

5. Results of the Gene-Ecological Zoning System in Cambodia

Based on the foregoing, brief descriptions are provided for 10 gene-ecological zones of Cambodia, including commentaries on the geographical, geological, climatic, and biological character of each region. The descriptions include a listing of high priority tree species that occur in each zone, and a summarization of species distributions across gene-ecozonal boundaries (Table 5). As earlier noted, the Cambodia Tree Seed Project aspires to record at least two unique seed sources for every priority species that is represented in a gene-ecological zone. Thus, the forementioned table also indicates which gene-ecological zones include only a single seed source for a specific species, so as to encourage the search for additional germplasm sites.

5.1 BIOLOGICAL AND GEOGRAPHICAL CHARACTER OF GENE ECOZONES

5.1.1 Coastal Cardamoms (A)

Geography: The Coastal Cardamom Gene-Ecological Zone comprises only 9% of Cambodia's land-cover, yet it represents one of the more distinctive and species-rich ecozones of Indochina. This zone stretches across the coastal piedmont and windward slopes of the Cardamom Mountains, and encompasses a series of discontinuous, but geologically related ranges, including the Kravanh Mountains, Kirirom Plateau and Elephant Mountains (Phnom Damrei). The southern boundary of this zone follows Cambodia's southern coastal zone from Koh Kong to Kampot, while the northern boundary is defined by high ridges and slopes that drain rainfall into the Gulf of Thailand (Maps 2, 3, 13). This zone is now gazetted for protection, owing primarily to high species diversity in the region. Nevertheless, the lower coastal foothills have suffered extensive degradation during the past two decades.

Determinant Environmental Factors: The Coastal Cardamom Gene Ecozone is delineated on the basis of its high-montane topography, high annual precipitation (2600-3800 mm, or more), and sandstone or sandy conglomerates. The region is colder than other regions of Cambodia, owing to the height of these mountains, various ridges and peaks of which reach from 1000-1700 m. These regions are lost in a mantle of dense cloud cover during most of the year, and are inhabited by vegetation that has yet to be characterized. The soils of this zone are very poor in retaining water and minerals, but abundant and continual precipitation in the region provides ample water for tall and dense, evergreen forests. The only other ecozone in Cambodia that compares in altitude is the Central Annamite ecozone (see below), but this massif is distinguished by its distinct substrates and a well-defined dry season.

Plant and Vegetative Characteristics: Important timber trees of the lowland Evergreen Forests include a diverse assemblage evergreen forest species, including members of the following genera: *Anisoptera*, *Calophyllum*, *Hopea*, *Lithocarpus*, *Palanquium*, *Pterospermum*, *Syzygium*, *Shorea* (Boyce, P., Eanghourt K., & Sophal M, 2002). These plant groups are replaced by a different assemblage of plants on the upper slopes of the mountains (>700 m), including species of *Castanopsis*, *Lithocarpus*, *Syzygium*, and *Tristania*. These elements characterize the wet-montane Evergreen Forests of the zone. The lowland forests of the Coastal Cardamom Mountain Ecozone once engendered some of the largest trees and forest canopies in Cambodia, but only residues of this productive habitat now exist due to clear-cutting practices. Although the coastal zones of the Cardamoms are now secondary, we are safe in assuming that they still conserve a variety of young 'priority trees' (see below). This region is likely to produce plants whose seeds, seedlings, and adult plants exhibit little resistance to drought.

Priority Species: *Afzelia xylocarpa* (Kurz) Craib., *Albizia lebbek* (L.) Benth. (one source), *Aquilaria crassna* Pierre, *Dalbergia cochinchinense* Pierre (one source), *Diospyros bejaudii* Lecompte (one source), *Dysoxylon louriei* Pierre, *Fagraea fragrans* Roxb., *Hopea odorata* Roxb., *Pinus merkusii* Jungh et de Vries, *Shorea cochinchinense* Pierre.

5.1.2 Northern Cardamoms (B)

Geography: The Northern Cardamom zone ranges across the leeward side of the Cardamom Mountains. The region is bordered to the North by the Tonle Sap Floodplain, and to the South the cloud-laden highlands of the Coastal Cardamom Ecozone. The eastern boundary is marked by the low alluvial plains of the Lower Mekong Floodplain Ecozone, where agricultural communities have removed all traces of its original woodlands. The Northern Cardamom Mountain Ecozone is slightly larger than the Coastal Cardamoms, covering around 12% of Cambodia's land surface.

Determinant Environmental Factors: The Northern Cardamom ecozone is distinguished from the Coastal Cardamoms on the basis of lower annual rainfall (800-1400 mm p.a.), and an extended dry season that often lasts for more than 4 months. A mixture of different soils can be found in this region, most notably Cretaceous sandstones. Nevertheless, a large granite outcrop dominates the highest and eastern-most reaches of the range (i.e., Mount Aural and environs). Like the coastal regions of the Cardamoms, the soils of the Northern Cardamoms are poor in retaining water and minerals.

Plant and Vegetative Characteristics: In response to drier climates and soils, the vegetation of the Northern Cardamoms is less robust and diverse than that of the coastal plains. Most forests are deciduous, and drop their foliage for over 4 months of the year. They produce timber trees of both primary and secondary quality, including species of *Anisoptera*, *Dipterocarpus*, *Ficus*, *Guttifera*, *Irvingia*, *Pahudia*, *Tetrameles*, and *Shorea* (Boyce, P., Eagnhourt K., & Sophal M, 2002).

Priority Species: *Afzelia xylocarpa* (Kurz) Craib., *Aquilaria crassna* Pierre, *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep. (one source), *Dalbergia cochinchinense* Pierre (one source), *Dalbergia oliveri* Gamble (one source), *Diospyros bejaudii* Lecompte, *Diospyros cruenata* Thwaites (one source), *Dysoxylon loureiri* Pierre (one source), *Fagraea fragrans* Roxb. (one source), *Gardenia angkorensis* Pit., *Hopea helferi* (Dyer Brandis), *Pinus merkusii* Jungh et de Vries, *Pterocarpus macrocarpus* Kurz, *Shorea cochinchinense* Pierre (one source).

5.1.3 Tonle Sap Floodplain (C)

Geography: The Tonle Sap floodplain includes the largest wetland habitat of Southeast Asia and extensive 'flooded forests.' Only vestiges of a once expansive semi-evergreen forest remain on the outer boundaries of contemporary floodplains (Maps 11, 12). Due to strict controls over the flooded forest of Tonle Sap Lake by fishery concessionaires, very few people inhabit the floodplain of this important body of water. As a consequence, vast flooded forests surround and sustain one of the world's most productive freshwater fisheries (McDonald et al. 1997). The boundaries of the Tonle Sap Floodplain ecozone extend from the northern base of the Cardamom Mountains to the southern boundary of the Northwestern and Central lowland zones. The region comprises about 11% of Cambodia's land surface.

Determinant Environmental Factors: Seasonal rains are a determinant environmental factor on the Tonle Sap Floodplain. The region receives only 800-2000 mm per year, this falls exclusively during the wet season. This water-source is negligible, however, to the vast amounts of water which pour into the region from the Mekong River. Rising Mekong River floodwaters wash over this central region of Cambodia on an annual basis, and thereby inundate a highly specialized forest that is adapted to seasonal floods. In the process, Tonle Sap Lake rises in depth by a factor of seven, and doubles its area by a factor of two. Extensive short-tree forests that surround the Tonle Sap Lake are submerged by floodwaters from 2-6 months a year. When this occurs, native trees drop their leaves, and suspend all growth until the lake-waters recede. As such, most woodlands of the Tonle Sap floodplain are deciduous forest, but of a type that is quite distinct from the lowland deciduous forest that dominate Cambodia. While most of Cambodia is flourishing due to the yearly onset of rains, the Tonle Sap floodplain goes dormant. And while most of Cambodia is suffering drought, the Tonle Sap floodplain is springing to life. Hence the phenology of the flooded forest is out of synchrony with other types of forests in Cambodia.

Although the productive nature of this region is governed primarily by annual floodwaters, most of the zone is also susceptible to *drought* for at least six months of each year. The soils of the Tonle Sap Floodplain gene-ecozone are distinctive from its mountainous southern boundaries, as they are covered by alluvial soils, the upper surface of which is obviously of relatively recent origin. These soils are relatively rich in nutrients, which accounts, albeit indirectly, for the substantial fish production of the region.

Plant and Vegetative Characteristics: This zone consists of high forests in the Battambang, Pailin and Pursat areas. However, considerable part of this zone is made up by the flooded vegetation of the Tonle Sap Floodplain and is represented by different types of forest. One observes a tall, riparian forest (or marsh-forest) along the minor tributaries and lower floodplain of Tonle Sap Lake. Timber trees in these regions are few in number (i.e., *Barringtonia*, *Coccoloba*, *Combretum*, and *Diospyros*; McDonald et al. 1997). On the other hand, the upper floodplain produces a thorn-forest of short stature, co-dominated by *Gmelina*, *Hymenocardia*, and *Vitex*. These trees are employed in the region as an energy source for smoking fish. Paradoxically, these flooded-forest plants are adapted primarily to dry conditions, as they are exposed to a combination of light and water for only two or three months of the year. Hence, the trees are small in stature (1-4 m tall), branch from the base, and tend to produce small leaves and thorns. These trees are employed in the region as an energy source for smoking fish, but various timber-trees of considerable significance to local communities are also present.

Priority Species: *Azadirachta xylocarpa* (Kurz) Craib.

5.1.4 Redlands (c)

Geography: The Redlands Gene-Ecozone can be interpreted as an eastern extension of the Tonle Sap Floodplain Ecozone. This region has a geological history that is more complex to the Tonle Sap floodplain, however, and lacks extensive aquatic habitats. The Redlands conserve only remnants of its original forests due to incursions of agricultural communities. The zone's northern borders are defined by the mountains and woodlands of the Central Lowland Ecozone, the Eastern Mekong Basin Ecozone, and Southern Annamite Ecozone. Its southern boundary is bordered by the Lower Mekong Floodplain, with which it shares many general landscape features (i.e., rice paddies!). It is distinguished, however, from the Lower Mekong Floodplain by virtue of its predominant igneous, fertile soils (Maps 8, 10). This gene-ecozone covers a mere 7% of Cambodia's land-cover, only minor portions of which still retain some forest cover.

Determinant Environmental Factors: The Redlands Ecozone is characterized generally by the interactions of three over-riding environmental factors: a monsoon climate, alluvial soils of the Mekong River, and relatively recent igneous flows that have transformed the chemical character of the soils. The region receives more water than other lowland regions of Cambodia (1400-2600 mm p.a.), which makes the region conducive to rice agriculture. The main characteristic that distinguishes this region, however, are igneous (basaltic) intrusions that render the soil more fertile, and therefore more desirable to agriculturalists. Still, about half of the region is covered with alluvia that also characterize the floodplains of the Mekong River (Map 7).

Plant and Vegetative Characteristics: Rice fields dominate this region of Cambodia. Although there are no detailed botanical descriptions of this zone in the literature, vestiges of once widespread forests in the eastern portion of the zone still exist.

Priority Species: *Diospyros bejaudii* Lecompte (one source), *Hopea helferi* (Dyer) Brandis (one source), *Hopea odorata* Roxb. (one source), *Pterocarpus macrocarpus* Kurz (one source), *Shorea cochinchinense* Pierre (one source).

5.1.5 Northwestern Lowlands (D)

Geography: Comprising about 11% of Cambodia's land-cover, the Northwestern Lowland Gene Ecozone forms part of an extensive lowland landscape that lies between the linear Dangrek Mountain chain on the northern frontiers of Cambodia, and the upper-most reaches of the Tonle Sap floodplain. The southwestern corner of this region generally follows the floodplain of Tonle Sap Lake, while the eastern boundary is demarcated (somewhat arbitrarily) by the Central Lowland Ecozone.

Determinant Environmental Factors: A defining factor that determines the boundaries of the Northwestern Lowlands is water availability. This region experiences a relatively long and intensive dry season, and therefore tends to engender slower-growing forests that are adapted to water stress. The region receives only 800-1400 mm of precipitation annually. Due, however, to the ancient alluvial soils that have settled in the basin, agricultural lands and forests coexist in this isolated region of Cambodia. Human populations have played a substantial role in this ecozone, as rice fields predominate in the southern regions of the zone.

Plant and Vegetative Characteristics: Lowland semi-evergreen forests in this region of Cambodia are dominated by *Irvingia*, *Mimosops*, *Pahudia*, *Pterocarpus*, *Shorea*, *Sindora*, and *Vitex*. Lowland deciduous forests are dominated by various *Diospyros*, *Dipterocarpus*, *Irvingia*, *Lagerstroemia*, *Pterocarpus*, and *Tetrameles* (Legris & Blasco, 1972; Rollet 1972).

Priority Species: *Azelia xylocarpa* (Kurz) Craib., *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep., *Dalbergia cochinchinense* Pierre, *Dalbergia oliveri* Gamble, *Diospyros bejaudii* Lecompte (one source), *Diospyros cruenata* Thwaites, *Gardenia angkorensis* Pit., *Hopea helferi* (Dyer) Brandis, *Hopea odorata* Roxb (one source).

5.1.6 Central Lowlands (d)

Geography: The Central Lowland Gene-Ecozone includes some of the most important timber production zones of Cambodia, and comprises the largest gene-Ecological zone (ca. 18%). This lowland basin provides a natural reservoir for waters that drain into the Tonle Sap and Mekong Rivers. A network of slow-moving rivers wind their way through the region and provide a steady

supply of water to semi-evergreen, deciduous, and marsh-forests. The northern boundary of this ecozone is defined by the narrow Dangrek Mountain-chain, while the eastern boundary of the zone is defined by the Mekong River. The southern border merges with the agricultural lands of the Redland gene ecozone. A poorly defined western border interfaces with the Northwestern Lowlands, the latter of which is distinguished primarily by its lower annual rainfalls and homogeneous soil types.

Determinant Environmental Factors: The tropical vegetation of the Central Lowlands is as complex as the distinctive water regimes (mostly 1400-2000 mm per year; Map 4) and soil types (Map 7, 8). Not unlike the Northwestern Ecozone, the Central Lowland Ecozone is covered primarily with fertile alluvial soils of various ages. Nevertheless, the heart of the region also includes substantial outcrops of sandstones and rhyolites (immediately S of Preah Vihear: Map 7). Numerous rivers that cut across the zone establish fertile riparian and floodplain habitats, and these tend to engender tall tropical forests that are very productive, and often classified as either evergreen or semi-evergreen vegetation. Unfortunately, forestry practices in this region have yet to prove sustainable.

Plant and Vegetative Characteristics: Lowland semi-evergreen forests in this region of Cambodia are dominated by *Irvingia*, *Mimosops*, *Pahudia*, *Pterocarpus*, *Shorea*, *Sindora*, and *Vitex*. Lowland deciduous forests are dominated by various *Diospyros*, *Dipterocarpus*, *Irvingia*, *Lagerstroemia*, *Pterocarpus*, and *Tetrameles* (Legris & Blasco, 1972; Rollet 1972).

Priority Species: *Albizia lebbek* (L.) Benth., *Azelia xylocarpa* (Kurz) Craib., *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep., *Cinnamomum cambodianum* Lecompte (one source), *Dalbergia cochinchinense* Pierre, *Dalbergia oliveri* Gamble, *Dasymaschalon lamentaceum* Finet et Gagnep. (one source), *Diospyros bejaudii* Lecompte, *Dysoxylon loureiri* Pierre, *Fagraea fragrans* Roxb., *Garcinia hanburyi* Hook. f., *Gardenia angkorensis* Pit., *Hopea helferi* (Dyer) Brandis, *Hopea odorata* Roxb., *Lasianthus kamputensis* Pierre ex Pit., *Pinus merkusii* Jungh et de Vries, *Pterocarpus macrocarpus* Kurz, *Shorea cochinchinense* Pierre.

5.1.7 Lower Mekong Floodplain (E)

Geography: The Lower Mekong Floodplain Gene-Ecozone covers about 10% of Cambodia's land-cover and is known primarily for its agricultural lands. Only small remnants of an ancient lowland forest can be found in the region today. Large human populations have settled here on account of the regions fertile alluvial soils and predictable sources of water for crops (i.e., the Mekong River). Natural and anthropogenic grasslands (mostly comprised of rice) stretch from Kampong Cham to the Mekong River Delta system of southern Vietnam.

Determinant Environmental Factors: The strong influence of seasonal droughts and the constant flow of the Mekong River define the general character of this gene-ecozone. Although the region only receives from 800-2000 mm annually, human inhabitants are often able to make good use of waters from the Mekong River. Even though the Mekong River does not begin to branch out until it crosses the Cambodia-Vietnam border, the river's meandering flow over geological time has endowed the Lower Mekong Floodplain with moderately fertile, alluvial soils. At this point in time, many parts of this ecozone exhibit the aspect of a desert during the dry season, owing to deforestation and the inability of people to irrigate their agricultural lands. Substantial annual rainfalls allow, however, for a reliable harvest of rice once a year.

Plant and Vegetative Characteristics: Rice paddies dominate this terrain, but rivers, lakes, and aquatic sinks serve as refugia for native riparian tree species and assorted grasses and sedges.

Priority Species: *Dalbergia oliveri* Gamble.

5.1.8 Eastern Mekong Basin (F)

Geography: The Eastern Mekong Basin Gene Ecozone forms a natural continuation of the Central Lowland Ecozone, but it can also be distinguished by its high annual rainfalls and unique substrates. This ecozone is defined by two important physiographic features of Cambodia and Vietnam, namely the Mekong River and the Annamite Mountains. Covering only 13% of Cambodia's land surface, the western boundary of the Eastern Mekong Basin is delimited by the Mekong River, the northern boundary by a westward extension of the Central Annamite Mountains, the southern boundary by a westward extension of the Southern Annamites, and the eastern boundary by the backbone of the Annamites in Vietnam. Indeed, eastern portions of this gene-ecozone encompass the foothills to this prominent mountain system. Like the Central Lowlands of Cambodia, this region has relatively low relief, and drains the water it receives toward the Mekong River by a complex system of slow-moving rivers. These waterways serve to distribute water throughout an otherwise seasonally dry region.

Determinant Environmental Factors: The region as a whole receives a considerable amount of monsoonal rains (2000-2600), but rains tend to operate on a rigid monsoonal calendar. As a result, the vegetation is leafless and dormant for over half the year, and often broken up by a patchwork of natural and anthropogenic grasslands. The western half of the zone is formed by alluvial soils that have been laid down by the Mekong River and its tributaries over the course of millions of years. The eastern-half is comprised primarily of shallow, sandstone and siltstone plateaus, which do not retain water. The strong seasonality of precipitation in this region, in concert with the dry-sandy soils, often engenders vegetation that is dominated locally by grasslands or woodland-savannahs, making the region unique not only in its vegetation but also animal life (i.e., substantial herds of grazers).

Plant and Vegetative Characteristics: Most of the forests of the Eastern Mekong Basin are deciduous, and important for the production of several luxury and primary timbers, such as *Dalbergia*, *Dipterocarpus*, *Pterocarpus*, and *Shorea*. Other co-dominant trees include *Iringia*, *Pentacme*, and *Terminalia* (Legris & Blasco, 1972; Rollet 1972).

Priority Species: *Dasymaschalon lamentaceum* Finet et Gagnep. (one source), *Diospyros cruenata* Thwaites (one source), *Pterocarpus macrocarpus* Kurz .

5.1.9. Central Annamites (G)

Geography: The Central Annamite Gene-Ecozone is defined by a western intrusion of the 'Kontum Massif.' This formation extends across the Central Annamites. The zone covers a mere 6% of Cambodia, but includes a very distinctive biological and cultural region of Cambodia. The ecozone is bordered on its North by Laos, to the East by Vietnam and the Annamite Mountains, and to the south by the East Mekong Basin Zone.

Determinant Environmental Factors: This ecozone is defined primarily by the distinct character of the Central Annamites. Cool temperatures prevail in higher altitudes (700-1500 m), and soils in the northern half of this region are comprised of gneisses, schists, and plutonic rhyolites. In contrast, the southern boundaries of the ecozone are characterized by basaltic flows. Substantial rains in the region (2000-2600 mm p.a.) account for its extensive forests. This range in precipitation probably exceeds the 2600 mm mark on a regional basis. These mountainous

regions of Cambodia are affected by monsoonal cycles, however, and operate on a schedule that differs considerably from that of the Cardamom Mountains of Southwest Cambodia. The rocky substrates of the northern regions are poor in mineral content, and therefore undesirable for agricultural purposes. The southern regions are formed, however, by relatively recent igneous activities, and are therefore fertile and productive for farmers. Hence human populations are much larger in these regions.

Plant and Vegetative Characteristics: There are no available reports on the character of the forests in this region of Cambodia. Suffice to say that most of the forest is evergreen or semi-evergreen, montane forest, and are undoubtedly dominated by the same plant genera that are found in the Central Annamites of Vietnam.

Priority Species: *Albizia lebbek* (L.) Benth., *Azelia xylocarpa* (Kurz) Craib., *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep. (one source), *Cinnamomum cambodianum* Lecompte, *Dalbergia cochinchinense* Pierre (one source), *Dalbergia oliveri* Gamble, *Dasymaschalon lamentaceum* Finet et Gagnep. (one source), *Diospyros cruenata* Thwaites, *Hopea helferi* (Dyer) Brandis (one source), *Pterocarpus macrocarpus* Kurz, *Shorea cochinchinense* Pierre, *Sterculia lyncophora* Hance.

5.1.10 Southern Annamites (g)

Geography: The Southern Annamite Ecozone is the smallest of all ecozones, covering only 3% of Cambodia. The zone is formed by a small mountain intrusion of Vietnam's Annamitic complex into the South-central corner of Cambodia. The region is bordered to the north by lowlands of the Eastern Mekong Basin, and to the South and East by the mountainous boundary of Vietnam.

Determinant Environmental Factors: Soil type and topography distinguish the Southern Annamite Gene Ecozone from others. Moderately high mountains (700-1000 m) are responsible for the cooler temperatures of this region, and substantial monsoonal rains that can amount to 2600 mm per year (Map 4). The region is also distinguished by large expanses of igneous rock that extend into the Southern Annamite Mountains of Vietnam.

Plant and Vegetative Characteristics: There are no existing descriptions of this region of Cambodia. Schmid's (1974: 66-70) vegetation studies on the basaltic regions of the southern Annamites are probably relevant here. Subdominant genera include *Dipterocarpus*, *Hopea*, *Lagerstroemia*, *Pometia*, *Pterospermum*, *Terminalia*, and *Tetrameles*.

Priority Species: *Aquilaria crassna* Pierre (one source), *Cananga latifolia* (Hook. F. & Thomson) Finet & Gagnep. (one source), *Dalbergia cochinchinense* Pierre (one source), *Dasymaschalon lamentaceum* Finet et Gagnep. (one source), *Diospyros bejaudii* Lecompte (one source), *Fagraea fragrans* Roxb., *Hopea helferi* (Dyer) Brandis (one source), *Hopea odorata* Roxb. (one source), *Pinus merkusii* Jungh et de Vries (one source), *Pterocarpus macrocarpus* Kurz (one source), *Shorea cochinchinense* Pierre (one source).

TABLE 5. Distribution of Priority Species in Gene Ecozones*

<i>Species</i>	<i>Gene-Ecological zones</i>										
	A	B	C	c	D	d	E	F	G	g	
<i>Afzelia xylocarpa</i>	X	X	X	X	X	X			X		
<i>Albizia lebbeck</i>	X					X			X		
<i>Aquilaria crassna</i>	X	X				X				X	
<i>Cananga latifolia</i>		X			X	X			X	X	
<i>Cinnamomum cambodianum</i>									X		
<i>Dalbergia cochinchinense</i>	X	X			X	X			X	X	
<i>Dalbergia oliveri</i>		X			X	X	X		X		
<i>Dasymaschalon lamentaceum</i>						X		X	X	X	
<i>Diospyros bejaudii</i>	X	X		X	X	X				X	
<i>Diospyros cruenata</i>		X			X			X	X		
<i>Dysoxylon loureiri</i>	X	X				X					
<i>Fagraea fragrans</i>	X	X				X				X	
<i>Garcinia hanburyi</i>						X					
<i>Gardenia angkorensis</i>		X			X	X					
<i>Hopea helferi</i>		X		X	X	X			X	X	
<i>Hopea odorata</i>	X			X	X	X				X	
<i>Lasianthus kamputensis</i>						X					
<i>Pinus merkusii</i>	X	X				X				X	
<i>Pterocarpus macrocarpus</i>		X		X		X		X	X	X	
<i>Shorea cochinchinense</i>	X	X		X		X			X	X	
<i>Sterculia lychnophora</i>									X		

* Dark 'X's denote a single seed source already established