39	low	23.31	high	13	13	3.70	2.22	2.78	low	0.65	mid-low	5
	14	3.70	6.67	5.56	mid-high	3.62	mid-high	8	14	7.41	0.00	2.78	low	1.38	mid-low	13
	15	7.41	0.00	2.78	low	1.92	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	3.70	15.56	11.11	high	2.48	mid-high	8	16	3.70	2.22	2.78	low	0.55	low	5
17	7.41	15.56	12.50	high	0.98	mid-low	7	17	3.70	4.44	4.17	mid-low	4.79	high	6	

18	0.00	2.22	1.39	low	0.16	low	1	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	0.00	0.00	null	1.82	mid-low	13	19	7.41	22.22	16.67	high	2.14	mid-high	8
20	3.70	4.44	4.17	mid-low	3.78	mid-high	6	20	0.00	2.22	1.39	low	2.86	mid-high	2
21	0.00	0.00	0.00	null	0.81	mid-low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	2.22	1.39	low	4.64	mid-high	2	22	11.11	4.44	6.94	mid-high	2.44	mid-high	12
23	0.00	0.00	0.00	null	5.07	high	13	23	14.81	2.22	6.94	mid-high	2.99	mid-high	12
24	0.00	0.00	0.00	null	3.00	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	25.93	4.44	12.50	high	4.94	high	12	25	3.70	6.67	5.56	mid-high	3.01	mid-high	8
26	7.41	8.89	8.33	high	6.48	high	8	26	0.00	0.00	0.00	null	0.51	low	13
27	3.70	4.44	4.17	mid-low	2.07	mid-high	6	27	0.00	0.00	0.00	null	0.06	low	13
28	3.70	4.44	4.17	mid-low	5.83	high	6	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						49.35	0.0008	Distribution GB vs ES						50.72	0.001
Distribution GB vs ELC Map						82.09	0.0156	Distribution GB vs ELC Map						53.77	0.0528

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Musa acuminata</i> subsp. <i>halabanensis</i>	Based on specific ELC Map <i>Musa acuminata</i> subsp. <i>Halabanensis</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.32	low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	0.49	low	13	2	0.00	0.00	0.00	null	22.71	high	13
	3	0.00	0.00	0.00	null	9.43	high	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	36.36	33.33	mid-high	3.79	mid-high	4	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.12	low	13	5	0.00	18.18	16.67	mid-low	19.09	high	2
	6	0.00	0.00	0.00	null	2.98	mid-high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	1.16	mid-low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	0.43	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	9.09	8.33	low	8.82	high	2	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	100.00	45.45	50.00	high	3.72	mid-high	8	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.26	low	13	11	0.00	18.18	16.67	mid-low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	2.33	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	9.09	8.33	low	1.33	mid-low	1	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	3.45	mid-high	13	14	0.00	9.09	8.33	low	1.38	mid-low	1

	15	0.00	0.00	0.00	null	6.39	high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	7.07	high	13	16	100.00	18.18	25.00	high	0.55	low	7
	17	0.00	0.00	0.00	null	0.32	low	13	17	0.00	9.09	8.33	low	4.79	high	2
	18	0.00	0.00	0.00	null	2.21	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	1.52	mid-low	13	19	0.00	27.27	25.00	high	2.14	mid-high	4
	20	0.00	0.00	0.00	null	0.85	low	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	10.57	high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	4.66	mid-high	13	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	2.42	mid-low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	4.64	mid-high	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	5.08	high	13	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.94	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	9.91	high	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	4.79	mid-high	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						1.20	1	Distribution GB vs ES						4.50	0.7342
	Distribution GB vs ELC Map						25.89	0.2501	Distribution GB vs ELC Map						180.3	0.0202

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Musa acuminata</i> var. <i>sumatrana</i>	Based on specific ELC Map <i>Musa acuminata</i> var. <i>Sumatrana</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	0.30	low	13	2	0.00	18.18	16.67	low	22.71	high	2
	3	0.00	0.00	0.00	null	0.56	mid-low	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	9.09	8.33	low	1.86	mid-low	1	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.20	low	13	5	0.00	9.09	8.33	low	19.09	high	2
	6	0.00	0.00	0.00	null	2.97	mid-high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	18.18	16.67	mid-high	14.26	high	4	7	0.00	18.18	16.67	low	6.18	high	2
	8	0.00	0.00	0.00	null	0.26	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	3.43	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	100.00	63.64	66.67	high	13.16	high	8	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	2.88	mid-high	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	2.58	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	9.10	high	13	13	0.00	18.18	16.67	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.07	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13

	15	0.00	0.00	0.00	null	0.73	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	9.09	8.33	low	10.32	high	2		16	100.00	18.18	25.00	high	0.55	low	7
	17	0.00	0.00	0.00	null	0.14	low	13		17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.77	mid-low	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	9.12	high	13		19	0.00	18.18	16.67	low	2.14	mid-high	2
	20	0.00	0.00	0.00	null	3.04	mid-high	13		20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	4.92	high	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	8.74	high	13		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	0.15	low	13		23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	1.29	mid-low	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	3.19	mid-high	13		25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.16	low	13		26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	1.65	mid-low	13		27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	3.42	mid-high	13		28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						0.57	1		Distribution GB vs ES						4.50	1
	Distribution GB vs ELC Map						6.60	0.8542		Distribution GB vs ELC Map						180.3	0.0196

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Musa balbisiana</i>	Based on specific ELC Map <i>Musa balbisiana</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13	1	0.00	30.00	21.43	high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	1.54	mid-low	13	2	0.00	0.00	0.00	null	22.71	high	13
	3	0.00	10.00	7.14	low	5.03	high	2	3	0.00	10.00	7.14	low	4.44	high	2
	4	0.00	0.00	0.00	null	3.64	mid-high	13	4	0.00	10.00	7.14	low	6.72	high	2
	5	0.00	0.00	0.00	null	0.42	low	13	5	0.00	0.00	0.00	null	19.09	high	13
	6	0.00	20.00	14.29	mid-high	2.45	mid-high	4	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	16.91	high	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	10.00	7.14	low	1.86	mid-high	2	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	1.14	mid-low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	4.59	mid-high	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	50.00	20.00	28.57	high	0.88	mid-low	7	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	7.31	high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	25.00	10.00	14.29	mid-high	1.35	mid-low	7	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.13	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.25	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.61	low	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.75	low	13	17	0.00	10.00	7.14	low	4.79	high	2
18	0.00	0.00	0.00	null	0.33	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13	

19	0.00	0.00	0.00	null	0.77	mid-low	13
20	0.00	0.00	0.00	null	1.91	mid-high	13
21	0.00	10.00	7.14	low	5.76	high	2
22	25.00	10.00	14.29	mid-high	4.32	mid-high	8
23	0.00	0.00	0.00	null	1.20	mid-low	13
24	0.00	10.00	7.14	low	6.22	high	2
25	0.00	0.00	0.00	null	20.86	high	13
26	0.00	0.00	0.00	null	2.22	mid-high	13
27	0.00	0.00	0.00	null	0.95	mid-low	13
28	0.00	0.00	0.00	null	5.89	high	13
Comparison						Chi Value	p value
Distribution GB vs ES						6.00	0.5412
Distribution GB vs ELC Map						133.9	0.0089

19	0.00	0.00	0.00	null	2.14	mid-high	13
20	25.00	10.00	14.29	mid-low	2.86	mid-high	6
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	25.00	10.00	14.29	mid-low	2.44	mid-high	6
23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	50.00	20.00	28.57	high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						6.00	0.4095
Distribution GB vs ELC Map						48.26	0.1014

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Musa schizocarpa</i>	Based on specific ELC Map <i>Musa schizocarpa</i>	Based on Generalist ELC Map							
	NA	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
		1	0.00	0.00	0.00	null	2.90	mid-high	13
		2	0.00	25.00	20.00	low	22.71	high	2
		3	0.00	0.00	0.00	null	4.44	high	13
		4	0.00	0.00	0.00	null	6.72	high	13
		5	0.00	0.00	0.00	null	19.09	high	13
		6	100.00	50.00	60.00	high	5.19	high	8
		7	0.00	0.00	0.00	null	6.18	high	13
		8	0.00	0.00	0.00	null	1.78	mid-low	13
		9	0.00	25.00	20.00	low	1.40	mid-low	1
		10	0.00	0.00	0.00	null	0.16	low	13
		11	0.00	0.00	0.00	null	1.58	mid-low	13
		12	0.00	0.00	0.00	null	0.04	low	13
		13	0.00	0.00	0.00	null	0.65	mid-low	13
		14	0.00	0.00	0.00	null	1.38	mid-low	13
		15	0.00	0.00	0.00	null	0.06	low	13
		16	0.00	0.00	0.00	null	0.55	low	13
		17	0.00	0.00	0.00	null	4.79	high	13
		18	0.00	0.00	0.00	null	2.44	mid-high	13
		19	0.00	0.00	0.00	null	2.14	mid-high	13

		20	0.00	0.00	0.00	null	2.86	mid-high	13	
		21	0.00	0.00	0.00	null	1.32	mid-low	13	
		22	0.00	0.00	0.00	null	2.44	mid-high	13	
		23	0.00	0.00	0.00	null	2.99	mid-high	13	
		24	0.00	0.00	0.00	null	2.09	mid-low	13	
		25	0.00	0.00	0.00	null	3.01	mid-high	13	
		26	0.00	0.00	0.00	null	0.51	low	13	
		27	0.00	0.00	0.00	null	0.06	low	13	
		28	0.00	0.00	0.00	null	0.52	low	13	
		Comparison							Chi Value	p value
		Distribution GB vs ES							1.00	1
		Distribution GB vs ELC Map							18.27	0.4513

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Oryza officinalis</i>	Based on specific ELC Map <i>Oryza officinalis</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	6.90	6.49	6.67	mid-high	2.90	mid-high	8
	2	0.00	0.00	0.00	null	0.17	low	13		2	37.93	38.96	38.52	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.04	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.49	mid-low	13		4	5.17	2.60	3.70	mid-high	6.72	high	12
	5	1.72	0.00	0.74	low	4.09	high	13		5	24.14	20.78	22.22	high	19.09	high	8
	6	0.00	0.00	0.00	null	1.30	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	5.17	6.49	5.93	mid-high	7.38	high	8		7	6.90	14.29	11.11	high	6.18	high	8
	8	0.00	0.00	0.00	null	0.27	mid-low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.00	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.50	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	1.72	2.60	2.22	mid-low	7.17	high	6		11	1.72	2.60	2.22	mid-low	1.58	mid-low	5
	12	0.00	0.00	0.00	null	2.77	mid-high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	4.05	mid-high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.58	mid-low	13		14	0.00	2.60	1.48	mid-low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.10	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	1.72	1.30	1.48	low	0.38	mid-low	5		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.17	low	13		17	3.45	3.90	3.70	mid-high	4.79	high	8

18	0.00	0.00	0.00	null	0.02	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	5.17	3.90	4.44	mid-high	1.19	mid-high	8	19	1.72	0.00	0.74	low	2.14	mid-high	13
20	1.72	1.30	1.48	low	8.64	high	6	20	1.72	0.00	0.74	low	2.86	mid-high	13
21	0.00	0.00	0.00	null	0.75	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
22	10.34	10.39	10.37	high	7.67	high	8	22	0.00	1.30	0.74	low	2.44	mid-high	2
23	0.00	0.00	0.00	null	0.91	mid-high	13	23	6.90	3.90	5.19	mid-high	2.99	mid-high	12
24	0.00	0.00	0.00	null	0.16	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	2.60	1.48	low	3.60	mid-high	2	25	3.45	2.60	2.96	mid-low	3.01	mid-high	6
26	8.62	7.79	8.15	mid-high	9.67	high	8	26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.29	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
28	63.79	63.64	63.70	high	36.93	high	8	28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						2.31	0.9756	Distribution GB vs ES						8.22	0.5907
Distribution GB vs ELC Map						39.04	0.1172	Distribution GB vs ELC Map						28.19	0.3195

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Oryza ridleyi</i>	Based on specific ELC Map <i>Oryza ridleyi</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	50.00	0.00	4.76	low	0.73	mid-low	13	1	50.00	0.00	4.76	low	2.90	mid-high	13
	2	0.00	15.79	14.29	mid-low	2.89	mid-high	2	2	50.00	10.53	14.29	mid-high	22.71	high	8
	3	0.00	68.42	61.90	high	25.73	high	4	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	6.54	high	13	4	0.00	5.26	4.76	low	6.72	high	2
	5	0.00	0.00	0.00	null	2.59	mid-high	13	5	0.00	47.37	42.86	high	19.09	high	4
	6	50.00	15.79	19.05	mid-high	26.53	high	8	6	0.00	21.05	19.05	high	5.19	high	4
	7	0.00	0.00	0.00	null	7.38	high	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	0.01	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	1.53	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.30	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.01	low	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.00	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.02	low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.00	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	3.57	high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	1.48	mid-high	13	16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.06	mid-low	13	17	0.00	0.00	0.00	null	4.79	high	13

	18	0.00	0.00	0.00	null	2.57	mid-high	13
	19	0.00	0.00	0.00	null	0.89	mid-low	13
	20	0.00	0.00	0.00	null	0.06	mid-low	13
	21	0.00	0.00	0.00	null	3.18	mid-high	13
	22	0.00	0.00	0.00	null	1.00	mid-low	13
	23	0.00	0.00	0.00	null	0.02	low	13
	24	0.00	0.00	0.00	null	11.33	high	13
	25	0.00	0.00	0.00	null	1.57	mid-high	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						5.33	0.3189
	Distribution GB vs ELC Map						68.52	0.0286

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	0.00	0.00	null	2.86	mid-high	13
21	0.00	5.26	4.76	low	1.32	mid-low	1
22	0.00	0.00	0.00	null	2.44	mid-high	13
23	0.00	10.53	9.52	mid-low	2.99	mid-high	2
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	0.00	0.00	null	3.01	mid-high	13
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						8.50	0.3143
Distribution GB vs ELC Map						17.45	0.4978

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Oryza rufipogon</i>	Based on specific ELC Map <i>Oryza rufipogon</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	4.35	1.27	low	0.73	mid-high	2		1	3.57	13.04	6.33	mid-high	2.90	mid-high	8
	2	0.00	0.00	0.00	null	0.18	low	13		2	21.43	17.39	20.25	high	22.71	high	12
	3	0.00	0.00	0.00	null	0.34	mid-low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	8.70	2.53	mid-low	0.18	low	1		4	5.36	4.35	5.06	mid-high	6.72	high	12
	5	0.00	4.35	1.27	low	3.82	mid-high	2		5	44.64	34.78	41.77	high	19.09	high	12
	6	0.00	0.00	0.00	null	1.49	mid-high	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	3.57	4.35	3.80	mid-high	6.63	high	12		7	8.93	4.35	7.59	high	6.18	high	12
	8	0.00	0.00	0.00	null	0.42	mid-low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.11	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.67	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	1.61	mid-high	13		11	0.00	8.70	2.53	mid-low	1.58	mid-low	1
	12	0.00	8.70	2.53	mid-low	10.40	high	2		12	0.00	0.00	0.00	null	0.04	low	13
	13	3.57	0.00	2.53	mid-low	2.68	mid-high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.21	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.31	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.18	low	13		16	0.00	4.35	1.27	low	0.55	low	1

	17	0.00	0.00	0.00	null	0.02	low	13	17	3.57	4.35	3.80	mid-low	4.79	high	10
	18	0.00	0.00	0.00	null	0.04	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.28	mid-low	13	19	0.00	4.35	1.27	low	2.14	mid-high	2
	20	0.00	0.00	0.00	null	1.67	mid-high	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	3.57	21.74	8.86	mid-high	7.04	high	8	21	3.57	0.00	2.53	mid-low	1.32	mid-low	13
	22	8.93	17.39	11.39	high	7.63	high	12	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	0.50	mid-low	13	23	8.93	0.00	6.33	mid-high	2.99	mid-high	13
	24	1.79	0.00	1.27	low	0.53	mid-low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	4.84	mid-high	13	25	0.00	4.35	1.27	low	3.01	mid-high	2
	26	7.14	0.00	5.06	mid-high	7.25	high	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	19.64	17.39	18.99	high	10.39	high	12	27	0.00	0.00	0.00	null	0.06	low	13
	28	51.79	13.04	40.51	high	29.86	high	12	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						101.9	1.00E-04	Distribution GB vs ES						23.03	0.0108
	Distribution GB vs ELC Map						33.04	0.2085	Distribution GB vs ELC Map						47.67	0.0792

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Parkia timoriana</i>	Based on specific ELC Map <i>Parkia timoriana</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-high	13		1	0.00	2.63	2.38	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.22	mid-low	13		2	0.00	7.89	7.14	mid-low	22.71	high	2
	3	0.00	0.00	0.00	null	0.01	low	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	0.29	mid-low	13		4	0.00	10.53	9.52	mid-high	6.72	high	4
	5	0.00	0.00	0.00	null	5.56	high	13		5	25.00	18.42	19.05	mid-high	19.09	high	8
	6	0.00	0.00	0.00	null	0.05	low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	5.32	mid-high	13		7	0.00	2.63	2.38	low	6.18	high	2
	8	0.00	0.00	0.00	null	0.35	mid-low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.21	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	4.76	mid-high	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.42	mid-low	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	4.26	mid-high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	4.07	mid-high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.11	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	2.64	mid-high	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	8.27	high	13		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.11	low	13		17	0.00	0.00	0.00	null	4.79	high	13

18	0.00	5.26	4.76	low	9.12	high	2	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	25.00	13.16	14.29	mid-high	11.52	high	8	19	0.00	0.00	0.00	null	2.14	mid-high	13
20	0.00	2.63	2.38	low	0.63	mid-low	1	20	0.00	5.26	4.76	mid-low	2.86	mid-high	2
21	50.00	52.63	52.38	high	9.65	high	8	21	0.00	2.63	2.38	low	1.32	mid-low	1
22	0.00	0.00	0.00	null	0.31	mid-low	13	22	0.00	10.53	9.52	mid-high	2.44	mid-high	4
23	0.00	0.00	0.00	null	0.01	low	13	23	25.00	21.05	21.43	high	2.99	mid-high	8
24	0.00	0.00	0.00	null	0.43	mid-low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	18.42	16.67	high	10.71	high	4	25	50.00	18.42	21.43	high	3.01	mid-high	8
26	0.00	0.00	0.00	null	0.12	low	13	26	0.00	0.00	0.00	null	0.51	low	13
27	25.00	7.89	9.52	mid-low	20.13	high	6	27	0.00	0.00	0.00	null	0.06	low	13
								28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						2.97	0.6567	Distribution GB vs ES						3.97	0.9017
Distribution GB vs ELC Map						9.77	0.6304	Distribution GB vs ELC Map						38.92	0.1395

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Pometia pinnata</i>	Based on specific ELC Map <i>Pometia pinnata</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	1.46	1.44	low	0.73	mid-low	1		1	0.00	7.32	7.18	high	2.90	mid-high	4
	2	25.00	5.85	6.22	mid-high	6.10	high	8		2	0.00	26.83	26.32	high	22.71	high	4
	3	25.00	18.05	18.18	high	22.52	high	8		3	0.00	4.88	4.78	mid-high	4.44	high	4
	4	25.00	20.00	20.10	high	14.12	high	8		4	50.00	6.34	7.18	high	6.72	high	8
	5	0.00	0.00	0.00	null	0.12	low	13		5	50.00	17.07	17.70	high	19.09	high	8
	6	0.00	19.02	18.66	high	6.83	high	4		6	0.00	4.88	4.78	mid-high	5.19	high	4
	7	0.00	9.27	9.09	high	4.83	mid-high	4		7	0.00	6.34	6.22	high	6.18	high	4
	8	0.00	0.00	0.00	null	0.19	low	13		8	0.00	0.98	0.96	low	1.78	mid-low	1
	9	0.00	5.85	5.74	mid-high	5.95	high	4		9	0.00	1.46	1.44	mid-low	1.40	mid-low	1
	10	0.00	1.46	1.44	low	2.92	mid-high	2		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.43	mid-low	13		11	0.00	1.95	1.91	mid-low	1.58	mid-low	1
	12	25.00	0.49	0.96	low	1.35	mid-low	5		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.41	3.35	mid-high	3.66	mid-high	4		13	0.00	0.98	0.96	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.00	low	13		14	0.00	0.49	0.48	low	1.38	mid-low	1
	15	0.00	1.95	1.91	mid-low	4.02	mid-high	2		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	2.93	2.87	mid-high	4.85	high	4		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	0.00	0.00	null	0.52	mid-low	13
	18	0.00	1.46	1.44	low	4.21	mid-high	2
	19	0.00	1.46	1.44	low	3.18	mid-high	2
	20	0.00	0.00	0.00	null	0.02	low	13
	21	0.00	0.00	0.00	null	0.46	mid-low	13
	22	0.00	0.00	0.00	null	0.38	low	13
	23	0.00	0.00	0.00	null	0.48	mid-low	13
	24	0.00	3.90	3.83	mid-high	7.58	high	4
	25	0.00	1.95	1.91	mid-low	3.02	mid-high	2
	26	0.00	0.00	0.00	null	0.12	low	13
	27	0.00	0.49	0.48	low	1.18	mid-low	1
	28	0.00	0.98	0.96	low	0.21	low	1
	Comparison						Chi Value	p value
	Distribution GB vs ES						54.16	0.0349
	Distribution GB vs ELC Map						21.53	0.3083
	17	0.00	2.93	2.87	mid-high	4.79	high	4
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	1.95	1.91	mid-low	2.14	mid-high	2
	20	0.00	2.93	2.87	mid-high	2.86	mid-high	4
	21	0.00	0.49	0.48	low	1.32	mid-low	1
	22	0.00	3.41	3.35	mid-high	2.44	mid-high	4
	23	0.00	4.88	4.78	mid-high	2.99	mid-high	4
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	2.44	2.39	mid-low	3.01	mid-high	2
	26	0.00	0.98	0.96	low	0.51	low	1
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.49	0.48	low	0.52	low	1
	Comparison						Chi Value	p value
	Distribution GB vs ES						17.63	0.4164
	Distribution GB vs ELC Map						16.13	0.6041

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Rubus alpestris</i>	Based on specific ELC Map <i>Rubus alpestris</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	4.17	4.00	low	0.73	mid-low	1		1	0.00	4.17	4.00	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	1.53	mid-low	13		2	0.00	4.17	4.00	low	22.71	high	2
	3	0.00	0.00	0.00	null	11.41	high	13		3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	3.82	mid-high	13		4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.01	low	13		5	0.00	0.00	0.00	null	19.09	high	13
	6	0.00	4.17	4.00	low	4.48	mid-high	2		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.91	mid-low	13		7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	1.29	mid-low	13		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	6.23	high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	4.28	mid-high	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	4.30	mid-high	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	4.17	4.00	low	24.43	high	2		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	2.85	mid-high	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.01	low	13		14	0.00	4.17	4.00	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	2.13	mid-low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.52	mid-low	13		16	0.00	4.17	4.00	low	0.55	low	1

	17	0.00	0.00	0.00	null	3.76	mid-high	13		17	0.00	33.33	32.00	high	4.79	high	4
	18	0.00	0.00	0.00	null	6.47	high	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	9.53	high	13		19	100.00	50.00	52.00	high	2.14	mid-high	8
	20	0.00	0.00	0.00	null	0.69	mid-low	13		20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.00	low	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.00	low	13		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	100.00	58.33	60.00	high	8.15	high	8		23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	29.17	28.00	mid-high	2.28	mid-high	4		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.07	low	13		25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	0.12	low	13		26	0.00	0.00	0.00	null	0.51	low	13
										27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						0.71	1		Distribution GB vs ES						1.00	1
	Distribution GB vs ELC Map						11.28	0.5513		Distribution GB vs ELC Map						45.79	0.1414

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Rubus fraxinifolius</i>	Based on specific ELC Map <i>Rubus fraxinifolius</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	8.89	8.79	high	2.90	mid-high	4
	2	0.00	2.22	2.20	mid-low	0.73	mid-low	1	2	0.00	6.67	6.59	mid-high	22.71	high	4
	3	0.00	12.22	12.09	high	1.83	mid-high	4	3	0.00	1.11	1.10	low	4.44	high	2
	4	0.00	37.78	37.36	high	12.29	high	4	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.10	low	13	5	0.00	6.67	6.59	mid-high	19.09	high	4
	6	0.00	1.11	1.10	low	4.26	mid-high	2	6	0.00	1.11	1.10	low	5.19	high	2
	7	0.00	6.67	6.59	mid-high	6.10	high	4	7	0.00	1.11	1.10	low	6.18	high	2
	8	0.00	0.00	0.00	null	1.37	mid-low	13	8	0.00	2.22	2.20	mid-low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	3.41	mid-high	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	1.11	1.10	low	10.51	high	2	10	0.00	3.33	3.30	mid-low	0.16	low	1
	11	0.00	2.22	2.20	mid-low	0.14	low	1	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	10.00	9.89	high	0.40	mid-low	3	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.33	3.30	mid-low	0.28	mid-low	1	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.76	mid-low	13	14	0.00	1.11	1.10	low	1.38	mid-low	1
	15	100.00	2.22	3.30	mid-low	6.14	high	6	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	1.11	1.10	low	3.69	mid-high	2	16	0.00	2.22	2.20	mid-low	0.55	low	1

	17	0.00	0.00	0.00	null	0.02	low	13	17	0.00	22.22	21.98	high	4.79	high	4
	18	0.00	0.00	0.00	null	0.06	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.46	mid-low	13	19	0.00	35.56	35.16	high	2.14	mid-high	4
	20	0.00	0.00	0.00	null	0.10	low	13	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.24	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	2.22	2.20	mid-low	2.49	mid-high	2	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	0.03	low	13	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	4.44	4.40	mid-high	5.18	high	4	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	7.78	7.69	high	5.49	high	4	25	0.00	0.00	0.00	null	3.01	mid-high	13
	26	0.00	0.00	0.00	null	5.03	mid-high	13	26	0.00	5.56	5.49	mid-high	0.51	low	3
	27	0.00	1.11	1.10	low	5.01	mid-high	2	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	4.44	4.40	mid-high	23.14	high	4	28	100.0 0	2.22	3.30	mid-low	0.52	low	5
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						44.00	0.1327	Distribution GB vs ES						44.00	0.1104
	Distribution GB vs ELC Map						15.29	0.5381	Distribution GB vs ELC Map						193	0.0144

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Rubus lineatus</i>	Based on specific ELC Map <i>Rubus lineatus</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	4.30	4.12	mid-high	4.55	high	4	2	0.00	1.08	1.03	low	22.71	high	2
	3	100.00	92.47	92.78	high	3.01	mid-high	8	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	1.25	mid-low	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.37	low	13	5	0.00	0.00	0.00	null	19.09	high	13
	6	0.00	0.00	0.00	null	0.00	low	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.66	mid-low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	2.15	2.06	mid-low	7.91	high	2	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	1.84	mid-low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	3.44	mid-high	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.53	low	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.01	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	31.92	high	13	13	0.00	3.23	3.09	mid-high	0.65	mid-low	3
	14	0.00	0.00	0.00	null	4.43	mid-high	13	14	0.00	1.08	1.03	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.25	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	6.24	high	13	16	0.00	1.08	1.03	low	0.55	low	1
	17	0.00	0.00	0.00	null	3.67	mid-high	13	17	0.00	4.30	4.12	high	4.79	high	4

	18	0.00	0.00	0.00	null	0.86	mid-low	13		18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	5.78	high	13		19	100.00	87.10	87.63	high	2.14	mid-high	8
	20	0.00	0.00	0.00	null	1.16	mid-low	13		20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.01	low	13		21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	9.74	high	13		22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	0.00	0.00	null	1.07	mid-low	13		23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.00	0.00	null	0.00	low	13		24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	1.08	1.03	low	5.66	high	2		25	0.00	1.08	1.03	low	3.01	mid-high	2
	26	0.00	0.00	0.00	null	2.13	mid-high	13		26	0.00	1.08	1.03	low	0.51	low	1
	27	0.00	0.00	0.00	null	2.78	mid-high	13		27	0.00	0.00	0.00	null	0.06	low	13
										28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						0.33	1		Distribution GB vs ES						0.59	1
	Distribution GB vs ELC Map						129.1	0.0042		Distribution GB vs ELC Map						183.2	0.0082

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Rubus rosifolius</i>	Based on specific ELC Map <i>Rubus rosifolius</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	low	13		1	0.00	0.85	0.83	low	2.90	mid-high	2
	2	0.00	0.85	0.83	low	8.67	high	2		2	0.00	3.42	3.33	mid-high	22.71	high	4
	3	0.00	0.85	0.83	low	6.66	high	2		3	0.00	0.00	0.00	null	4.44	high	13
	4	33.33	5.13	5.83	high	8.57	high	8		4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	3.42	3.33	mid-high	11.55	high	4		5	0.00	0.85	0.83	low	19.09	high	2
	6	0.00	1.71	1.67	mid-low	9.09	high	2		6	0.00	0.85	0.83	low	5.19	high	2
	7	0.00	0.85	0.83	low	9.19	high	2		7	0.00	1.71	1.67	mid-low	6.18	high	2
	8	0.00	5.13	5.00	high	2.17	mid-low	3		8	0.00	0.85	0.83	low	1.78	mid-low	1
	9	0.00	0.85	0.83	low	1.11	mid-low	1		9	0.00	2.56	2.50	mid-high	1.40	mid-low	3
	10	0.00	3.42	3.33	mid-high	0.71	low	3		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	3.84	mid-high	13		11	0.00	1.71	1.67	mid-low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	6.06	high	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.85	0.83	low	2.72	mid-high	2		13	0.00	1.71	1.67	mid-low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	3.31	mid-high	13		14	0.00	1.71	1.67	mid-low	1.38	mid-low	1
	15	0.00	1.71	1.67	mid-low	4.75	mid-high	2		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	2.33	mid-low	13		16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	2.56	2.50	mid-high	1.68	mid-low	3	17	0.00	10.26	10.00	high	4.79	high	4
	18	0.00	1.71	1.67	mid-low	2.49	mid-high	2	18	0.00	10.26	10.00	high	2.44	mid-high	4
	19	0.00	0.85	0.83	low	1.49	mid-low	1	19	66.67	43.59	44.17	high	2.14	mid-high	8
	20	0.00	0.85	0.83	low	0.60	low	1	20	0.00	0.85	0.83	low	2.86	mid-high	2
	21	0.00	0.00	0.00	null	0.13	low	13	21	0.00	1.71	1.67	mid-low	1.32	mid-low	1
	22	0.00	5.13	5.00	high	1.45	mid-low	3	22	0.00	3.42	3.33	mid-high	2.44	mid-high	4
	23	0.00	0.85	0.83	low	0.76	low	1	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	0.00	0.85	0.83	low	0.18	low	1	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	0.00	0.00	null	0.82	mid-low	13	25	33.33	5.98	6.67	high	3.01	mid-high	8
	26	33.33	6.84	7.50	high	3.15	mid-high	8	26	0.00	1.71	1.67	mid-low	0.51	low	1
	27	0.00	4.27	4.17	mid-high	0.74	low	3	27	0.00	0.00	0.00	null	0.06	low	13
	28	33.33	51.28	50.83	high	5.03	mid-high	8	28	0.00	5.98	5.83	high	0.52	low	3
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						9.03	0.6559	Distribution GB vs ES						5.63	0.778
	Distribution GB vs ELC Map						18.09	0.5441	Distribution GB vs ELC Map						70.48	0.0461

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Saccharum officinarum</i>	Based on specific ELC Map <i>Saccharum officinarum</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-high	13	1	6.52	0.00	4.76	mid-low	2.90	mid-high	13
	2	2.17	5.88	3.17	mid-low	5.26	high	6	2	2.17	11.76	4.76	mid-low	22.71	high	6
	3	0.00	0.00	0.00	null	0.25	mid-low	13	3	2.17	17.65	6.35	mid-high	4.44	high	8
	4	19.57	11.76	17.46	high	23.78	high	12	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.31	mid-low	13	5	6.52	17.65	9.52	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.11	low	13	6	4.35	11.76	6.35	mid-high	5.19	high	8
	7	4.35	0.00	3.17	mid-low	5.26	mid-high	13	7	0.00	11.76	3.17	low	6.18	high	2
	8	0.00	0.00	0.00	null	0.17	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.46	mid-low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	4.35	17.65	7.94	high	6.89	high	8	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	5.88	1.59	low	2.95	mid-high	2	11	0.00	5.88	1.59	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.06	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	17.65	4.76	mid-high	16.43	high	4	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.15	low	13	14	0.00	5.88	1.59	low	1.38	mid-low	1
15	0.00	0.00	0.00	null	0.33	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13	

16	0.00	5.88	1.59	low	6.43	high	2	16	0.00	0.00	0.00	null	0.55	low	13
17	0.00	0.00	0.00	null	0.13	low	13	17	0.00	0.00	0.00	null	4.79	high	13
18	2.17	0.00	1.59	low	0.48	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
19	6.52	23.53	11.11	high	10.04	high	8	19	2.17	11.76	4.76	mid-low	2.14	mid-high	6
20	0.00	0.00	0.00	null	0.02	low	13	20	8.70	0.00	6.35	mid-high	2.86	mid-high	13
21	0.00	0.00	0.00	null	0.00	low	13	21	4.35	0.00	3.17	low	1.32	mid-low	13
22	4.35	0.00	3.17	mid-low	0.29	mid-low	13	22	21.74	0.00	15.87	high	2.44	mid-high	13
23	2.17	0.00	1.59	low	0.27	mid-low	13	23	13.04	0.00	9.52	high	2.99	mid-high	13
24	0.00	0.00	0.00	null	1.09	mid-high	13	24	4.35	0.00	3.17	low	2.09	mid-low	13
25	2.17	0.00	1.59	low	4.55	mid-high	13	25	19.57	0.00	14.29	high	3.01	mid-high	13
26	2.17	0.00	1.59	low	0.67	mid-high	13	26	2.17	0.00	1.59	low	0.51	low	13
27	6.52	0.00	4.76	mid-high	2.68	mid-high	13	27	0.00	0.00	0.00	null	0.06	low	13
28	43.48	11.76	34.92	high	10.22	high	12	28	2.17	5.88	3.17	low	0.52	low	5
Comparison						Chi Value	p value	Comparison						Chi Value	p value
Distribution GB vs ES						84.04	1.00E-04	Distribution GB vs ES						4.85	0.8125
Distribution GB vs ELC Map						105.6	0.0112	Distribution GB vs ELC Map						170.4	0.0003

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Saccharum robustum</i>	Based on specific ELC Map <i>Saccharum robustum</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-high	13		1	0.00	0.00	0.00	null	2.90	mid-high	13
	2	0.00	0.00	0.00	null	1.04	mid-high	13		2	16.67	27.27	21.74	high	22.71	high	8
	3	0.00	0.00	0.00	null	0.01	low	13		3	8.33	9.09	8.70	low	4.44	high	6
	4	0.00	0.00	0.00	null	0.32	mid-low	13		4	0.00	0.00	0.00	null	6.72	high	13
	5	41.67	27.27	34.78	mid-high	17.80	high	12		5	8.33	9.09	8.70	low	19.09	high	6
	6	0.00	0.00	0.00	null	6.14	high	13		6	8.33	0.00	4.35	low	5.19	high	13
	7	41.67	45.45	43.48	high	2.80	mid-high	8		7	0.00	0.00	0.00	null	6.18	high	13
	8	16.67	18.18	17.39	mid-low	27.94	high	6		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	2.85	mid-high	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	9.09	4.35	low	14.74	high	2		10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	4.45	high	13		11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.01	low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.47	mid-low	13		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	0.00	0.00	null	0.01	low	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.01	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.05	low	13		16	0.00	0.00	0.00	null	0.55	low	13
	17	0.00	0.00	0.00	null	0.01	low	13		17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	11.03	high	13		18	0.00	0.00	0.00	null	2.44	mid-high	13

19	0.00	0.00	0.00	null	0.07	mid-low	13
20	0.00	0.00	0.00	null	1.09	mid-high	13
21	0.00	0.00	0.00	null	4.27	mid-high	13
22	0.00	0.00	0.00	null	0.17	mid-low	13
23	0.00	0.00	0.00	null	0.54	mid-low	13
24	0.00	0.00	0.00	null	3.28	mid-high	13
25	0.00	0.00	0.00	null	0.16	mid-low	13
Comparison						Chi Value	p value
Distribution GB vs ES						2.06	0.5929
Distribution GB vs ELC Map						75.21	0.0306

19	0.00	0.00	0.00	null	2.14	mid-high	13
20	8.33	27.27	17.39	mid-high	2.86	mid-high	8
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	16.67	0.00	8.70	low	2.44	mid-high	13
23	33.33	27.27	30.43	high	2.99	mid-high	12
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	0.00	0.00	null	3.01	mid-high	13
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						2.00	0.8469
Distribution GB vs ELC Map						54.52	0.0494

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Saccharum spontaneum</i>	Based on specific ELC Map <i>Saccharum spontaneum</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	3.45	3.42	3.42	mid-low	0.73	low	5	1	3.45	7.69	6.85	mid-high	2.90	mid-high	8
	2	0.00	0.85	0.68	low	3.37	mid-high	2	2	10.34	5.13	6.16	mid-high	22.71	high	8
	3	0.00	0.00	0.00	null	1.01	mid-low	13	3	0.00	0.85	0.68	low	4.44	high	2
	4	6.90	5.13	5.48	mid-high	8.16	high	8	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	2.56	2.05	low	2.23	mid-low	1	5	0.00	9.40	7.53	high	19.09	high	4
	6	0.00	0.85	0.68	low	1.38	mid-low	1	6	0.00	0.00	0.00	null	5.19	high	13
	7	3.45	3.42	3.42	mid-low	6.37	high	6	7	0.00	4.27	3.42	mid-low	6.18	high	2
	8	6.90	3.42	4.11	mid-high	0.99	mid-low	7	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.31	low	13	9	0.00	0.85	0.68	low	1.40	mid-low	1
	10	0.00	4.27	3.42	mid-low	7.25	high	2	10	3.45	2.56	2.74	mid-low	0.16	low	5
	11	0.00	0.85	0.68	low	3.62	mid-high	2	11	0.00	5.98	4.79	mid-high	1.58	mid-low	3
	12	0.00	2.56	2.05	low	5.08	high	2	12	0.00	0.00	0.00	null	0.04	low	13
	13	3.45	5.13	4.79	mid-high	25.15	high	8	13	0.00	4.27	3.42	mid-low	0.65	mid-low	1
	14	0.00	2.56	2.05	low	1.62	mid-low	1	14	0.00	0.00	0.00	null	1.38	mid-low	13
15	0.00	0.00	0.00	null	1.82	mid-low	13	15	0.00	0.00	0.00	null	0.06	low	13	

	16	0.00	5.98	4.79	mid-high	3.36	mid-high	4		16	0.00	5.13	4.11	mid-low	0.55	low	1
	17	0.00	0.00	0.00	null	0.32	low	13		17	0.00	6.84	5.48	mid-high	4.79	high	4
	18	0.00	0.00	0.00	null	0.10	low	13		18	3.45	5.13	4.79	mid-high	2.44	mid-high	8
	19	0.00	0.00	0.00	null	4.00	mid-high	13		19	0.00	10.26	8.22	high	2.14	mid-high	4
	20	0.00	0.00	0.00	null	0.07	low	13		20	24.14	5.13	8.90	high	2.86	mid-high	12
	21	0.00	0.00	0.00	null	0.03	low	13		21	6.90	0.85	2.05	low	1.32	mid-low	9
	22	0.00	0.00	0.00	null	0.20	low	13		22	17.24	5.98	8.22	high	2.44	mid-high	8
	23	41.38	14.53	19.86	high	6.29	high	8		23	10.34	5.98	6.85	mid-high	2.99	mid-high	8
	24	0.00	2.56	2.05	low	2.64	mid-high	2		24	3.45	0.00	0.68	low	2.09	mid-low	13
	25	31.03	9.40	13.70	high	4.47	mid-high	8		25	17.24	10.26	11.64	high	3.01	mid-high	8
	26	0.00	11.97	9.59	high	2.62	mid-high	4		26	0.00	2.56	2.05	low	0.51	low	1
	27	0.00	7.69	6.16	high	0.94	mid-low	3		27	0.00	0.00	0.00	null	0.06	low	13
	28	3.45	12.82	10.96	high	5.87	high	8		28	0.00	0.85	0.68	low	0.52	low	1
	Comparison						Chi Value	p value		Comparison						Chi Value	p value
	Distribution GB vs ES						44.57	0.0057		Distribution GB vs ES						60.66	0.0006
	Distribution GB vs ELC Map						133.9	0.0071		Distribution GB vs ELC Map						141.4	0.0014

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Salacca zalacca</i>	Based on specific ELC Map <i>Salacca zalacca</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	6.25	5.56	low	2.90	mid-high	2
	2	0.00	0.00	0.00	null	0.65	mid-low	13	2	0.00	12.50	11.11	mid-high	22.71	high	4
	3	0.00	0.00	0.00	null	5.09	high	13	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.41	mid-high	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	0.00	0.00	null	0.21	low	13	5	0.00	50.00	44.44	high	19.09	high	4
	6	0.00	7.14	6.25	low	1.18	mid-low	1	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	7.14	6.25	low	0.73	mid-low	1	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	0.02	low	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.55	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	0.60	mid-low	13	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.10	low	13	11	50.00	6.25	11.11	mid-high	1.58	mid-low	7
	12	0.00	0.00	0.00	null	3.39	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.85	mid-low	13	13	0.00	6.25	5.56	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.30	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	50.00	50.00	50.00	high	11.80	high	8	15	0.00	0.00	0.00	null	0.06	low	13
16	0.00	14.29	12.50	high	3.30	mid-high	4	16	0.00	6.25	5.56	low	0.55	low	1	

	17	0.00	0.00	0.00	null	2.75	mid-high	13
	18	0.00	7.14	6.25	low	15.25	high	2
	19	0.00	0.00	0.00	null	4.72	high	13
	20	0.00	0.00	0.00	null	0.15	low	13
	21	0.00	7.14	6.25	low	3.51	mid-high	2
	22	0.00	0.00	0.00	null	2.35	mid-low	13
	23	50.00	0.00	6.25	low	0.31	low	13
	24	0.00	7.14	6.25	low	11.55	high	2
	25	0.00	0.00	0.00	null	2.37	mid-high	13
	26	0.00	0.00	0.00	null	4.11	mid-high	13
	27	0.00	0.00	0.00	null	16.44	high	13
	28	0.00	0.00	0.00	null	4.58	high	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						1.00	1
	Distribution GB vs ELC Map						164.6	0.0201
	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	2.14	mid-high	13
	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	2.44	mid-high	13
	23	0.00	6.25	5.56	low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	50.00	6.25	11.11	mid-high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value
	Distribution GB vs ES						14.00	0.1639
	Distribution GB vs ELC Map						46.23	0.0865

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Syzygium aqueum</i>	Based on specific ELC Map <i>Syzygium aqueum</i>								Based on Generalist ELC Map								
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	3.33	2.63	low	0.73	low	1		1	0.00	10.00	7.89	mid-high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	7.99	high	13		2	0.00	20.00	15.79	high	22.71	high	4
	3	0.00	6.67	5.26	mid-low	5.40	mid-high	2		3	0.00	3.33	2.63	low	4.44	high	2
	4	0.00	6.67	5.26	mid-low	10.32	high	2		4	0.00	6.67	5.26	mid-low	6.72	high	2
	5	0.00	6.67	5.26	mid-low	5.95	mid-high	2		5	0.00	6.67	5.26	mid-low	19.09	high	2
	6	0.00	0.00	0.00	null	1.30	mid-low	13		6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	6.50	high	13		7	12.50	6.67	7.89	mid-high	6.18	high	8
	8	0.00	0.00	0.00	null	1.43	mid-low	13		8	0.00	3.33	2.63	low	1.78	mid-low	1
	9	0.00	0.00	0.00	null	0.44	low	13		9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	12.50	3.33	5.26	mid-low	2.33	mid-high	6		10	0.00	0.00	0.00	null	0.16	low	13
	11	12.50	16.67	15.79	high	12.46	high	8		11	0.00	6.67	5.26	mid-low	1.58	mid-low	1
	12	0.00	6.67	5.26	mid-low	4.61	mid-high	2		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.33	2.63	low	6.88	high	2		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	12.50	16.67	15.79	high	7.78	high	8		14	0.00	6.67	5.26	mid-low	1.38	mid-low	1
	15	0.00	3.33	2.63	low	2.04	mid-low	1		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	5.90	mid-high	13		16	0.00	3.33	2.63	low	0.55	low	1

	17	12.50	3.33	5.26	mid-low	2.61	mid-high	6	17	37.50	0.00	7.89	mid-high	4.79	high	13
	18	0.00	3.33	2.63	low	0.75	low	1	18	0.00	3.33	2.63	low	2.44	mid-high	2
	19	12.50	0.00	2.63	low	2.48	mid-high	13	19	0.00	3.33	2.63	low	2.14	mid-high	2
	20	0.00	10.00	7.89	high	0.97	mid-low	3	20	0.00	0.00	0.00	null	2.86	mid-high	13
	21	0.00	0.00	0.00	null	0.07	low	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	0.31	low	13	22	0.00	3.33	2.63	low	2.44	mid-high	2
	23	0.00	3.33	2.63	low	1.15	mid-low	1	23	0.00	0.00	0.00	null	2.99	mid-high	13
	24	12.50	0.00	2.63	low	0.96	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	25.00	0.00	5.26	mid-low	0.15	low	13	25	50.00	16.67	23.68	high	3.01	mid-high	8
	26	0.00	6.67	5.26	mid-low	6.03	high	2	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	1.08	mid-low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	1.34	mid-low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						14.00	0.4054	Distribution GB vs ES						17.20	0.1606
	Distribution GB vs ELC Map						358.7	1.00E-04	Distribution GB vs ELC Map						84.01	0.0259

Appendix 27 Representativeness of *ex situ* collection (*contd.*)

<i>Syzygium cumini</i>	Based on specific ELC Map <i>Syzygium cumini</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	2.27	2.04	low	0.73	mid-low	1	1	0.00	9.09	8.16	mid-high	2.90	mid-high	4
	2	0.00	2.27	2.04	low	1.89	mid-high	2	2	0.00	9.09	8.16	mid-high	22.71	high	4
	3	0.00	2.27	2.04	low	6.74	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	11.36	10.20	mid-high	31.02	high	4	4	0.00	2.27	2.04	low	6.72	high	2
	5	0.00	0.00	0.00	null	4.24	mid-high	13	5	0.00	11.36	10.20	high	19.09	high	4
	6	0.00	2.27	2.04	low	6.29	high	2	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	7.65	high	13	7	0.00	2.27	2.04	low	6.18	high	2
	8	0.00	2.27	2.04	low	0.94	mid-low	1	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.17	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	0.00	0.00	null	3.84	mid-high	13	10	0.00	2.27	2.04	low	0.16	low	1
	11	0.00	0.00	0.00	null	0.23	low	13	11	0.00	2.27	2.04	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.01	low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.59	mid-low	13	13	0.00	2.27	2.04	low	0.65	mid-low	1
	14	0.00	0.00	0.00	null	0.07	low	13	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.03	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.13	low	13	16	20.00	6.82	8.16	mid-high	0.55	low	7
	17	0.00	2.27	2.04	low	3.85	mid-high	2	17	0.00	2.27	2.04	low	4.79	high	2

	18	0.00	0.00	0.00	null	0.68	mid-low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	4.55	4.08	mid-high	7.73	high	4	19	0.00	2.27	2.04	low	2.14	mid-high	2
	20	0.00	2.27	2.04	low	0.77	mid-low	1	20	0.00	4.55	4.08	mid-high	2.86	mid-high	4
	21	0.00	0.00	0.00	null	1.61	mid-high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	4.55	4.08	mid-high	6.18	high	4	22	60.00	13.64	18.37	high	2.44	mid-high	8
	23	60.00	29.55	32.65	high	3.76	mid-high	8	23	0.00	9.09	8.16	mid-high	2.99	mid-high	4
	24	20.00	11.36	12.24	high	4.64	mid-high	8	24	0.00	2.27	2.04	low	2.09	mid-low	1
	25	20.00	22.73	22.45	high	4.92	high	8	25	20.00	18.18	18.37	high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	0.37	mid-low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.07	low	13	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.84	mid-low	13	28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						3.73	0.9438	Distribution GB vs ES						12.23	0.5881
	Distribution GB vs ELC Map						51.26	0.0734	Distribution GB vs ELC Map						111.8	0.0147

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Syzygium malaccense</i>	Based on specific ELC Map <i>Syzygium malaccense</i>									Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type		ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13		1	0.00	11.54	9.38	high	2.90	mid-high	4
	2	16.67	26.92	25.00	high	12.41	high	8		2	0.00	11.54	9.38	high	22.71	high	4
	3	0.00	7.69	6.25	mid-low	1.10	mid-low	1		3	0.00	15.38	12.50	high	4.44	high	4
	4	0.00	3.85	3.13	low	2.90	mid-high	2		4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	7.69	6.25	mid-low	4.78	high	2		5	16.67	15.38	15.63	high	19.09	high	8
	6	0.00	0.00	0.00	null	0.76	mid-low	13		6	0.00	7.69	6.25	mid-low	5.19	high	2
	7	0.00	0.00	0.00	null	0.01	low	13		7	0.00	3.85	3.13	low	6.18	high	2
	8	0.00	15.38	12.50	high	16.35	high	4		8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	7.69	6.25	mid-low	3.70	mid-high	2		9	0.00	3.85	3.13	low	1.40	mid-low	1
	10	0.00	0.00	0.00	null	0.96	mid-low	13		10	0.00	0.00	0.00	null	0.16	low	13
	11	16.67	3.85	6.25	mid-low	8.46	high	6		11	0.00	3.85	3.13	low	1.58	mid-low	1
	12	0.00	0.00	0.00	null	0.54	mid-low	13		12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	3.85	3.13	low	2.91	mid-high	2		13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	16.67	0.00	3.13	low	4.40	mid-high	13		14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	0.39	low	13		15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.03	low	13		16	0.00	3.85	3.13	low	0.55	low	1
	17	16.67	3.85	6.25	mid-low	18.22	high	6		17	16.67	3.85	6.25	mid-low	4.79	high	6

	18	0.00	0.00	0.00	null	6.31	high	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	1.37	mid-low	13	19	33.33	0.00	6.25	mid-low	2.14	mid-high	13
	20	0.00	3.85	3.13	low	3.07	mid-high	2	20	16.67	3.85	6.25	mid-low	2.86	mid-high	6
	21	0.00	3.85	3.13	low	0.35	low	1	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	16.67	7.69	9.38	high	7.55	high	8	22	16.67	3.85	6.25	mid-low	2.44	mid-high	6
	23	16.67	0.00	3.13	low	0.55	mid-low	13	23	0.00	7.69	6.25	mid-low	2.99	mid-high	2
	24	0.00	0.00	0.00	null	0.03	low	13	24	0.00	0.00	0.00	null	2.09	mid-low	13
	25	0.00	3.85	3.13	low	1.99	mid-high	2	25	0.00	3.85	3.13	low	3.01	mid-high	2
	26	0.00	0.00	0.00	null	0.11	low	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	0.00	0.00	null	0.03	low	13	27	0.00	0.00	0.00	null	0.06	low	13
									28	0.00	0.00	0.00	null	0.52	low	13
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						13.18	0.3404	Distribution GB vs ES						17.13	0.1939
	Distribution GB vs ELC Map						34.70	0.1573	Distribution GB vs ELC Map						42.21	0.1132

Appendix 27 Representativeness of *ex situ* collection (*contd.*)

<i>Vigna minima</i>	Based on specific ELC Map <i>Vigna minima</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	33.33	3.45	6.25	mid-low	0.73	mid-low	5	1	33.33	10.34	12.50	mid-high	2.90	mid-high	8
	2	0.00	20.69	18.75	high	5.04	high	4	2	0.00	10.34	9.38	mid-low	22.71	high	2
	3	0.00	13.79	12.50	high	7.89	high	4	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.35	mid-high	13	4	0.00	3.45	3.13	low	6.72	high	2
	5	0.00	0.00	0.00	null	2.06	mid-low	13	5	33.33	20.69	21.88	high	19.09	high	8
	6	0.00	0.00	0.00	null	8.74	high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.29	low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	0.00	0.00	0.00	null	4.17	mid-high	13	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	0.00	0.00	null	0.01	low	13	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	6.90	6.25	mid-low	4.03	mid-high	2	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	6.92	high	13	11	33.33	0.00	3.13	low	1.58	mid-low	13
	12	0.00	0.00	0.00	null	3.27	mid-high	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	6.90	6.25	mid-low	6.99	high	2	13	0.00	6.90	6.25	mid-low	0.65	mid-low	1
	14	33.33	10.34	12.50	high	29.98	high	8	14	0.00	3.45	3.13	low	1.38	mid-low	1
	15	0.00	0.00	0.00	null	0.22	low	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.53	mid-low	13	16	0.00	13.79	12.50	mid-high	0.55	low	3
17	0.00	3.45	3.13	low	4.71	mid-high	2	17	0.00	0.00	0.00	null	4.79	high	13	

18	0.00	0.00	0.00	null	0.01	low	13
19	0.00	3.45	3.13	low	1.14	mid-low	1
20	0.00	10.34	9.38	mid-high	1.06	mid-low	3
21	0.00	0.00	0.00	null	0.06	low	13
22	0.00	6.90	6.25	mid-low	0.40	mid-low	1
23	0.00	3.45	3.13	low	0.65	mid-low	1
24	0.00	10.34	9.38	mid-high	4.91	mid-high	4
25	33.33	0.00	3.13	low	3.81	mid-high	13
26	0.00	0.00	0.00	null	0.06	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						17.33	0.2084
Distribution GB vs ELC Map						52.61	0.0806

18	0.00	0.00	0.00	null	2.44	mid-high	13
19	0.00	3.45	3.13	low	2.14	mid-high	2
20	0.00	0.00	0.00	null	2.86	mid-high	13
21	0.00	0.00	0.00	null	1.32	mid-low	13
22	0.00	13.79	12.50	mid-high	2.44	mid-high	4
23	0.00	0.00	0.00	null	2.99	mid-high	13
24	0.00	0.00	0.00	null	2.09	mid-low	13
25	0.00	13.79	12.50	mid-high	3.01	mid-high	4
26	0.00	0.00	0.00	null	0.51	low	13
27	0.00	0.00	0.00	null	0.06	low	13
28	0.00	0.00	0.00	null	0.52	low	13
Comparison						Chi Value	p value
Distribution GB vs ES						5.25	0.8281
Distribution GB vs ELC Map						31.31	0.1938

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Vigna radiata</i>	Based on specific ELC Map <i>Vigna radiata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	7.69	10.39	10.00	high	2.90	mid-high	8
	2	0.00	0.00	0.00	null	2.08	mid-high	13	2	0.00	9.09	7.78	high	22.71	high	4
	3	0.00	1.30	1.20	low	5.66	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.00	mid-high	13	4	0.00	0.00	0.00	null	6.72	high	13
	5	0.00	1.30	1.20	low	0.62	low	1	5	0.00	10.39	8.89	high	19.09	high	4
	6	0.00	2.60	2.41	mid-low	2.99	mid-high	2	6	0.00	1.30	1.11	low	5.19	high	2
	7	0.00	0.00	0.00	null	0.68	mid-low	13	7	0.00	2.60	2.22	mid-low	6.18	high	2
	8	100.00	29.87	34.94	high	10.79	high	8	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	7.79	7.23	mid-high	5.71	high	4	9	0.00	1.30	1.11	low	1.40	mid-low	1
	10	0.00	5.19	4.82	mid-high	1.60	mid-low	3	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.02	low	13	11	7.69	1.30	2.22	mid-low	1.58	mid-low	5
	12	0.00	1.30	1.20	low	0.69	mid-low	1	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.04	low	13	13	0.00	3.90	3.33	mid-low	0.65	mid-low	1
	14	0.00	3.90	3.61	mid-high	2.09	mid-high	4	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	18.18	16.87	high	7.65	high	4	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.81	mid-low	13	16	0.00	3.90	3.33	mid-low	0.55	low	1

	17	0.00	3.90	3.61	mid-high	0.96	mid-low	3	17	7.69	6.49	6.67	mid-high	4.79	high	8
	18	0.00	2.60	2.41	mid-low	0.49	low	1	18	0.00	1.30	1.11	low	2.44	mid-high	2
	19	0.00	0.00	0.00	null	0.21	low	13	19	0.00	14.29	12.22	high	2.14	mid-high	4
	20	0.00	1.30	1.20	low	2.72	mid-high	2	20	30.77	2.60	6.67	mid-high	2.86	mid-high	12
	21	0.00	7.79	7.23	mid-high	27.30	high	4	21	0.00	1.30	1.11	low	1.32	mid-low	1
	22	0.00	0.00	0.00	null	8.53	high	13	22	7.69	5.19	5.56	mid-high	2.44	mid-high	8
	23	0.00	1.30	1.20	low	0.28	low	1	23	0.00	3.90	3.33	mid-low	2.99	mid-high	2
	24	0.00	1.30	1.20	low	3.03	mid-high	2	24	0.00	1.30	1.11	low	2.09	mid-low	1
	25	0.00	0.00	0.00	null	0.34	low	13	25	38.46	11.69	15.56	high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	5.23	mid-high	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	7.79	7.23	mid-high	5.78	high	4	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	2.60	2.41	mid-low	0.97	mid-low	1	28	0.00	7.79	6.67	mid-high	0.52	low	3
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						14.09	0.5199	Distribution GB vs ES						60.17	0.0023
	Distribution GB vs ELC Map						49.61	0.0921	Distribution GB vs ELC Map						106.2	0.0217

Appendix 27 Representativeness of *ex situ* collection (contd.)

<i>Vigna trilobata</i>	Based on specific ELC Map <i>Vigna trilobata</i>								Based on Generalist ELC Map							
	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type	ELC CAT	GB (%)	ES (%)	Total Sp (%)	class	ELC map (%)	Quart Class. ELC map	Gap type
	1	0.00	0.00	0.00	null	0.73	mid-low	13	1	0.00	15.15	12.82	mid-high	2.90	mid-high	4
	2	0.00	0.00	0.00	null	2.08	mid-high	13	2	0.00	0.00	0.00	null	22.71	high	13
	3	0.00	3.03	2.56	low	5.66	high	2	3	0.00	0.00	0.00	null	4.44	high	13
	4	0.00	0.00	0.00	null	2.00	mid-high	13	4	0.00	3.03	2.56	low	6.72	high	2
	5	0.00	3.03	2.56	low	0.62	low	1	5	0.00	9.09	7.69	mid-low	19.09	high	2
	6	0.00	0.00	0.00	null	2.99	mid-high	13	6	0.00	0.00	0.00	null	5.19	high	13
	7	0.00	0.00	0.00	null	0.68	mid-low	13	7	0.00	0.00	0.00	null	6.18	high	13
	8	100.00	66.67	71.79	high	10.79	high	8	8	0.00	0.00	0.00	null	1.78	mid-low	13
	9	0.00	12.12	10.26	high	5.71	high	4	9	0.00	0.00	0.00	null	1.40	mid-low	13
	10	0.00	6.06	5.13	mid-high	1.60	mid-low	3	10	0.00	0.00	0.00	null	0.16	low	13
	11	0.00	0.00	0.00	null	0.02	low	13	11	0.00	0.00	0.00	null	1.58	mid-low	13
	12	0.00	0.00	0.00	null	0.69	mid-low	13	12	0.00	0.00	0.00	null	0.04	low	13
	13	0.00	0.00	0.00	null	0.04	low	13	13	0.00	0.00	0.00	null	0.65	mid-low	13
	14	0.00	3.03	2.56	low	2.09	mid-high	2	14	0.00	0.00	0.00	null	1.38	mid-low	13
	15	0.00	0.00	0.00	null	7.65	high	13	15	0.00	0.00	0.00	null	0.06	low	13
	16	0.00	0.00	0.00	null	0.81	mid-low	13	16	0.00	0.00	0.00	null	0.55	low	13

	17	0.00	3.03	2.56	low	0.96	mid-low	1	17	0.00	0.00	0.00	null	4.79	high	13
	18	0.00	0.00	0.00	null	0.49	low	13	18	0.00	0.00	0.00	null	2.44	mid-high	13
	19	0.00	0.00	0.00	null	0.21	low	13	19	0.00	3.03	2.56	low	2.14	mid-high	2
	20	0.00	0.00	0.00	null	2.72	mid-high	13	20	33.33	9.09	12.82	mid-high	2.86	mid-high	8
	21	0.00	0.00	0.00	null	27.30	high	13	21	0.00	0.00	0.00	null	1.32	mid-low	13
	22	0.00	0.00	0.00	null	8.53	high	13	22	33.33	12.12	15.38	high	2.44	mid-high	8
	23	0.00	0.00	0.00	null	0.28	low	13	23	16.67	12.12	12.82	mid-high	2.99	mid-high	8
	24	0.00	0.00	0.00	null	3.03	mid-high	13	24	0.00	3.03	2.56	low	2.09	mid-low	1
	25	0.00	0.00	0.00	null	0.34	low	13	25	16.67	30.30	28.21	high	3.01	mid-high	8
	26	0.00	0.00	0.00	null	5.23	mid-high	13	26	0.00	0.00	0.00	null	0.51	low	13
	27	0.00	3.03	2.56	low	5.78	high	2	27	0.00	0.00	0.00	null	0.06	low	13
	28	0.00	0.00	0.00	null	0.97	mid-low	13	28	0.00	3.03	2.56	low	0.52	low	1
	Comparison						Chi Value	p value	Comparison						Chi Value	p value
	Distribution GB vs ES						3.00	0.8626	Distribution GB vs ES						8.76	0.4267
	Distribution GB vs ELC Map						49.61	0.0953	Distribution GB vs ELC Map						55.77	0.0464

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Amaranthus tricolor</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron borneense</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron bubalinum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron clypearia</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Archidendron cockburnii</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Archidendron contortum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron crateradenum</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Archidendron ellipticum</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Archidendron fagifolium</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Archidendron globosum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron havilandii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron jiringa</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Archidendron kunstleri</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron microcarpum</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Archidendron minahassae</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Archidendron oppositum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron palauense</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Archidendron pauciflorum</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Archidendron trichophyllum</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Archidendron triplinervium</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Arenga pinnata</i>	Yes	No	Yes	No	Yes	No	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Artocarpus altilis</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Artocarpus anisophyllus</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Artocarpus brevipedunculatus</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Artocarpus camansi</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Artocarpus elasticus</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Artocarpus horridus</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus integer</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Artocarpus kemando</i>	Yes	No	No	No	Yes	No	No	Yes
<i>Artocarpus lanceifolius</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Artocarpus lowii</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus maingayi</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus odoratissimus</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Artocarpus rigidus</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Artocarpus sarawakensis</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus scortechinii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Artocarpus sepicanus</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus sericicarpus</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Artocarpus sumatranus</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Artocarpus tamaran</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Artocarpus teysmannii</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Averrhoa bilimbi</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Averrhoa carambola</i>	Yes	No	Yes	No	Yes	No	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Cajanus cajan</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Cajanus goensis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Cajanus scarabaeoides</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Citrus hystrix</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Citrus maxima</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Cocos nucifera</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Colocasia esculenta</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Colocasia gigantea</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Cucumis melo</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dimocarpus longan</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Dioscorea alata</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Dioscorea bancana</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea elegans</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea filiformis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea grata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea havilandii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea lamprocaula</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Dioscorea madiunensis</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Dioscorea nienhuysii</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea nummularia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea orbiculata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea platycarpa</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Dioscorea polyclados</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea prainiana</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea pubera</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea pyriformis</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Dioscorea salicifolia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea sarasinii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea sexrimata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea tenuifolia</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea vanvuurenii</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Dioscorea vilis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Dioscorea warburgiana</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Diospyros discolor</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Durio affinis</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Durio beccarianus</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Durio bukitrayaensis</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Durio carinatus</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Durio dulcis</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Durio graveolens</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Durio kutejensis</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Durio lanceolatus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Durio lissocarpus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Durio lowianus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Durio macrantha</i>	Yes	No	No	No	No	Yes	No	Yes
<i>Durio malaccensis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Durio oblongus</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Durio oxleyanus</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Durio testudinarius</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Durio zibethinus</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus androchaete</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus aurata</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus aureocordata</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus auricoma</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus brunneoaurata</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus chartacea</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus deltoidea</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus deltoidea</i> subsp. <i>motleyana</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus fulva</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ficus glabristipulata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus glandulifera</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ficus grossularioides</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus halmaherae</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus hirta</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus hirta</i> subsp. <i>dumosa</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus hirta</i> subsp. <i>roxburghii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Ficus inaequipetiolata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus kofmaniae</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus lamponga</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus litseifolia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus oleifolia</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus oleifolia</i> subsp. <i>intermedia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus padana</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ficus pedunculosa</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus ruficaulis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus schefferiana</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus setiflora</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus subfulva</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ficus subglabritepala</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ficus tricolor</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ficus tricolor</i> var. <i>serroh</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Garcinia celebica</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Garcinia diospyrifolia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Garcinia mangostana</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Garcinia nitida</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Garcinia opaca</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Garcinia penangiana</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Garcinia rigida</i>	Yes	No	Yes	No	Yes	No	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

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<i>Gnetum costatum</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Gnetum gnemon</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Gnetum gnemon</i> var. <i>brunonianum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Gnetum gnemon</i> var. <i>gracile</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Gnetum gnemon</i> var. <i>ovalifolium</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Gnetum gnemon</i> var. <i>tenerum</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ipomoea aquatica</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Ipomoea asarifolia</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ipomoea coptica</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ipomoea graminea</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ipomoea imperati</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ipomoea littoralis</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ipomoea obscura</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ipomoea pes-caprae</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ipomoea sagittifolia</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Ipomoea stibaropoda</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Lablab purpureus</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Lansium domesticum</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Mangifera altissima</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera applanata</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera casturi</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Mangifera dewildei</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

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<i>Mangifera gedebe</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera gracilipes</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Mangifera griffithii</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera lalijiwa</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera laurina</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Mangifera longipetiolata</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera magnifica</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera microphylla</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Mangifera minor</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera mucronulata</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera oblongifolia</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Mangifera orophila</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera paludosa</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera parvifolia</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera pedicellata</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Mangifera quadrifida</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Mangifera rigida</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Mangifera rubropetala</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera rufocostata</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera similis</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Mangifera sulavesiana</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Mangifera sumbawaensis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Mangifera swintonioides</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera timorensis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Mangifera torquenda</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Metroxylon sagu</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Momordica charantia</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Musa acuminata</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Musa acuminata</i> subsp. <i>halabanensis</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Musa acuminata</i> subsp. <i>malaccensis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Musa acuminata</i> subsp. <i>microcarpa</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Musa acuminata</i> var. <i>sumatrana</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Musa acuminata</i> var. <i>tomentosa</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Musa balbisiana</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Musa balbisiana</i> var. <i>brachycarpa</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Musa celebica</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Musa lanceolata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Musa schizocarpa</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Nephelium lappaceum</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Ocimum americanum</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Oryza longiglumis</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Oryza meyeriana</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Oryza minuta</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Oryza officinalis</i>	Yes	No	Yes	No	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Oryza ridleyi</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Oryza rufipogon</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Oryza schlechteri</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Parkia singularis</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Parkia speciosa</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Parkia sumatrana</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Parkia timoriana</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Parkia versteeghii</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Pometia pinnata</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Rubus acuminatissimus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Rubus alpestris</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Rubus banghamii</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Rubus ferdinandimuelleri</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Rubus fraxinifolius</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Rubus lineatus</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Rubus lorentzianus</i>	Yes	No	No	Yes	Yes	Yes	No	Yes
<i>Rubus macgregorii</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Rubus niveus</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Rubus papuanus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Rubus rosifolius</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Rubus sumatranus</i>	Yes	No	Yes	Yes	Yes	Yes	No	Yes
<i>Saccharum officinarum</i>	Yes	No	Yes	No	Yes	Yes	No	Yes

Appendix 28 The gap analysis of in situ and ex situ conservation of priority CWR taxa in Indonesia and recommendation actions (*contd.*)

Taxon	In situ gap categories			Ex situ gap categories		Recommendation actions		
	Taxa within existing PA network but lacking management	Taxa not actively conserved <i>in situ</i>	ecogeographic areas not conserved <i>in situ</i>	Taxa not adequately conserved <i>ex situ</i>	Ecogeographic areas not yet conserved <i>ex situ</i>	Further field surveys	Priority for <i>in situ</i> conservation	Further collecting programs
<i>Saccharum robustum</i>	No	Yes	Yes	No	Yes	Yes	Yes	Yes
<i>Saccharum spontaneum</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Salacca zalacca</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Solanum melongena</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Sorghum nitidum</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Sorghum plumosum</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Sorghum propinquum</i>	Yes	No	Yes	Yes	Yes	No	No	Yes
<i>Sorghum timorense</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Syzygium aqueum</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Syzygium cumini</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Syzygium malaccense</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Vigna minima</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Vigna radiata</i>	Yes	No	Yes	No	Yes	No	No	Yes
<i>Vigna trilobata</i>	Yes	No	Yes	No	Yes	Yes	No	Yes
<i>Vigna umbellata</i>	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix 29 Validation criteria for species distribution models in RCP 4.5 scenario and year 2050.

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Archidendron clypearia</i>	212	0.7673	0.0553	0.4525	5542	350723	1.58	Yes
<i>Archidendron ellipticum</i>	93	0.7964	0.0771	0.3845	10718	383422	2.80	Yes
<i>Archidendron fagifolium</i>	83	0.8746	0.0435	0.2572	5684	299385	1.90	Yes
<i>Archidendron globosum</i>	14	0.7086	0.0955	0.6058	38900	464492	8.37	Yes
<i>Archidendron jiringa</i>	91	0.7563	0.0814	0.4083	15162	493316	3.07	Yes
<i>Archidendron microcarpum</i>	56	0.87	0.0487	0.3013	2322	401573	0.58	Yes
<i>Archidendron triplinervium</i>	15	0.8799	0.0398	0.5045	15611	402372	3.88	Yes
<i>Arenga pinnata</i>	108	0.8302	0.0563	0.3982	8186	338987	2.41	Yes
<i>Artocarpus altilis</i>	72	0.7508	0.0874	0.4691	6771	436164	1.55	Yes
<i>Artocarpus anisophyllus</i>	84	0.8235	0.047	0.392	646	510653	0.13	Yes
<i>Artocarpus elasticus</i>	259	0.7536	0.0475	0.4079	6590	659026	1.00	Yes
<i>Artocarpus kemando</i>	83	0.7695	0.0568	0.4885	5661	492656	1.15	Yes
<i>Artocarpus lanceifolius</i>	62	0.8758	0.0598	0.2573	4465	285210	1.57	Yes
<i>Artocarpus rigidus</i>	105	0.8112	0.0454	0.4196	21036	422700	4.98	Yes
<i>Artocarpus sepicanus</i>	14	0.9854	-0.4989	0.7605	292	18647	1.57	Yes
<i>Artocarpus teysmannii</i>	68	0.772	0.0783	0.3127	5878	578885	1.02	Yes
<i>Averrhoa bilimbi</i>	61	0.7144	0.0926	0.5273	30901	304333	10.15	Yes
<i>Averrhoa carambola</i>	57	0.8191	0.0863	0.3244	15659	339207	4.62	Yes
<i>Cajanus scarabaeoides</i>	41	0.9717	0.0152	0.0855	8802	128996	6.82	Yes
<i>Cocos nucifera</i>	57	0.8015	0.0887	0.4021	23699	291461	8.13	Yes
<i>Colocasia esculenta</i>	110	0.7845	0.067	0.3144	25919	401673	6.45	Yes
<i>Dimocarpus longan</i>	85	0.7569	0.0724	0.3451	8607	672858	1.28	Yes
<i>Dioscorea alata</i>	73	0.8905	0.049	0.2153	1639	248046	0.66	Yes
<i>Dioscorea pyriformis</i>	73	0.7773	0.1035	0.3381	13062	255367	5.11	Yes
<i>Durio zibethinus</i>	132	0.8041	0.057	0.4257	12083	362872	3.33	Yes

Appendix 29 Validation criteria for species distribution models in RCP 4.5 scenario and year 2050 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Ficus chartacea</i>	14	0.7794	0.0618	0.5722	47113	538942	8.74	Yes
<i>Ficus fulva</i>	52	0.7786	0.093	0.3695	18071	472889	3.82	Yes
<i>Ficus grossularioides</i>	138	0.8646	0.0415	0.3744	5248	331663	1.58	Yes
<i>Ficus hirta</i>	60	0.8537	0.0776	0.2452	5447	232743	2.34	Yes
<i>Ficus oleifolia</i>	71	0.9247	0.0368	0.1282	1222	276819	0.44	Yes
<i>Ficus padana</i>	112	0.9159	0.0329	0.2784	6250	222293	2.81	Yes
<i>Ficus tricolor</i>	42	0.9879	0.0059	0.0725	4060	60380	6.72	Yes
<i>Garcinia celebica</i>	116	0.7001	0.0869	0.453	26799	382118	7.01	Yes
<i>Gnetum gnemon</i>	205	0.8079	0.0524	0.3077	1874	488829	0.38	Yes
<i>Ipomoea aquatica</i>	77	0.7161	0.1002	0.424	18283	431032	4.24	Yes
<i>Ipomoea littoralis</i>	91	0.7849	0.087	0.3339	21322	342759	6.22	Yes
<i>Ipomoea obscura</i>	84	0.9088	0.0369	0.2204	6576	224806	2.93	Yes
<i>Ipomoea pes-caprae</i>	136	0.8338	0.0559	0.2528	16847	370380	4.55	Yes
<i>Mangifera griffithii</i>	53	0.8451	0.0565	0.2709	9765	450922	2.17	Yes
<i>Mangifera laurina</i>	92	0.7459	0.0651	0.455	11176	489415	2.28	Yes
<i>Mangifera minor</i>	73	0.906	0.0341	0.3543	4154	254037	1.64	Yes
<i>Musa acuminata</i>	84	0.8403	0.0682	0.3905	5592	297064	1.88	Yes
<i>Nephelium lappaceum</i>	85	0.744	0.0597	0.434	10378	652410	1.59	Yes
<i>Oryza meyeriana</i>	73	0.8592	0.0647	0.3965	11706	171389	6.83	Yes
<i>Oryza minuta</i>	54	0.855	0.0588	0.3274	13597	296453	4.59	Yes
<i>Oryza officinalis</i>	146	0.888	0.0418	0.2909	3093	269997	1.15	Yes
<i>Oryza rufipogon</i>	90	0.8519	0.0649	0.1992	2680	263466	1.02	Yes
<i>Parkia speciosa</i>	84	0.8079	0.058	0.4114	2560	456203	0.56	Yes
<i>Rubus fraxinifolius</i>	95	0.9549	0.0184	0.1487	388	168369	0.23	Yes
<i>Rubus lineatus</i>	98	0.9921	0.0033	0.1205	1	23134	0.00	Yes
<i>Rubus niveus</i>	53	0.9899	0.0055	0.0262	169	60106	0.28	Yes

Appendix 29 Validation criteria for species distribution models in RCP 4.5 scenario and year 2050 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Rubus rosifolius</i>	123	0.9069	0.0377	0.2153	5939	185068	3.21	Yes
<i>Saccharum officinarum</i>	66	0.7997	0.082	0.406	7033	329182	2.14	Yes
<i>Saccharum spontaneum</i>	150	0.8442	0.0445	0.4283	13557	312761	4.33	Yes
<i>Solanum melongena</i>	75	0.8947	0.0519	0.3007	3086	242864	1.27	Yes
<i>Sorghum nitidum</i>	97	0.8604	0.0433	0.3515	23262	283266	8.21	Yes
<i>Sorghum propinquum</i>	83	0.7986	0.0729	0.2904	12143	468628	2.59	Yes
<i>Vigna radiata</i>	99	0.8428	0.0608	0.3346	14523	211836	6.86	Yes

Appendix 30 Validation criteria for species distribution models in RCP 4.5 scenario and year 2080.

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Archidendron clypearia</i>	212	0.7673	0.0553	0.4525	5542	350723	1.58	Yes
<i>Archidendron ellipticum</i>	93	0.7964	0.0771	0.3845	10718	383422	2.80	Yes
<i>Archidendron fagifolium</i>	83	0.8746	0.0435	0.2572	5684	299385	1.90	Yes
<i>Archidendron globosum</i>	14	0.7086	0.0955	0.6058	38900	464492	8.37	Yes
<i>Archidendron jiringa</i>	91	0.7563	0.0814	0.4083	15162	493316	3.07	Yes
<i>Archidendron microcarpum</i>	56	0.87	0.0487	0.3013	2322	401573	0.58	Yes
<i>Archidendron triplinervium</i>	15	0.8799	0.0398	0.5045	15611	402372	3.88	Yes
<i>Arenga pinnata</i>	108	0.8302	0.0563	0.3982	8186	338987	2.41	Yes
<i>Artocarpus altilis</i>	72	0.7508	0.0874	0.4691	6771	436164	1.55	Yes
<i>Artocarpus anisophyllus</i>	84	0.8235	0.047	0.392	646	510653	0.13	Yes
<i>Artocarpus elasticus</i>	259	0.7536	0.0475	0.4079	6590	659026	1.00	Yes
<i>Artocarpus kemando</i>	83	0.7695	0.0568	0.4885	5661	492656	1.15	Yes
<i>Artocarpus lanceifolius</i>	62	0.8758	0.0598	0.2573	4465	285210	1.57	Yes
<i>Artocarpus rigidus</i>	105	0.8112	0.0454	0.4196	21036	422700	4.98	Yes
<i>Artocarpus sepicanus</i>	14	0.9854	-0.4989	0.7605	292	18647	1.57	Yes
<i>Artocarpus teysmannii</i>	68	0.772	0.0783	0.3127	5878	578885	1.02	Yes
<i>Averrhoa bilimbi</i>	61	0.7144	0.0926	0.5273	30901	304333	10.15	Yes
<i>Averrhoa carambola</i>	57	0.8191	0.0863	0.3244	15659	339207	4.62	Yes
<i>Cajanus scarabaeoides</i>	41	0.9717	0.0152	0.0855	8802	128996	6.82	Yes
<i>Cocos nucifera</i>	57	0.8015	0.0887	0.4021	23699	291461	8.13	Yes
<i>Colocasia esculenta</i>	110	0.7845	0.067	0.3144	25919	401673	6.45	Yes
<i>Dimocarpus longan</i>	85	0.7569	0.0724	0.3451	8607	672858	1.28	Yes
<i>Dioscorea alata</i>	73	0.8905	0.049	0.2153	1639	248046	0.66	Yes
<i>Dioscorea pyrifolia</i>	73	0.7773	0.1035	0.3381	13062	255367	5.11	Yes
<i>Durio zibethinus</i>	132	0.8041	0.057	0.4257	12083	362872	3.33	Yes

Appendix 30 Validation criteria for species distribution models in RCP 4.5 scenario and year 2080 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Ficus chartacea</i>	14	0.7794	0.0618	0.5722	47113	538942	8.74	Yes
<i>Ficus fulva</i>	52	0.7786	0.093	0.3695	18071	472889	3.82	Yes
<i>Ficus grossularioides</i>	138	0.8646	0.0415	0.3744	5248	331663	1.58	Yes
<i>Ficus hirta</i>	60	0.8537	0.0776	0.2452	5447	232743	2.34	Yes
<i>Ficus oleifolia</i>	71	0.9247	0.0368	0.1282	1222	276819	0.44	Yes
<i>Ficus padana</i>	112	0.9159	0.0329	0.2784	6250	222293	2.81	Yes
<i>Ficus tricolor</i>	42	0.9879	0.0059	0.0725	4060	60380	6.72	Yes
<i>Garcinia celebica</i>	116	0.7001	0.0869	0.453	26799	382118	7.01	Yes
<i>Gnetum gnemon</i>	205	0.8079	0.0524	0.3077	1874	488829	0.38	Yes
<i>Ipomoea aquatica</i>	77	0.7161	0.1002	0.424	18283	431032	4.24	Yes
<i>Ipomoea littoralis</i>	91	0.7849	0.087	0.3339	21322	342759	6.22	Yes
<i>Ipomoea obscura</i>	84	0.9088	0.0369	0.2204	6576	224806	2.93	Yes
<i>Ipomoea pes-caprae</i>	136	0.8338	0.0559	0.2528	16847	370380	4.55	Yes
<i>Mangifera griffithii</i>	53	0.8451	0.0565	0.2709	9765	450922	2.17	Yes
<i>Mangifera laurina</i>	92	0.7459	0.0651	0.455	11176	489415	2.28	Yes
<i>Mangifera minor</i>	73	0.906	0.0341	0.3543	4154	254037	1.64	Yes
<i>Musa acuminata</i>	84	0.8403	0.0682	0.3905	5592	297064	1.88	Yes
<i>Nephelium lappaceum</i>	85	0.744	0.0597	0.434	10378	652410	1.59	Yes
<i>Oryza meyeriana</i>	73	0.8592	0.0647	0.3965	11706	171389	6.83	Yes
<i>Oryza minuta</i>	54	0.855	0.0588	0.3274	13597	296453	4.59	Yes
<i>Oryza officinalis</i>	146	0.888	0.0418	0.2909	3093	269997	1.15	Yes
<i>Oryza rufipogon</i>	90	0.8519	0.0649	0.1992	2680	263466	1.02	Yes
<i>Parkia speciosa</i>	84	0.8079	0.058	0.4114	2560	456203	0.56	Yes
<i>Rubus fraxinifolius</i>	95	0.9549	0.0184	0.1487	388	168369	0.23	Yes
<i>Rubus lineatus</i>	98	0.9921	0.0033	0.1205	1	23134	0.00	Yes
<i>Rubus niveus</i>	53	0.9899	0.0055	0.0262	169	60106	0.28	Yes

Appendix 30 Validation criteria for species distribution models in RCP 4.5 scenario and year 2080 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Rubus rosifolius</i>	123	0.9069	0.0377	0.2153	5939	185068	3.21	Yes
<i>Saccharum officinarum</i>	66	0.7997	0.082	0.406	7033	329182	2.14	Yes
<i>Saccharum spontaneum</i>	150	0.8442	0.0445	0.4283	13557	312761	4.33	Yes
<i>Solanum melongena</i>	75	0.8947	0.0519	0.3007	3086	242864	1.27	Yes
<i>Sorghum nitidum</i>	97	0.8604	0.0433	0.3515	23262	283266	8.21	Yes
<i>Sorghum propinquum</i>	83	0.7986	0.0729	0.2904	12143	468628	2.59	Yes
<i>Vigna radiata</i>	99	0.8428	0.0608	0.3346	14523	211836	6.86	Yes

Appendix 31 Validation criteria for species distribution models in RCP 8.5 scenario and year 2050

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Archidendron clypearia</i>	212	0.7627	0.0557	0.3966	5503	471698	1.17	Yes
<i>Archidendron ellipticum</i>	93	0.7913	0.0719	0.398	9622	434056	2.22	Yes
<i>Archidendron fagifolium</i>	83	0.8652	0.0588	0.2149	3672	380476	0.97	Yes
<i>Archidendron globosum</i>	14	0.6195	0.1144	0.6469	53003	255978	20.71	No
<i>Archidendron jiringa</i>	91	0.7431	0.0849	0.4211	11533	434590	2.65	Yes
<i>Archidendron microcarpum</i>	56	0.8788	0.0468	0.2681	1693	393543	0.43	Yes
<i>Archidendron triplinervium</i>	15	0.862	0.0329	0.5476	65595	216144	30.35	No
<i>Arenga pinnata</i>	108	0.8227	0.0556	0.3919	15887	356857	4.45	Yes
<i>Artocarpus altilis</i>	72	0.743	0.0888	0.5485	9629	364795	2.64	Yes
<i>Artocarpus anisophyllus</i>	84	0.831	0.0492	0.3375	681	562932	0.12	Yes
<i>Artocarpus elasticus</i>	259	0.7578	0.0447	0.4368	4875	607262	0.80	Yes
<i>Artocarpus kemando</i>	83	0.7933	0.0555	0.3678	8892	615408	1.44	Yes
<i>Artocarpus lanceifolius</i>	62	0.8996	0.0497	0.2208	2870	280975	1.02	Yes
<i>Artocarpus rigidus</i>	105	0.7851	0.0532	0.4544	13421	470320	2.85	Yes
<i>Artocarpus sepicanus</i>	14	0.9758	-0.4976	0.721	752	33383	2.25	Yes
<i>Artocarpus teysmannii</i>	68	0.7365	0.0932	0.3852	6374	514754	1.24	Yes
<i>Averrhoa bilimbi</i>	61	0.7203	0.0864	0.5848	22354	262105	8.53	Yes
<i>Averrhoa carambola</i>	57	0.8241	0.0814	0.3618	4155	313206	1.33	Yes
<i>Cajanus scarabaeoides</i>	41	0.9717	0.0143	0.0847	9117	140809	6.47	Yes
<i>Cocos nucifera</i>	57	0.8211	0.0889	0.4887	11627	173128	6.72	Yes
<i>Colocasia esculenta</i>	110	0.7943	0.0644	0.3195	26694	396045	6.74	Yes
<i>Dimocarpus longan</i>	85	0.7689	0.0712	0.3978	7081	556933	1.27	Yes
<i>Dioscorea alata</i>	73	0.8872	0.06	0.351	1063	189883	0.56	Yes
<i>Dioscorea pyriformis</i>	73	0.7901	0.0925	0.4251	18394	190747	9.64	Yes

Appendix 31 Validation criteria for species distribution models in RCP 8.5 scenario and year 2050 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Durio zibethinus</i>	132	0.7911	0.0566	0.3371	13273	528406	2.51	Yes
<i>Ficus chartacea</i>	14	0.8008	0.0483	0.6919	11522	228476	5.04	Yes
<i>Ficus fulva</i>	52	0.8108	0.0686	0.3881	18069	403766	4.48	Yes
<i>Ficus grossularioides</i>	138	0.7644	0.0676	0.3491	7108	394848	1.80	Yes
<i>Ficus hirta</i>	60	0.8576	0.08	0.2543	2661	277855	0.96	Yes
<i>Ficus oleifolia</i>	71	0.9142	0.0413	0.1697	1532	234361	0.65	Yes
<i>Ficus padana</i>	112	0.9146	0.0311	0.1977	9085	281992	3.22	Yes
<i>Ficus tricolor</i>	42	0.9852	0.007	0.0667	4906	66844	7.34	Yes
<i>Garcinia celebica</i>	116	0.7205	0.0831	0.4278	25266	401794	6.29	Yes
<i>Gnetum gnemon</i>	205	0.7959	0.0566	0.279	2648	544246	0.49	Yes
<i>Ipomoea aquatica</i>	77	0.7083	0.0994	0.4098	20659	517754	3.99	Yes
<i>Ipomoea littoralis</i>	91	0.7888	0.0856	0.4032	19510	303431	6.43	Yes
<i>Ipomoea obscura</i>	84	0.9023	0.0415	0.2985	6198	189183	3.28	Yes
<i>Ipomoea pes-caprae</i>	136	0.8431	0.0534	0.2347	10837	385397	2.81	Yes
<i>Mangifera griffithii</i>	53	0.8527	0.0613	0.2483	8760	417289	2.10	Yes
<i>Mangifera laurina</i>	92	0.7158	0.0707	0.477	11362	489817	2.32	Yes
<i>Mangifera minor</i>	73	0.9116	0.0302	0.2958	5178	310465	1.67	Yes
<i>Musa acuminata</i>	84	0.8381	0.0605	0.3989	8059	279773	2.88	Yes
<i>Nephelium lappaceum</i>	85	0.7276	0.063	0.4279	13988	669364	2.09	Yes
<i>Oryza meyeriana</i>	73	0.871	0.0539	0.1949	6695	297135	2.25	Yes
<i>Oryza minuta</i>	54	0.854	0.0626	0.2857	8556	367567	2.33	Yes
<i>Oryza officinalis</i>	146	0.8876	0.0402	0.2918	4759	257751	1.85	Yes
<i>Oryza rufipogon</i>	90	0.8566	0.0629	0.1953	2254	263107	0.86	Yes
<i>Parkia speciosa</i>	84	0.7816	0.0613	0.4412	15493	435567	3.56	Yes
<i>Rubus fraxinifolius</i>	95	0.9514	0.0222	0.166	248	167287	0.15	Yes

Appendix 31 Validation criteria for species distribution models in RCP 8.5 scenario and year 2050 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Rubus lineatus</i>	98	0.9915	0.0036	0.1163	8	22496	0.04	Yes
<i>Rubus niveus</i>	53	0.9899	0.0069	0.025	464	56246	0.82	Yes
<i>Rubus rosifolius</i>	123	0.9061	0.0397	0.2188	7148	192016	3.72	Yes
<i>Saccharum officinarum</i>	66	0.7787	0.094	0.3774	3814	410783	0.93	Yes
<i>Saccharum spontaneum</i>	150	0.8447	0.0397	0.4138	13665	322898	4.23	Yes
<i>Solanum melongena</i>	75	0.8955	0.0527	0.2867	3345	244292	1.37	Yes
<i>Sorghum nitidum</i>	97	0.8764	0.0437	0.3366	18122	255433	7.09	Yes
<i>Sorghum propinquum</i>	83	0.8298	0.0589	0.2905	4552	460974	0.99	Yes
<i>Vigna radiata</i>	99	0.8455	0.0599	0.3283	13852	207566	6.67	Yes

Appendix 32 Validation criteria for species distribution models in RCP 8.5 scenario and year 2080.

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Archidendron clypearia</i>	212	0.7725	0.0554	0.4122	6571	415519	1.58	Yes
<i>Archidendron ellipticum</i>	93	0.8069	0.0737	0.3928	9409	357745	2.63	Yes
<i>Archidendron fagifolium</i>	83	0.8702	0.0445	0.2486	6147	326177	1.88	Yes
<i>Archidendron globosum</i>	14	0.7163	0.0948	0.6372	24073	399196	6.03	Yes
<i>Archidendron jiringa</i>	91	0.7591	0.078	0.4406	7893	410811	1.92	Yes
<i>Archidendron microcarpum</i>	56	0.8739	0.0484	0.3331	1981	332934	0.60	Yes
<i>Archidendron triplinervium</i>	15	0.8769	0.0364	0.5354	29263	347915	8.41	Yes
<i>Arenga pinnata</i>	108	0.8269	0.0584	0.381	12749	358316	3.56	Yes
<i>Artocarpus altilis</i>	72	0.7528	0.0845	0.4528	6861	478717	1.43	Yes
<i>Artocarpus anisophyllus</i>	84	0.8417	0.0445	0.3503	567	508062	0.11	Yes
<i>Artocarpus elasticus</i>	259	0.7537	0.0469	0.4218	4653	635458	0.73	Yes
<i>Artocarpus kemando</i>	83	0.7629	0.0542	0.447	8347	578604	1.44	Yes
<i>Artocarpus lanceifolius</i>	62	0.8842	0.0497	0.1851	2863	381892	0.75	Yes
<i>Artocarpus rigidus</i>	105	0.7986	0.048	0.3925	20070	470345	4.27	Yes
<i>Artocarpus sepicanus</i>	14	0.9662	-0.4953	0.7011	710	45219	1.57	Yes
<i>Artocarpus teysmannii</i>	68	0.7529	0.0834	0.3782	14234	478296	2.98	Yes
<i>Averrhoa bilimbi</i>	61	0.7226	0.0886	0.4902	30670	377962	8.11	Yes
<i>Averrhoa carambola</i>	57	0.8164	0.0862	0.3353	15961	340664	4.69	Yes
<i>Cajanus scarabaeoides</i>	41	0.9747	0.0138	0.0968	9632	103145	9.34	Yes
<i>Cocos nucifera</i>	57	0.8044	0.0903	0.4736	18716	224708	8.33	Yes
<i>Colocasia esculenta</i>	110	0.7927	0.0659	0.3517	24326	329147	7.39	Yes
<i>Dimocarpus longan</i>	85	0.7703	0.0688	0.3449	6369	651644	0.98	Yes
<i>Dioscorea alata</i>	73	0.8905	0.0494	0.2422	3173	238389	1.33	Yes
<i>Dioscorea pyrifolia</i>	73	0.7821	0.0991	0.2745	15403	359490	4.28	Yes
<i>Durio zibethinus</i>	132	0.8015	0.0587	0.411	12576	372429	3.38	Yes

Appendix 32 Validation criteria for species distribution models in RCP 8.5 scenario and year 2080 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Ficus chartacea</i>	14	0.8095	0.0553	0.6539	12442	323097	3.85	Yes
<i>Ficus fulva</i>	52	0.784	0.0911	0.3872	17256	436412	3.95	Yes
<i>Ficus grossularioides</i>	138	0.8624	0.0425	0.3576	6139	352250	1.74	Yes
<i>Ficus hirta</i>	60	0.8655	0.0735	0.2159	4438	252079	1.76	Yes
<i>Ficus oleifolia</i>	71	0.9274	0.0362	0.1831	980	192406	0.51	Yes
<i>Ficus padana</i>	112	0.916	0.0348	0.2808	6903	215427	3.20	Yes
<i>Ficus tricolor</i>	42	0.988	0.0058	0.0789	4131	56175	7.35	Yes
<i>Garcinia celebica</i>	116	0.7004	0.0906	0.4794	23383	330497	7.08	Yes
<i>Gnetum gnemon</i>	205	0.8096	0.0508	0.3017	1870	485529	0.39	Yes
<i>Ipomoea aquatica</i>	77	0.7174	0.0945	0.4206	19538	488090	4.00	Yes
<i>Ipomoea littoralis</i>	91	0.788	0.0877	0.4027	15914	278499	5.71	Yes
<i>Ipomoea obscura</i>	84	0.9114	0.0356	0.2028	6159	239643	2.57	Yes
<i>Ipomoea pes-caprae</i>	136	0.8413	0.0529	0.2812	17317	328608	5.27	Yes
<i>Mangifera griffithii</i>	53	0.8466	0.0547	0.238	7668	506479	1.51	Yes
<i>Mangifera laurina</i>	92	0.7579	0.061	0.4312	12794	501331	2.55	Yes
<i>Mangifera minor</i>	73	0.9042	0.0315	0.3173	5744	283096	2.03	Yes
<i>Musa acuminata</i>	84	0.8366	0.0681	0.3978	5199	282581	1.84	Yes
<i>Nephelium lappaceum</i>	85	0.7266	0.0618	0.4022	11338	749797	1.51	Yes
<i>Oryza meyeriana</i>	73	0.8567	0.0691	0.4463	8654	151779	5.70	Yes
<i>Oryza minuta</i>	54	0.8576	0.0557	0.3273	12892	285221	4.52	Yes
<i>Oryza officinalis</i>	146	0.8794	0.0441	0.3411	3365	243028	1.38	Yes
<i>Oryza rufipogon</i>	90	0.8486	0.0659	0.1906	2358	281487	0.84	Yes
<i>Parkia speciosa</i>	84	0.8105	0.0587	0.4036	1884	449637	0.42	Yes
<i>Rubus fraxinifolius</i>	95	0.9561	0.0185	0.1492	329	163615	0.20	Yes
<i>Rubus lineatus</i>	98	0.9921	0.0033	0.1284	2	22146	0.01	Yes
<i>Rubus niveus</i>	53	0.9901	0.0054	0.0272	150	58705	0.26	Yes

Appendix 32 Validation criteria for species distribution models in RCP 8.5 scenario and year 2080 (*contd.*)

Taxon	N	ATAUC	STAUC	Threshold	Number of Pixels with STAUC>0.15	Number of Pixels with STAUC<0.15	ASD15 (%)	Valid
<i>Rubus rosifolius</i>	123	0.9094	0.0361	0.2305	6215	180289	3.45	Yes
<i>Saccharum officinarum</i>	66	0.8004	0.083	0.4206	6220	307778	2.02	Yes
<i>Saccharum spontaneum</i>	150	0.8331	0.0465	0.4158	19642	337700	5.82	Yes
<i>Solanum melongena</i>	75	0.8947	0.052	0.2783	3624	246772	1.47	Yes
<i>Sorghum nitidum</i>	97	0.8662	0.0428	0.3724	20392	252425	8.08	Yes
<i>Sorghum propinquum</i>	83	0.8165	0.0699	0.3199	9336	392633	2.38	Yes
<i>Vigna radiata</i>	99	0.8497	0.0561	0.2794	13212	258339	5.11	Yes

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios

Taxon	Crop Genepool	RCP 4.5						
		2050						
		Current area (km2)	Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Archidendron clypearia</i>	Archidendron	615,094	68,450	11.13	39,464	6.42	6.42	4.71
<i>Archidendron ellipticum</i>	Archidendron	753,664	140,008	18.58	105,392	13.98	13.98	4.59
<i>Archidendron fagifolium</i>	Archidendron	610,730	48,282	7.91	48,874	8.00	8.00	-0.10
<i>Archidendron jiringa</i>	Archidendron	886,962	249,422	28.12	119,428	13.46	13.46	14.66
<i>Archidendron microcarpum</i>	Archidendron	826,282	62,142	7.52	80,634	9.76	9.76	-2.24
<i>Arenga pinnata</i>	BlackPalmSugar	805,872	6,726	0.83	118,252	14.67	14.67	-13.84
<i>Artocarpus altilis</i>	Breadfruit	837,254	112,634	13.45	64,018	7.65	7.65	5.81
<i>Artocarpus anisophyllus</i>	Breadfruit	1,219,646	59,414	4.87	256,462	21.03	21.03	-16.16
<i>Artocarpus elasticus</i>	Breadfruit	1,116,058	252,110	22.59	36,936	3.31	3.31	19.28
<i>Artocarpus kemando</i>	Breadfruit	1,195,940	38,156	3.19	237,462	19.86	19.86	-16.67
<i>Artocarpus lanceifolius</i>	Breadfruit	571,424	55,456	9.70	47,530	8.32	8.32	1.39
<i>Artocarpus rigidus</i>	Breadfruit	894,572	149,786	16.74	156,886	17.54	17.54	-0.79
<i>Artocarpus sepicanus</i>	Breadfruit	61,874	7,318	11.83	31,314	50.61	50.61	-38.78
<i>Artocarpus teysmannii</i>	Breadfruit	1,155,016	107,396	9.30	92,886	8.04	8.04	1.26
<i>Averrhoa bilimbi</i>	Starfruit	766,810	35,742	4.66	132,084	17.23	17.23	-12.56
<i>Averrhoa carambola</i>	Starfruit	765,714	20,546	2.68	76,528	9.99	9.99	-7.31
<i>Cajanus scarabaeoides</i>	Pigeon_pea	235,964	49,300	20.89	9,668	4.10	4.10	16.80
<i>Cocos nucifera</i>	Coconut	625,082	40,220	6.43	34,982	5.60	5.60	0.84
<i>Colocasia esculenta</i>	Taro	782,306	90,286	11.54	17,408	2.23	2.23	9.32
<i>Dimocarpus longan</i>	Longan	1,130,878	263,354	23.29	31,302	2.77	2.77	20.52
<i>Dioscorea alata</i>	Yam	579,454	6,584	1.14	86,668	14.96	14.96	-13.82
<i>Dioscorea pyriformis</i>	Yam	439,964	127,470	28.97	30,576	6.95	6.95	22.02

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 4.5						
		2050						
		Current area (km ²)	Gain (km ²)	Gain (%)	Loss (km ²)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Durio zibethinus</i>	Durian	747,320	98,516	13.18	94,406	12.63	12.63	0.55
<i>Ficus chartacea</i>	Fig	1,052,008	121,482	11.55	678	0.06	0.06	11.48
<i>Ficus fulva</i>	Fig	970,846	57,754	5.95	46,680	4.81	4.81	1.14
<i>Ficus grossularioides</i>	Fig	829,782	68,476	8.25	224,436	27.05	27.05	-18.80
<i>Ficus hirta</i>	Fig	560,970	37,218	6.63	121,808	21.71	21.71	-15.08
<i>Ficus oleifolia</i>	Fig	526,718	56,198	10.67	26,834	5.09	5.09	5.57
<i>Ficus padana</i>	Fig	441,688	33,082	7.49	17,684	4.00	4.00	3.49
<i>Ficus tricolor</i>	Fig	133,484	1,608	1.20	6,212	4.65	4.65	-3.45
<i>Garcinia celebica</i>	Mangosteen	874,000	47,792	5.47	103,958	11.89	11.89	-6.43
<i>Gnetum gnemon</i>	Gnetum	963,088	65,094	6.76	46,776	4.86	4.86	1.90
<i>Ipomoea aquatica</i>	Ipomoea	1,014,974	31,448	3.10	147,792	14.56	14.56	-11.46
<i>Ipomoea littoralis</i>	Sweet_potato	619,484	136,022	21.96	27,344	4.41	4.41	17.54
<i>Ipomoea obscura</i>	Ipomoea	483,654	8,510	1.76	29,400	6.08	6.08	-4.32
<i>Ipomoea pes-caprae</i>	Ipomoea	711,506	107,068	15.05	44,120	6.20	6.20	8.85
<i>Mangifera griffithii</i>	Mangoes	899,156	58,682	6.53	36,464	4.06	4.06	2.47
<i>Mangifera laurina</i>	Mangoes	1,058,835	44,776	4.23	106,334	10.04	10.04	-5.81
<i>Mangifera minor</i>	Mangoes	536,370	46,750	8.72	66,738	12.44	12.44	-3.73
<i>Musa acuminata</i>	Banana	609,984	40,166	6.58	44,838	7.35	7.35	-0.77
<i>Nephelium lappaceum</i>	Rambutan	1,483,344	123,186	8.30	280,954	18.94	18.94	-10.64
<i>Oryza meyeriana</i>	Rice	336,978	51,848	15.39	22,636	6.72	6.72	8.67
<i>Oryza minuta</i>	Rice	606,478	62,910	10.37	49,288	8.13	8.13	2.25
<i>Oryza officinalis</i>	Rice	489,396	163,132	33.33	106,348	21.73	21.73	11.60
<i>Oryza rufipogon</i>	Rice	613,592	54,602	8.90	135,902	22.15	22.15	-13.25

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 4.5						
		2050						
		Current area (km ²)	Gain (km ²)	Gain (%)	Loss (km ²)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Parkia speciosa</i>	Parkia	1,079,894	68,564	6.35	230,932	21.38	21.38	-15.04
<i>Rubus fraxinifolius</i>	Raspberry	409,740	3,344	0.82	75,570	18.44	18.44	-17.63
<i>Rubus lineatus</i>	Raspberry	48,622	494	1.02	2,846	5.85	5.85	-4.84
<i>Rubus niveus</i>	Raspberry	114,608	9,636	8.41	3,694	3.22	3.22	5.18
<i>Rubus rosifolius</i>	Raspberry	401,860	16,144	4.02	35,990	8.96	8.96	-4.94
<i>Saccharum officinarum</i>	Sugarcane	660,074	83,072	12.59	70,716	10.71	10.71	1.87
<i>Saccharum spontaneum</i>	Sugarcane	718,302	24,630	3.43	90,296	12.57	12.57	-9.14
<i>Solanum melongena</i>	Aubergine	500,316	20,106	4.02	28,522	5.70	5.70	-1.68
<i>Sorghum nitidum</i>	Sorghum	683,870	29,226	4.27	100,040	14.63	14.63	-10.35
<i>Sorghum propinquum</i>	Sorghum	885,574	111,446	12.58	35,478	4.01	4.01	8.58
<i>Vigna radiata</i>	Mungbean	433,194	47,528	10.97	28,004	6.46	6.46	4.51

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 4.5					
		2080					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Archidendron clypearia</i>	Archidendron	86,460	14.06	63,224	10.28	10.28	3.78
<i>Archidendron ellipticum</i>	Archidendron	126,412	16.77	116,736	15.49	15.49	1.28
<i>Archidendron fagifolium</i>	Archidendron	44,280	7.25	44,066	7.22	7.22	0.04
<i>Archidendron jiringa</i>	Archidendron	190,028	21.42	106,520	12.01	12.01	9.42
<i>Archidendron microcarpum</i>	Archidendron	20,032	2.42	201,420	24.38	24.38	-21.95
<i>Arenga pinnata</i>	BlackPalmSugar	3,456	0.43	141,474	17.56	17.56	-17.13
<i>Artocarpus altilis</i>	Breadfruit	104,152	12.44	61,044	7.29	7.29	5.15
<i>Artocarpus anisophyllus</i>	Breadfruit	55,926	4.59	250,768	20.56	20.56	-15.98
<i>Artocarpus elasticus</i>	Breadfruit	236,496	21.19	31,018	2.78	2.78	18.41
<i>Artocarpus kemando</i>	Breadfruit	110,050	9.20	109,690	9.17	9.17	0.03
<i>Artocarpus lanceifolius</i>	Breadfruit	131,474	23.01	30,258	5.30	5.30	17.71
<i>Artocarpus rigidus</i>	Breadfruit	135,266	15.12	127,430	14.24	14.24	0.88
<i>Artocarpus sepicanus</i>	Breadfruit	23,622	38.18	15,402	24.89	24.89	13.29
<i>Artocarpus teysmannii</i>	Breadfruit	93,596	8.10	146,852	12.71	12.71	-4.61
<i>Averrhoa bilimbi</i>	Starfruit	2,606	0.34	223,438	29.14	29.14	-28.80
<i>Averrhoa carambola</i>	Starfruit	19,194	2.51	56,862	7.43	7.43	-4.92
<i>Cajanus scarabaeoides</i>	Pigeon_pea	59,450	25.19	8,150	3.45	3.45	21.74
<i>Cocos nucifera</i>	Coconut	5,530	0.88	119,268	19.08	19.08	-18.20
<i>Colocasia esculenta</i>	Taro	20,122	2.57	86,772	11.09	11.09	-8.52
<i>Dimocarpus longan</i>	Longan	230,386	20.37	53,080	4.69	4.69	15.68
<i>Dioscorea alata</i>	Yam	9,978	1.72	60,072	10.37	10.37	-8.65
<i>Dioscorea pyriformis</i>	Yam	186,792	42.46	25,700	5.84	5.84	36.61
<i>Durio zibethinus</i>	Durian	83,972	11.24	127,562	17.07	17.07	-5.83
<i>Ficus chartacea</i>	Fig	14,564	1.38	37,112	3.53	3.53	-2.14
<i>Ficus fulva</i>	Fig	47,874	4.93	54,212	5.58	5.58	-0.65

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 4.5					
		2080					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Ficus grossularioides</i>	Fig	42,596	5.13	216,782	26.13	26.13	-20.99
<i>Ficus hirta</i>	Fig	76,568	13.65	143,712	25.62	25.62	-11.97
<i>Ficus oleifolia</i>	Fig	0	0.00	359,866	68.32	68.32	-68.32
<i>Ficus padana</i>	Fig	56,228	12.73	11,224	2.54	2.54	10.19
<i>Ficus tricolor</i>	Fig	258	0.19	9,928	7.44	7.44	-7.24
<i>Garcinia celebica</i>	Mangosteen	32,386	3.71	147,558	16.88	16.88	-13.18
<i>Gnetum gnemon</i>	Gnetum	48,680	5.05	75,090	7.80	7.80	-2.74
<i>Ipomoea aquatica</i>	Ipomoea	30,826	3.04	172,846	17.03	17.03	-13.99
<i>Ipomoea littoralis</i>	Sweet_potato	172,152	27.79	55,626	8.98	8.98	18.81
<i>Ipomoea obscura</i>	Ipomoea	9,288	1.92	16,672	3.45	3.45	-1.53
<i>Ipomoea pes-caprae</i>	Ipomoea	76,370	10.73	62,314	8.76	8.76	1.98
<i>Mangifera griffithii</i>	Mangoes	63,770	7.09	77,818	8.65	8.65	-1.56
<i>Mangifera laurina</i>	Mangoes	59,672	5.64	74,432	7.03	7.03	-1.39
<i>Mangifera minor</i>	Mangoes	137,086	25.56	39,890	7.44	7.44	18.12
<i>Musa acuminata</i>	Banana	41,428	6.79	59,056	9.68	9.68	-2.89
<i>Nephelium lappaceum</i>	Rambutan	180,098	12.14	199,110	13.42	13.42	-1.28
<i>Oryza meyeriana</i>	Rice	38,556	11.44	24,516	7.28	7.28	4.17
<i>Oryza minuta</i>	Rice	35,522	5.86	102,534	16.91	16.91	-11.05
<i>Oryza officinalis</i>	Rice	169,126	34.56	70,646	14.44	14.44	20.12
<i>Oryza rufipogon</i>	Rice	210,308	34.27	46,490	7.58	7.58	26.70
<i>Parkia speciosa</i>	Parkia	76,948	7.13	187,924	17.40	17.40	-10.28
<i>Rubus fraxinifolius</i>	Raspberry	2,494	0.61	68,222	16.65	16.65	-16.04
<i>Rubus lineatus</i>	Raspberry	292	0.60	2,408	4.95	4.95	-4.35
<i>Rubus niveus</i>	Raspberry	8,858	7.73	2,194	1.91	1.91	5.81
<i>Rubus rosifolius</i>	Raspberry	28,610	7.12	23,508	5.85	5.85	1.27

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 4.5					
		2080					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Saccharum officinarum</i>	Sugarcane	104,468	15.83	81,174	12.30	12.30	3.53
<i>Saccharum spontaneum</i>	Sugarcane	22,974	3.20	59,874	8.34	8.34	-5.14
<i>Solanum melongena</i>	Aubergine	14,510	2.90	25,552	5.11	5.11	-2.21
<i>Sorghum nitidum</i>	Sorghum	19,458	2.85	148,040	21.65	21.65	-18.80
<i>Sorghum propinquum</i>	Sorghum	122,750	13.86	48,862	5.52	5.52	8.34
<i>Vigna radiata</i>	Mungbean	62,190	14.36	29,348	6.77	6.77	7.58

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 8.5					
		2050					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Archidendron clypearia</i>	Archidendron	398,740	64.83	56,258	9.15	9.15	55.68
<i>Archidendron ellipticum</i>	Archidendron	253,514	33.64	116,716	15.49	15.49	18.15
<i>Archidendron faqifolium</i>	Archidendron	188,172	30.81	29,150	4.77	4.77	26.04
<i>Archidendron jiringa</i>	Archidendron	181,568	20.47	175,946	19.84	19.84	0.63
<i>Archidendron microcarpum</i>	Archidendron	145,808	17.65	180,750	21.88	21.88	-4.23
<i>Arenga pinnata</i>	BlackPalmSugar	57,096	7.08	116,714	14.48	14.48	-7.40
<i>Artocarpus altilis</i>	Breadfruit	84,380	10.08	167,936	20.06	20.06	-9.98
<i>Artocarpus anisophyllus</i>	Breadfruit	86,944	7.13	178,336	14.62	14.62	-7.49
<i>Artocarpus elasticus</i>	Breadfruit	227,678	20.40	116,464	10.44	10.44	9.96
<i>Artocarpus kemando</i>	Breadfruit	219,218	18.33	164,372	13.74	13.74	4.59
<i>Artocarpus lanceifolius</i>	Breadfruit	111,848	19.57	114,032	19.96	19.96	-0.38
<i>Artocarpus rigidus</i>	Breadfruit	170,650	19.08	96,142	10.75	10.75	8.33
<i>Artocarpus sepicanus</i>	Breadfruit	27,066	43.74	20,670	33.41	33.41	10.34
<i>Artocarpus teysmannii</i>	Breadfruit	114,922	9.95	221,962	19.22	19.22	-9.27
<i>Averrhoa bilimbi</i>	Starfruit	40,584	5.29	234,508	30.58	30.58	-25.29
<i>Averrhoa carambola</i>	Starfruit	31,148	4.07	159,918	20.88	20.88	-16.82
<i>Cajanus scarabaeoides</i>	Pigeon_pea	70,570	29.91	6,682	2.83	2.83	27.08
<i>Cocos nucifera</i>	Coconut	28,614	4.58	280,942	44.94	44.94	-40.37
<i>Colocasia esculenta</i>	Taro	153,492	19.62	88,124	11.26	11.26	8.36
<i>Dimocarpus longan</i>	Longan	101,808	9.00	103,440	9.15	9.15	-0.14
<i>Dioscorea alata</i>	Yam	838	0.14	196,936	33.99	33.99	-33.84
<i>Dioscorea pyrifolia</i>	Yam	65,926	14.98	85,720	19.48	19.48	-4.50
<i>Durio zibethinus</i>	Durian	376,736	50.41	39,510	5.29	5.29	45.12
<i>Ficus chartacea</i>	Fig	1,774	0.17	573,342	54.50	54.50	-54.33

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 8.5					
		2050					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Ficus fulva</i>	Fig	67,702	6.97	193,118	19.89	19.89	-12.92
<i>Ficus grossularioides</i>	Fig	106,810	12.87	132,680	15.99	15.99	-3.12
<i>Ficus hirta</i>	Fig	120,336	21.45	118,836	21.18	21.18	0.27
<i>Ficus oleifolia</i>	Fig	40,872	7.76	95,610	18.15	18.15	-10.39
<i>Ficus padana</i>	Fig	152,642	34.56	11,712	2.65	2.65	31.91
<i>Ficus tricolor</i>	Fig	19,560	14.65	9,414	7.05	7.05	7.60
<i>Garcinia celebica</i>	Mangosteen	120,898	13.83	138,094	15.80	15.80	-1.97
<i>Gnetum gnemon</i>	Gnetum	183,702	19.07	47,674	4.95	4.95	14.12
<i>Ipomoea aquatica</i>	Ipomoea	162,936	16.05	96,046	9.46	9.46	6.59
<i>Ipomoea littoralis</i>	Sweet_potato	148,786	24.02	118,378	19.11	19.11	4.91
<i>Ipomoea obscura</i>	Ipomoea	1,476	0.31	91,066	18.83	18.83	-18.52
<i>Ipomoea pes-caprae</i>	Ipomoea	130,400	18.33	44,470	6.25	6.25	12.08
<i>Mangifera griffithii</i>	Mangoes	111,974	12.45	156,192	17.37	17.37	-4.92
<i>Mangifera laurina</i>	Mangoes	89,692	8.47	146,338	13.82	13.82	-5.35
<i>Mangifera minor</i>	Mangoes	139,246	25.96	42,866	7.99	7.99	17.97
<i>Musa acuminata</i>	Banana	56,758	9.30	90,332	14.81	14.81	-5.50
<i>Nephelium lappaceum</i>	Rambutan	128,156	8.64	244,796	16.50	16.50	-7.86
<i>Oryza meyeriana</i>	Rice	289,882	86.02	17,460	5.18	5.18	80.84
<i>Oryza minuta</i>	Rice	192,370	31.72	41,766	6.89	6.89	24.83
<i>Oryza officinalis</i>	Rice	167,666	34.26	128,766	26.31	26.31	7.95
<i>Oryza rufipogon</i>	Rice	51,302	8.36	134,172	21.87	21.87	-13.51
<i>Parkia speciosa</i>	Parkia	74,096	6.86	250,908	23.23	23.23	-16.37
<i>Rubus fraxinifolius</i>	Raspberry	9,220	2.25	82,738	20.19	20.19	-17.94
<i>Rubus lineatus</i>	Raspberry	2,528	5.20	6,140	12.63	12.63	-7.43
<i>Rubus niveus</i>	Raspberry	19,810	17.29	20,978	18.30	18.30	-1.02

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

Taxon	Crop Genepool	RCP 8.5					
		2050					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Rubus rosifolius</i>	Raspberry	42,296	10.53	45,590	11.34	11.34	-0.82
<i>Saccharum officinarum</i>	Sugarcane	235,426	35.67	64,040	9.70	9.70	25.96
<i>Saccharum spontaneum</i>	Sugarcane	61,588	8.57	105,008	14.62	14.62	-6.04
<i>Solanum melongena</i>	Aubergine	23,184	4.63	28,226	5.64	5.64	-1.01
<i>Sorghum nitidum</i>	Sorghum	50,132	7.33	184,898	27.04	27.04	-19.71
<i>Sorghum propinquum</i>	Sorghum	135,158	15.26	85,124	9.61	9.61	5.65
<i>Vigna radiata</i>	Mungbean	44,018	10.16	17,188	3.97	3.97	6.19

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

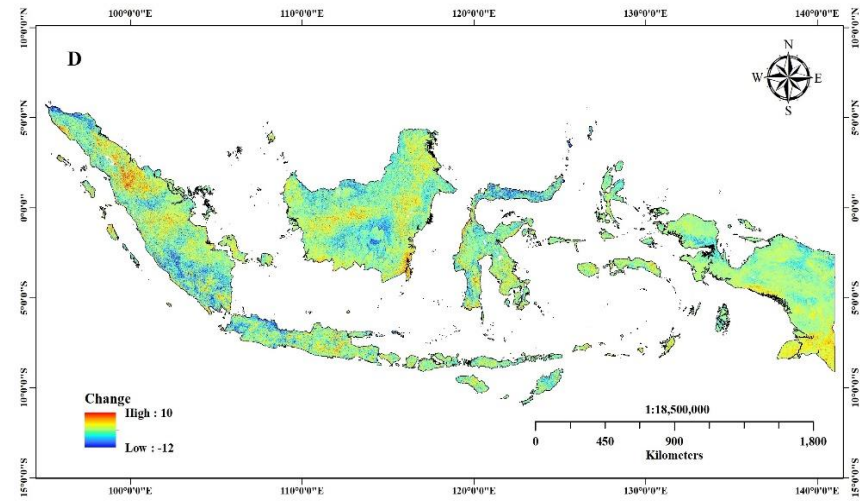
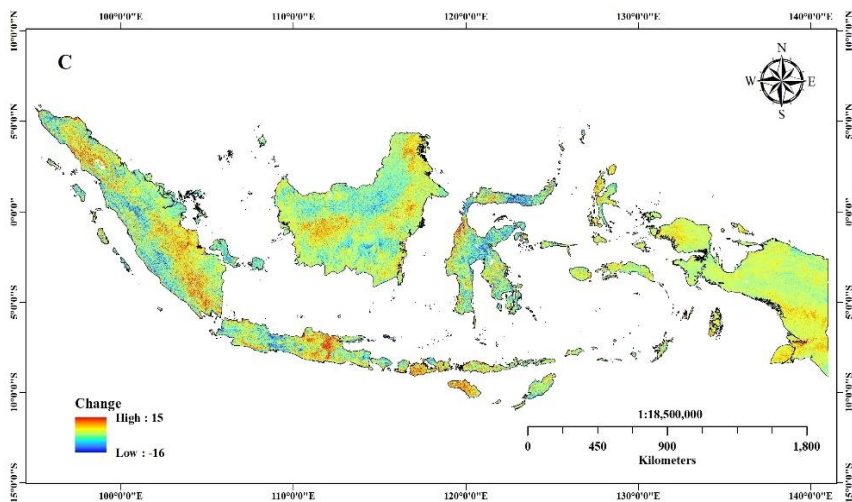
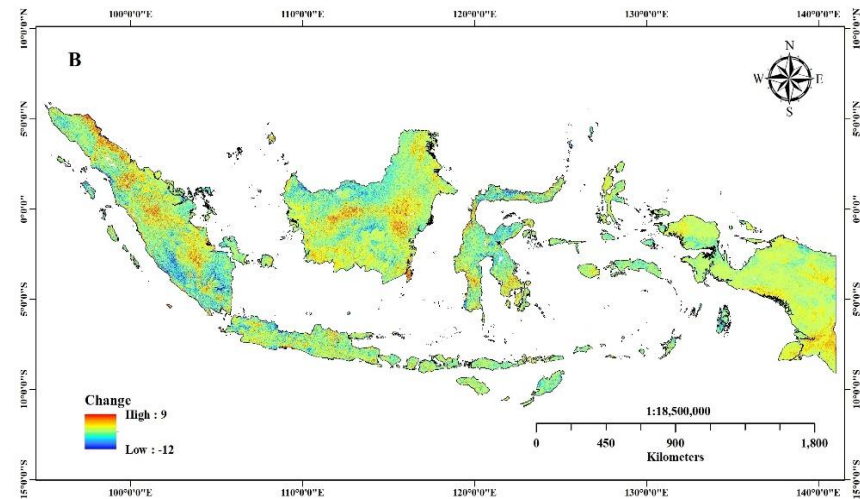
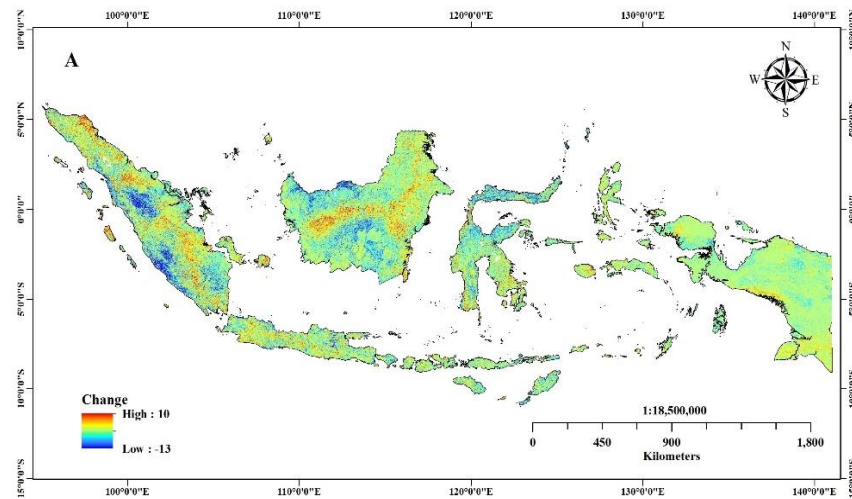
Taxon	Crop Genepool	RCP 8.5					
		2080					
		Gain (km ²)	Gain (%)	Loss (km ²)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Archidendron clypearia</i>	Archidendron	258,610	42.04	29,524	4.80	4.80	37.24
<i>Archidendron ellipticum</i>	Archidendron	118,154	15.68	137,510	18.25	18.25	-2.57
<i>Archidendron fagifolium</i>	Archidendron	84,716	13.87	30,798	5.04	5.04	8.83
<i>Archidendron jiringa</i>	Archidendron	167,280	18.86	216,834	24.45	24.45	-5.59
<i>Archidendron microcarpum</i>	Archidendron	37,290	4.51	193,742	23.45	23.45	-18.93
<i>Arenga pinnata</i>	BlackPalmSugar	26,654	3.31	90,396	11.22	11.22	-7.91
<i>Artocarpus altilis</i>	Breadfruit	187,480	22.39	53,578	6.40	6.40	15.99
<i>Artocarpus anisophyllus</i>	Breadfruit	73,126	6.00	275,514	22.59	22.59	-16.59
<i>Artocarpus elasticus</i>	Breadfruit	223,802	20.05	59,638	5.34	5.34	14.71
<i>Artocarpus kemando</i>	Breadfruit	107,690	9.00	129,728	10.85	10.85	-1.84
<i>Artocarpus lanceifolius</i>	Breadfruit	239,764	41.96	41,678	7.29	7.29	34.67
<i>Artocarpus rigidus</i>	Breadfruit	198,996	22.24	112,738	12.60	12.60	9.64
<i>Artocarpus sepicanus</i>	Breadfruit	46,522	75.19	16,538	26.73	26.73	48.46
<i>Artocarpus teysmannii</i>	Breadfruit	42,984	3.72	212,940	18.44	18.44	-14.71
<i>Averrhoa bilimbi</i>	Starfruit	102,080	13.31	51,626	6.73	6.73	6.58
<i>Averrhoa carambola</i>	Starfruit	25,656	3.35	78,120	10.20	10.20	-6.85
<i>Cajanus scarabaeoides</i>	Pigeon_pea	34,638	14.68	45,048	19.09	19.09	-4.41
<i>Cocos nucifera</i>	Coconut	20,186	3.23	158,420	25.34	25.34	-22.11
<i>Colocasia esculenta</i>	Taro	44,504	5.69	119,864	15.32	15.32	-9.63
<i>Dimocarpus longan</i>	Longan	245,832	21.74	60,684	5.37	5.37	16.37
<i>Dioscorea alata</i>	Yam	14,964	2.58	111,294	19.21	19.21	-16.62
<i>Dioscorea pyriformis</i>	Yam	328,894	74.75	19,072	4.33	4.33	70.42
<i>Durio zibethinus</i>	Durian	133,240	17.83	110,550	14.79	14.79	3.04
<i>Ficus chartacea</i>	Fig	3,380	0.32	384,310	36.53	36.53	-36.21
<i>Ficus fulva</i>	Fig	38,862	4.00	102,372	10.54	10.54	-6.54

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

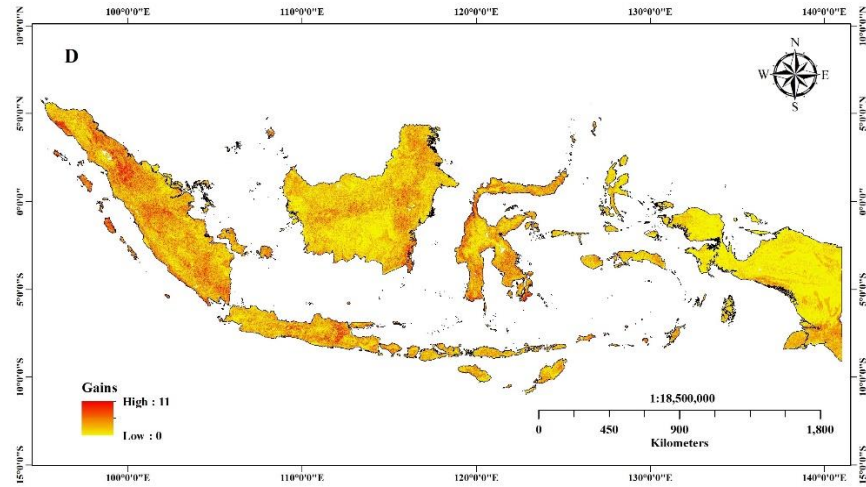
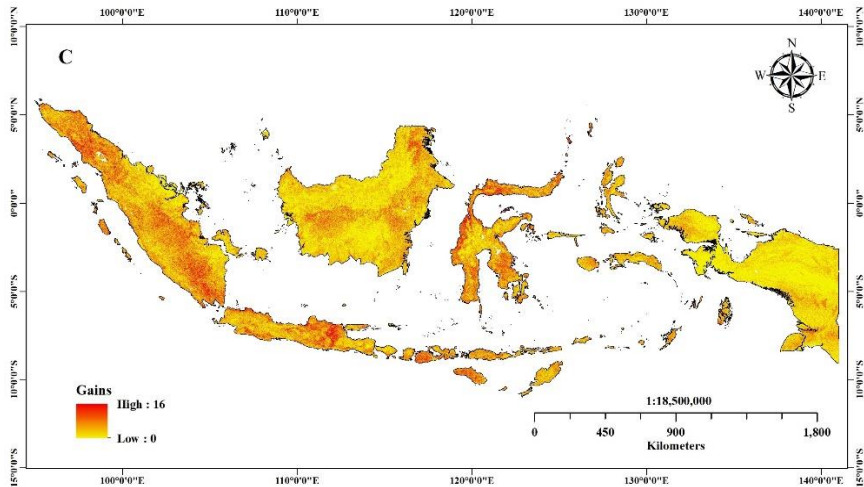
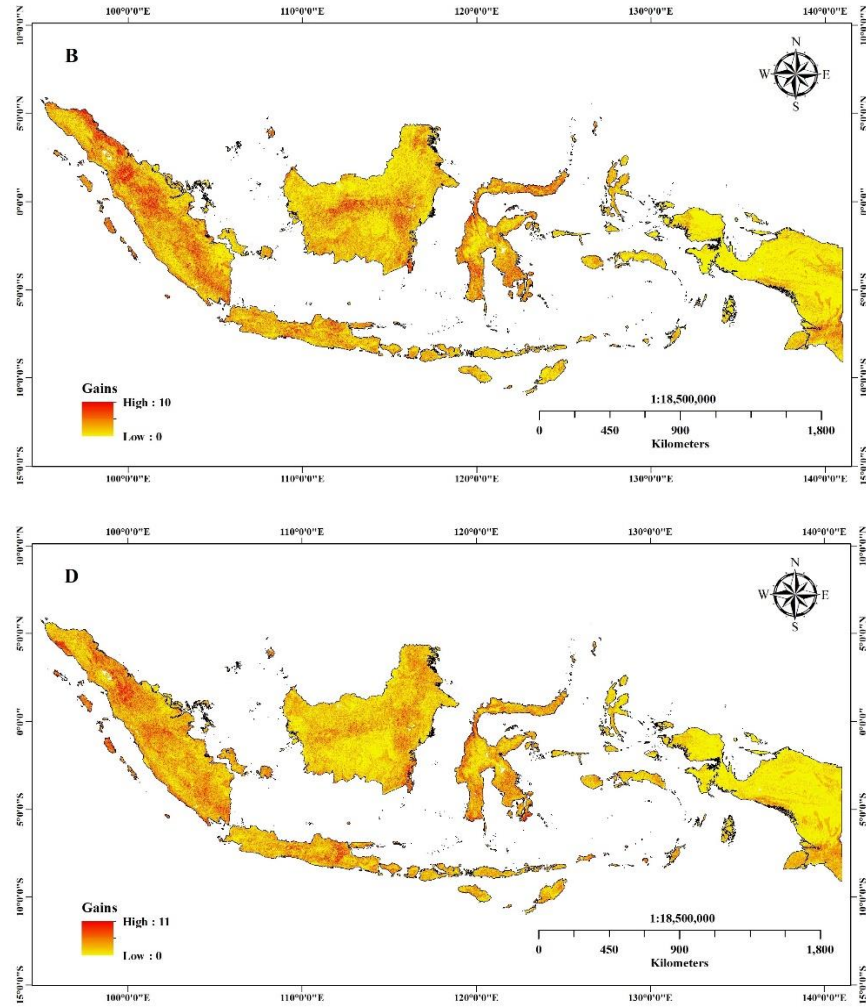
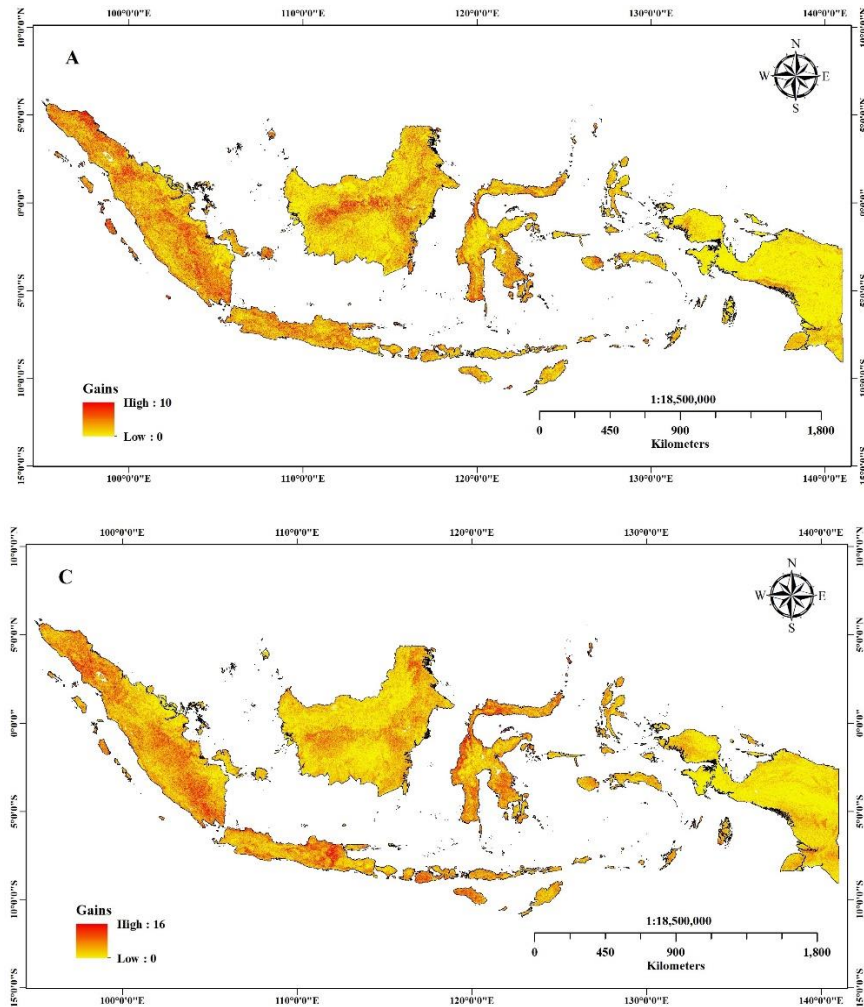
Taxon	Crop Genepool	RCP 8.5					
		2080					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Ficus grossularioides</i>	Fig	89,804	10.82	202,808	24.44	24.44	-13.62
<i>Ficus hirta</i>	Fig	72,092	12.85	120,028	21.40	21.40	-8.55
<i>Ficus oleifolia</i>	Fig	7,510	1.43	147,456	28.00	28.00	-26.57
<i>Ficus padana</i>	Fig	37,732	8.54	34,760	7.87	7.87	0.67
<i>Ficus tricolor</i>	Fig	860	0.64	13,732	10.29	10.29	-9.64
<i>Garcinia celebica</i>	Mangosteen	43,024	4.92	209,264	23.94	23.94	-19.02
<i>Gnetum gnemon</i>	Gnetum	96,366	10.01	84,656	8.79	8.79	1.22
<i>Ipomoea aquatica</i>	Ipomoea	103,214	10.17	102,932	10.14	10.14	0.03
<i>Ipomoea littoralis</i>	Sweet_potato	71,258	11.50	101,916	16.45	16.45	-4.95
<i>Ipomoea obscura</i>	Ipomoea	22,904	4.74	14,954	3.09	3.09	1.64
<i>Ipomoea pes-caprae</i>	Ipomoea	69,276	9.74	88,932	12.50	12.50	-2.76
<i>Mangifera griffithii</i>	Mangoes	137,314	15.27	8,176	0.91	0.91	14.36
<i>Mangifera laurina</i>	Mangoes	118,684	11.21	153,174	14.47	14.47	-3.26
<i>Mangifera minor</i>	Mangoes	127,844	23.84	86,534	16.13	16.13	7.70
<i>Musa acuminata</i>	Banana	47,812	7.84	82,236	13.48	13.48	-5.64
<i>Nephelium lappaceum</i>	Rambutan	242,296	16.33	203,370	13.71	13.71	2.62
<i>Oryza meyeriana</i>	Rice	33,324	9.89	49,436	14.67	14.67	-4.78
<i>Oryza minuta</i>	Rice	64,274	10.60	74,526	12.29	12.29	-1.69
<i>Oryza officinalis</i>	Rice	143,370	29.30	139,980	28.60	28.60	0.69
<i>Oryza rufipogon</i>	Rice	80,702	13.15	126,604	20.63	20.63	-7.48
<i>Parkia speciosa</i>	Parkia	67,008	6.21	243,860	22.58	22.58	-16.38
<i>Rubus fraxinifolius</i>	Raspberry	4,972	1.21	86,824	21.19	21.19	-19.98
<i>Rubus lineatus</i>	Raspberry	394	0.81	4,720	9.71	9.71	-8.90
<i>Rubus niveus</i>	Raspberry	8,890	7.76	5,788	5.05	5.05	2.71
<i>Rubus rosifolius</i>	Raspberry	23,852	5.94	52,704	13.12	13.12	-7.18

Appendix 33 Gains and losses areas of future distribution of priority CWR taxa in different scenarios (*contd.*)

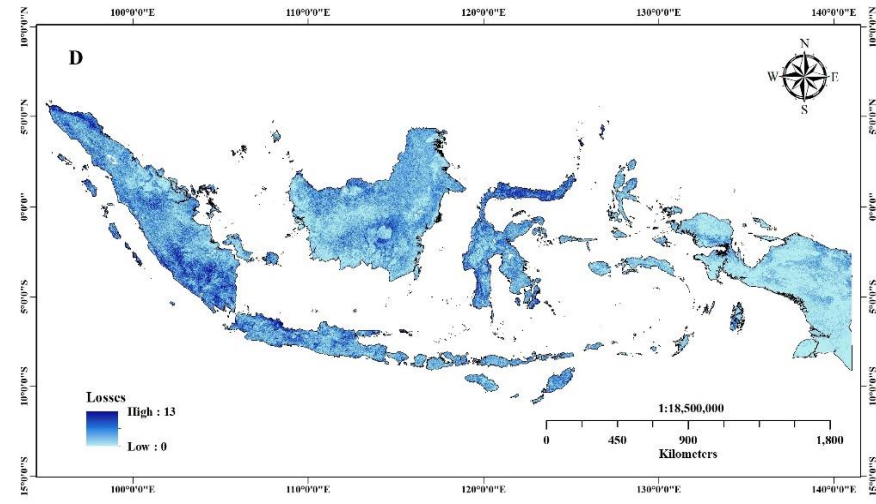
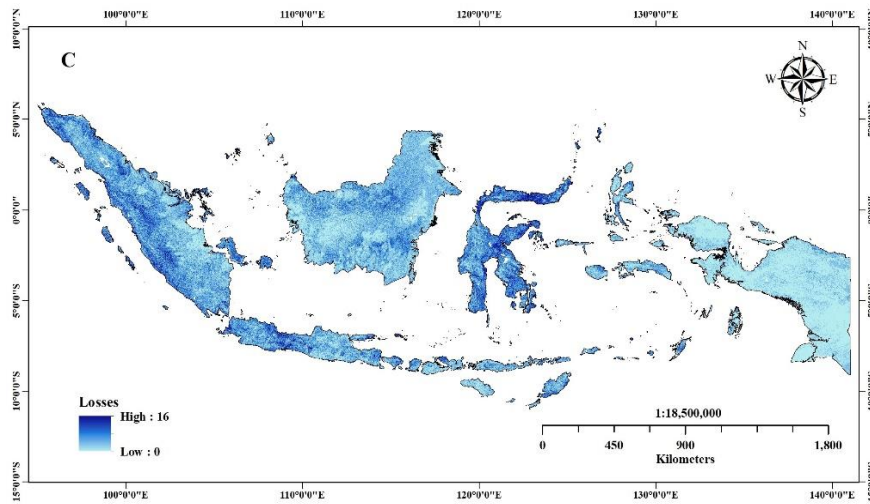
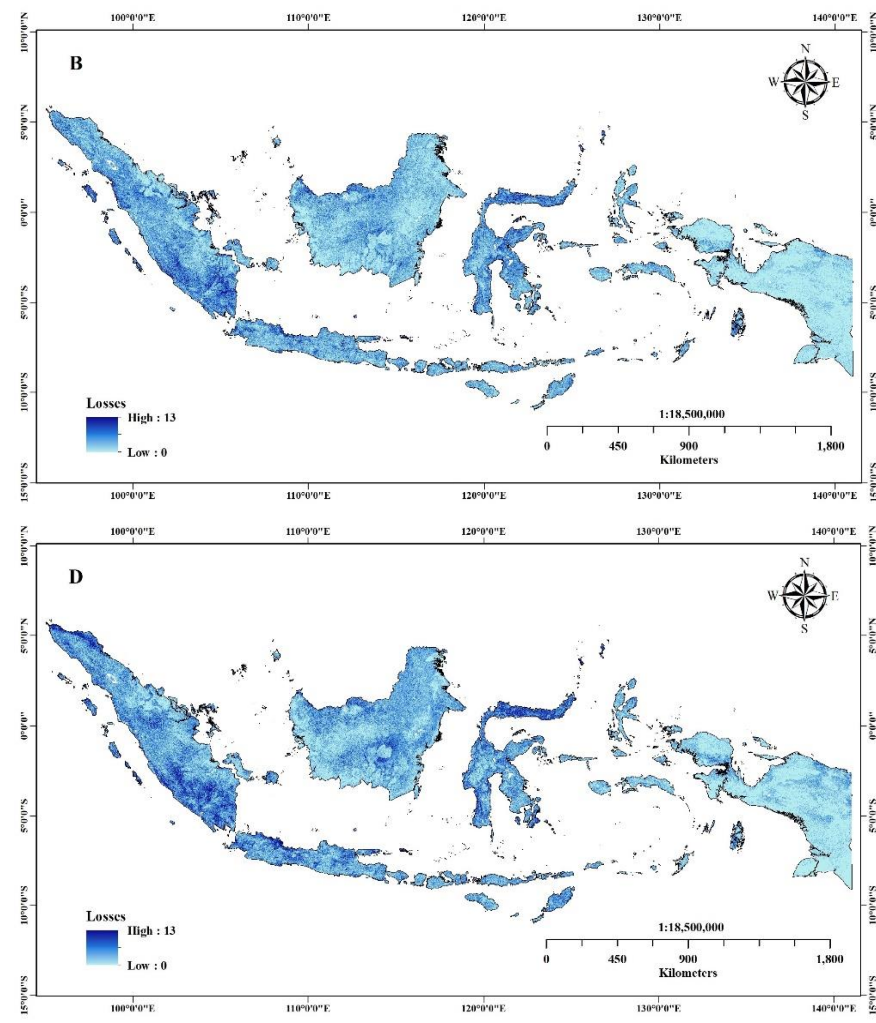
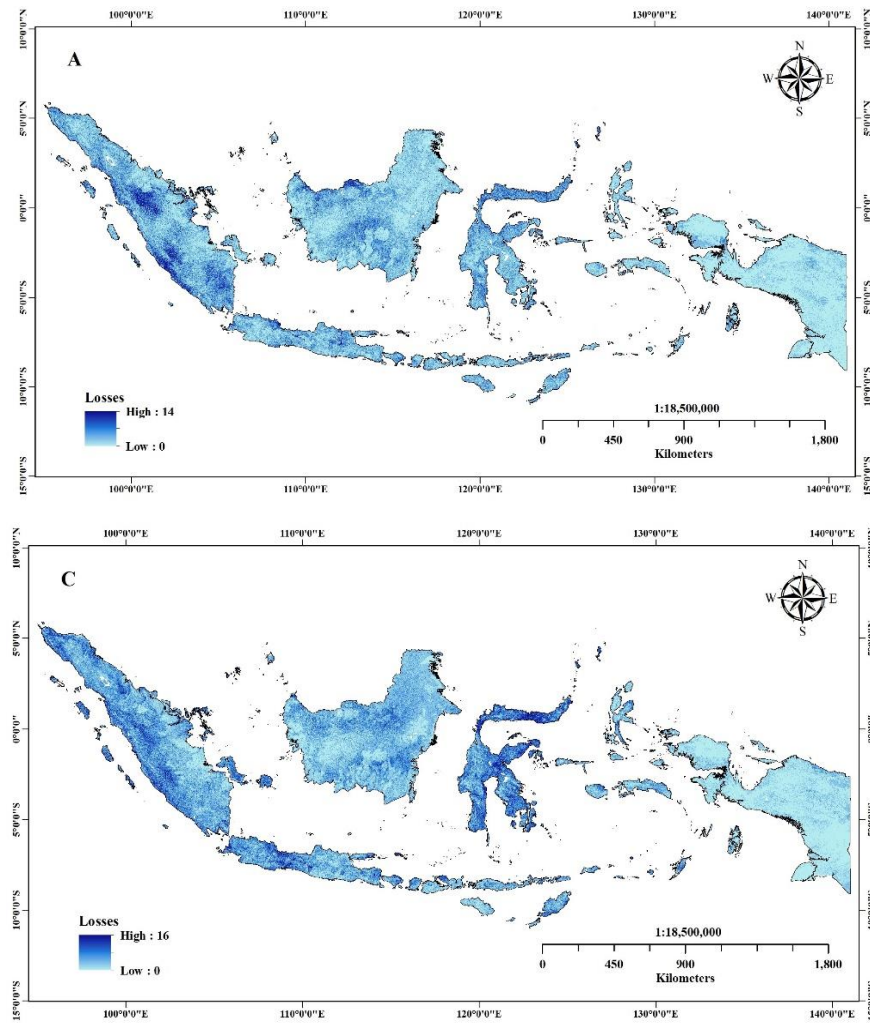
Taxon	Crop Genepool	RCP 8.5					
		2080					
		Gain (km2)	Gain (%)	Loss (km2)	Loss (%)	Change No Migration (%)	Change Unlimited Migration (%)
<i>Saccharum officinarum</i>	Sugarcane	140,576	21.30	172,654	26.16	26.16	-4.86
<i>Saccharum spontaneum</i>	Sugarcane	59,848	8.33	63,466	8.84	8.84	-0.50
<i>Solanum melongena</i>	Aubergine	28,300	5.66	27,824	5.56	5.56	0.10
<i>Sorghum nitidum</i>	Sorghum	30,906	4.52	169,142	24.73	24.73	-20.21
<i>Sorghum propinquum</i>	Sorghum	94,964	10.72	176,600	19.94	19.94	-9.22
<i>Vigna radiata</i>	Mungbean	131,458	30.35	21,550	4.97	4.97	25.37



Appendix 34 Species changes based on A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080.



Appendix 35 The future distribution gains hotspots based on A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080.



Appendix 36 The future distribution losses hotspots based on A. RCP 4.5 in year 2050, B. RCP 4.5 in year 2080, C. RCP 8.5 in year 2050, D. RCP 8.5 in year 2080.

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia

Taxon	Crop Genepool	Current	Number of PAs as Refugia							
			RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
			Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Archidendron clypearia</i>	Archidendron	322	345	315	331	312	345	296	356	318
<i>Archidendron ellipticum</i>	Archidendron	318	308	299	316	307	302	281	305	294
<i>Archidendron faqifolium</i>	Archidendron	267	270	257	267	256	305	259	280	261
<i>Archidendron jiringa</i>	Archidendron	265	281	249	290	256	259	234	279	244
<i>Archidendron microcarpum</i>	Archidendron	138	130	120	115	111	110	100	124	111
<i>Arenga pinnata</i>	BlackPalmSugar	325	305	305	310	309	319	304	321	311
<i>Artocarpus altilis</i>	Breadfruit	300	307	287	303	289	256	244	305	285
<i>Artocarpus anisophyllus</i>	Breadfruit	159	148	139	150	138	168	148	136	127
<i>Artocarpus elasticus</i>	Breadfruit	382	384	374	392	376	375	357	391	371
<i>Artocarpus kemando</i>	Breadfruit	192	384	179	198	188	193	174	194	184
<i>Artocarpus lanceifolius</i>	Breadfruit	145	150	136	154	135	151	116	162	130
<i>Artocarpus rigidus</i>	Breadfruit	272	251	239	252	242	272	252	259	236
<i>Artocarpus sepicanus</i>	Breadfruit	35	26	26	32	30	26	26	26	27
<i>Artocarpus teysmannii</i>	Breadfruit	291	296	283	295	281	317	265	284	275
<i>Averrhoa bilimbi</i>	Starfruit	342	331	325	302	302	268	266	348	331
<i>Averrhoa carambola</i>	Starfruit	310	303	293	310	299	272	267	301	288
<i>Cajanus scarabaeoides</i>	Pigeon_pea	173	192	168	189	169	198	171	158	139
<i>Cocos nucifera</i>	Coconut	300	304	290	271	268	256	238	267	254
<i>Colocasia esculenta</i>	Taro	337	343	330	325	322	327	311	327	318
<i>Dimocarpus longan</i>	Longan	198	213	175	206	183	168	156	208	177
<i>Dioscorea alata</i>	Yam	285	234	233	234	230	186	183	221	219
<i>Dioscorea pyrifolia</i>	Yam	291	324	282	336	284	260	245	363	287
<i>Durio zibethinus</i>	Durian	304	309	269	300	283	347	292	302	278
<i>Ficus chartacea</i>	Fig	123	128	123	123	123	98	97	106	106
<i>Ficus fulva</i>	Fig	319	313	307	319	311	269	244	304	301

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia (*contd.*)

Taxon	Crop Genepool	Current	Number of PAs as Refugia							
			RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
			Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Ficus grossularioides</i>	Fig	267	248	242	251	244	258	253	246	236
<i>Ficus hirta</i>	Fig	239	233	220	253	221	226	202	219	202
<i>Ficus oleifolia</i>	Fig	166	164	158	97	97	156	146	141	141
<i>Ficus padana</i>	Fig	200	204	197	217	199	239	194	214	194
<i>Ficus tricolor</i>	Fig	88	86	85	85	85	100	88	85	85
<i>Garcinia celebica</i>	Mangosteen	371	369	359	364	357	370	346	370	348
<i>Gnetum gnemon</i>	Gnetum	312	316	302	307	299	330	301	317	300
<i>Ipomoea aquatica</i>	Ipomoea	397	373	366	366	364	382	369	393	375
<i>Ipomoea littoralis</i>	Ipomoea	316	331	314	323	304	328	300	308	300
<i>Ipomoea obscura</i>	Ipomoea	294	284	280	292	282	235	234	304	285
<i>Ipomoea pes-caprae</i>	Ipomoea	347	348	339	351	339	346	330	340	329
<i>Mangifera griffithii</i>	Mangoes	233	233	226	233	220	218	194	249	230
<i>Mangifera laurina</i>	Mangoes	384	383	373	385	376	366	360	373	358
<i>Mangifera minor</i>	Mangoes	173	160	159	169	164	170	161	165	157
<i>Musa acuminata</i>	Banana	267	265	259	263	256	241	230	274	260
<i>Nephelium lappaceum</i>	Rambutan	334	308	305	333	320	318	310	330	319
<i>Oryza meyeriana</i>	Rice	199	208	194	206	192	313	195	200	185
<i>Oryza minuta</i>	Rice	285	280	269	254	251	316	272	271	258
<i>Oryza officinalis</i>	Rice	243	237	208	254	228	215	191	228	206
<i>Oryza rufipogon</i>	Rice	230	204	198	239	206	206	193	208	188
<i>Parkia speciosa</i>	Parkia	237	231	215	232	218	201	195	228	218
<i>Rubus fraxinifolius</i>	Raspberry	239	215	212	217	212	196	193	209	206
<i>Rubus lineatus</i>	Raspberry	71	69	69	70	70	72	69	69	69
<i>Rubus niveus</i>	Raspberry	99	105	98	107	99	81	75	101	95
<i>Rubus rosifolius</i>	Raspberry	168	161	158	167	163	169	152	161	154

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia (*contd.*)

Taxon	Crop Genepool	Current	Number of PAs as Refugia							
			RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
			Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Saccharum officinarum</i>	Sugarcane	39	43	39	43	37	51	39	43	36
<i>Saccharum spontaneum</i>	Sugarcane	312	292	289	302	299	302	284	300	289
<i>Solanum melongena</i>	Aubergine	304	302	295	306	299	302	292	309	296
<i>Sorghum nitidum</i>	Sorghum	303	285	280	281	273	280	255	271	267
<i>Sorghum propinquum</i>	Sorghum	359	367	355	368	355	363	344	333	325
<i>Vigna radiata</i>	Mungbean	250	258	238	271	243	252	238	293	245

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia (*contd.*)

Taxon	Crop Genepool	Number of PAs contain Holdouts							
		RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Archidendron clypearia</i>	Archidendron	43	64	73	90	65	109	37	61
<i>Archidendron ellipticum</i>	Archidendron	72	95	75	86	117	150	95	110
<i>Archidendron fagifolium</i>	Archidendron	59	73	55	66	39	69	46	57
<i>Archidendron jiringa</i>	Archidendron	73	104	72	95	122	152	123	152
<i>Archidendron microcarpum</i>	Archidendron	47	59	78	87	77	90	69	80
<i>Arenga pinnata</i>	BlackPalmSugar	142	149	157	163	127	152	99	122
<i>Artocarpus altilis</i>	Breadfruit	72	90	94	111	163	186	58	80
<i>Artocarpus anisophyllus</i>	Breadfruit	90	105	90	104	69	89	91	108
<i>Artocarpus elasticus</i>	Breadfruit	36	64	38	57	104	159	53	88
<i>Artocarpus kemando</i>	Breadfruit	76	113	52	70	68	91	78	88
<i>Artocarpus lanceifolius</i>	Breadfruit	36	44	27	37	53	77	29	42
<i>Artocarpus rigidus</i>	Breadfruit	101	125	102	133	87	126	91	115
<i>Artocarpus sepicanus</i>	Breadfruit	30	31	23	24	29	30	30	26
<i>Artocarpus teysmannii</i>	Breadfruit	76	96	87	108	142	166	134	143
<i>Averrhoa bilimbi</i>	Starfruit	100	108	164	166	206	217	58	73
<i>Averrhoa carambola</i>	Starfruit	120	126	100	107	154	178	121	132
<i>Cajanus scarabaeoides</i>	Pigeon_pea	11	17	7	14	5	8	65	80
<i>Cocos nucifera</i>	Coconut	78	85	148	152	171	196	146	153
<i>Colocasia esculenta</i>	Taro	23	61	131	140	86	135	118	133
<i>Dimocarpus longan</i>	Longan	34	65	44	63	111	133	57	86
<i>Dioscorea alata</i>	Yam	138	141	142	144	208	210	165	170
<i>Dioscorea pyriformis</i>	Yam	34	48	23	36	128	146	14	24
<i>Durio zibethinus</i>	Durian	84	122	111	129	29	68	103	125
<i>Ficus chartacea</i>	Fig	0	2	19	24	93	94	66	67
<i>Ficus fulva</i>	Fig	75	85	70	86	168	204	108	116

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia (*contd.*)

Taxon	Crop Genepool	Number of PAs contain Holdouts							
		RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Ficus grossularioides</i>	Fig	134	144	131	136	81	109	110	127
<i>Ficus hirta</i>	Fig	92	98	86	96	112	132	100	109
<i>Ficus oleifolia</i>	Fig	45	60	149	149	86	94	119	120
<i>Ficus padana</i>	Fig	26	39	11	20	16	30	45	59
<i>Ficus tricolor</i>	Fig	22	23	32	33	17	26	32	32
<i>Garcinia celebica</i>	Mangosteen	122	149	138	169	138	188	166	187
<i>Gnetum gnemon</i>	Gnetum	68	85	99	113	62	131	84	104
<i>Ipomoea aquatica</i>	Ipomoea	163	176	166	183	143	200	105	137
<i>Ipomoea littoralis</i>	Ipomoea	35	41	50	59	92	121	87	95
<i>Ipomoea obscura</i>	Ipomoea	73	82	66	71	192	192	48	53
<i>Ipomoea pes-caprae</i>	Ipomoea	54	81	74	97	70	130	84	109
<i>Mangifera griffithii</i>	Mangoes	40	48	56	67	103	136	12	17
<i>Mangifera laurina</i>	Mangoes	106	121	81	96	115	161	114	135
<i>Mangifera minor</i>	Mangoes	62	68	39	50	37	58	45	59
<i>Musa acuminata</i>	Banana	69	86	66	79	111	131	72	86
<i>Nephelium lappaceum</i>	Rambutan	146	167	101	126	135	155	105	134
<i>Oryza meyeriana</i>	Rice	32	38	30	40	14	32	51	64
<i>Oryza minuta</i>	Rice	70	78	127	133	57	98	85	90
<i>Oryza officinalis</i>	Rice	86	118	54	84	114	155	93	122
<i>Oryza rufipogon</i>	Rice	89	104	58	77	101	123	101	117
<i>Parkia speciosa</i>	Parkia	83	99	86	95	130	142	80	89
<i>Rubus fraxinifolius</i>	Raspberry	106	110	104	105	123	132	115	120
<i>Rubus lineatus</i>	Raspberry	24	25	26	29	27	34	32	33
<i>Rubus niveus</i>	Raspberry	8	11	8	10	48	58	23	24
<i>Rubus rosifolius</i>	Raspberry	58	71	32	58	52	88	68	77

Appendix 37 Number of PAs as refugia and that contain significant holdouts of priority CWR taxa in Indonesia (*contd.*)

Taxon	Crop Genepool	Number of PAs contain Holdouts							
		RCP 4.5 (2050)		RCP 4.5 (2080)		RCP 4.5 (2050)		RCP 4.5 (2080)	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Saccharum officinarum</i>	Sugarcane	14	20	16	22	8	18	18	25
<i>Saccharum spontaneum</i>	Sugarcane	110	132	93	107	134	157	100	119
<i>Solanum melongena</i>	Aubergine	55	65	46	50	65	72	44	55
<i>Sorghum nitidum</i>	Sorghum	119	142	152	165	179	203	171	181
<i>Sorghum propinquum</i>	Sorghum	36	53	43	65	113	146	142	157
<i>Vigna radiata</i>	Mungbean	42	65	34	55	49	77	20	40

Appendix 38 Number of PAs that contain high priority zone of ecogeographic representativeness for further ex situ collection with significant holdouts populations of priority CWR taxa in Indonesia

Taxon	Crop Genepool	Number of PAs contain high priority zone of ecogeographic representativeness with significant Holdouts population							
		RCP 4.5 - 2050		RCP 4.5 - 2080		RCP 8.5 - 2050		RCP 8.5 - 2080	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Archidendron clypearia</i>	Archidendron	36	61	63	82	49	86	33	57
<i>Archidendron ellipticum</i>	Archidendron	28	38	31	34	49	67	36	40
<i>Archidendron fagifolium</i>	Archidendron	52	63	38	50	30	63	38	49
<i>Archidendron jiringa</i>	Archidendron	67	104	67	95	104	137	107	138
<i>Archidendron microcarpum</i>	Archidendron	45	57	72	81	67	80	64	75
<i>Arenga pinnata</i>	BlackPalmSugar	122	127	128	134	102	128	92	114
<i>Artocarpus altilis</i>	Breadfruit	52	67	65	82	104	120	42	64
<i>Artocarpus anisophyllus</i>	Breadfruit	67	82	69	86	50	71	61	80
<i>Artocarpus elasticus</i>	Breadfruit	16	30	15	27	45	63	22	37
<i>Artocarpus kemando</i>	Breadfruit	57	105	53	71	63	89	75	87
<i>Artocarpus lanceifolius</i>	Breadfruit	27	35	19	31	33	55	20	30
<i>Artocarpus rigidus</i>	Breadfruit	61	85	62	87	54	88	62	82
<i>Artocarpus sepicanus</i>	Breadfruit	24	25	20	21	24	25	25	21
<i>Artocarpus teysmannii</i>	Breadfruit	54	77	61	84	97	116	99	106
<i>Averrhoa bilimbi</i>	Starfruit	83	94	135	137	162	171	50	65
<i>Averrhoa carambola</i>	Starfruit	96	103	76	86	113	136	90	102
<i>Cajanus scarabaeoides</i>	Pigeon_pea	3	3	3	4	2	3	12	19
<i>Cocos nucifera</i>	Coconut	17	19	31	34	29	36	28	32
<i>Colocasia esculenta</i>	Taro	4	9	20	21	19	26	18	23
<i>Dimocarpus longan</i>	Longan	7	17	13	16	29	35	20	26
<i>Dioscorea alata</i>	Yam	30	32	29	30	42	42	36	38
<i>Dioscorea pyrifolia</i>	Yam	32	48	19	37	107	128	12	26
<i>Durio zibethinus</i>	Durian	7	8	8	9	0	5	6	9

Appendix 38 Number of PAs that contain high priority zone of ecogeographic representativeness for further ex situ collection with significant holdouts populations of priority CWR taxa in Indonesia

Taxon	Crop Genepool	Number of PAs contain high priority zone of ecogeographic representativeness with significant Holdouts population							
		RCP 4.5 - 2050		RCP 4.5 - 2080		RCP 8.5 - 2050		RCP 8.5 - 2080	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Ficus chartacea</i>	Fig	0	1	16	22	65	66	46	46
<i>Ficus fulva</i>	Fig	56	74	60	78	123	149	89	100
<i>Ficus grossularioides</i>	Fig	42	44	40	42	23	34	39	43
<i>Ficus hirta</i>	Fig	46	51	42	50	52	67	53	60
<i>Ficus oleifolia</i>	Fig	39	57	101	101	63	70	87	89
<i>Ficus padana</i>	Fig	21	28	5	16	7	17	23	32
<i>Ficus tricolor</i>	Fig	19	20	27	28	14	26	28	28
<i>Garcinia celebica</i>	Mangosteen	48	61	47	59	52	74	59	69
<i>Gnetum gnemon</i>	Gnetum	48	68	74	89	44	104	60	76
<i>Ipomoea aquatica</i>	Ipomoea	109	125	112	132	102	137	69	103
<i>Ipomoea littoralis</i>	Ipomoea	39	44	43	54	82	120	76	86
<i>Ipomoea obscura</i>	Ipomoea	85	94	74	84	166	167	62	71
<i>Ipomoea pes-caprae</i>	Ipomoea	54	85	68	101	68	136	83	110
<i>Mangifera griffithii</i>	Mangoes	22	30	28	37	58	82	11	16
<i>Mangifera laurina</i>	Mangoes	49	60	38	49	45	79	50	64
<i>Mangifera minor</i>	Mangoes	59	70	35	47	37	61	41	57
<i>Musa acuminata</i>	Banana	42	55	38	52	58	75	38	50
<i>Nephelium lappaceum</i>	Rambutan	111	136	83	112	110	131	84	120
<i>Oryza meyeriana</i>	Rice	32	38	30	40	14	32	51	64
<i>Oryza minuta</i>	Rice	68	78	114	124	45	97	79	87
<i>Oryza officinalis</i>	Rice	33	44	24	38	47	65	41	53
<i>Oryza rufipogon</i>	Rice	21	24	10	18	21	27	20	27
<i>Parkia speciosa</i>	Parkia	77	92	78	88	102	120	70	85
<i>Rubus fraxinifolius</i>	Raspberry	87	89	84	85	92	101	88	93

Appendix 38 Number of PAs that contain high priority zone of ecogeographic representativeness for further ex situ collection with significant holdouts populations of priority CWR taxa in Indonesia

Taxon	Crop Genepool	Number of PAs contain high priority zone of ecogeographic representativeness with significant Holdouts population							
		RCP 4.5 - 2050		RCP 4.5 - 2080		RCP 8.5 - 2050		RCP 8.5 - 2080	
		Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration	Unlimited	No Migration
<i>Rubus lineatus</i>	Raspberry	14	15	13	15	12	15	16	17
<i>Rubus niveus</i>	Raspberry	8	11	8	10	40	50	22	24
<i>Rubus rosifolius</i>	Raspberry	55	70	32	59	43	78	61	71
<i>Saccharum officinarum</i>	Sugarcane	10	16	11	16	7	16	12	17
<i>Saccharum spontaneum</i>	Sugarcane	83	103	73	91	90	113	75	95
<i>Solanum melongena</i>	Aubergine	55	68	50	59	61	70	43	55
<i>Sorghum nitidum</i>	Sorghum	115	135	142	157	162	187	160	171
<i>Sorghum propinquum</i>	Sorghum	28	47	35	59	83	115	96	111
<i>Vigna radiata</i>	Mungbean	29	53	27	50	36	65	16	31