APPENDIX A

Table A 1: Species mean across treatment of percent germination in the field (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
BS+f	5	230.5555556	46.11111111	1043.124143		
BS	5	212.037037	42.40740741	1192.301097		
COMPOST+F	5	194.4444444	38.88888889	948.6454047		
compost	5	219.4444444	43.88888889	1090.792181		
control	5	220.3703704	44.07407407	1628.343621		
Afzelia xylocarpa	5	440.7407407	88.14814815	32.75034294		
Schleichera oleosa	5	337.962963	67.59259259	52.72633745		
Eugenia cumini	5	127.7777778	25.55555556	78.27503429		
Gmelina arborea	5	140.7407407	28.14814815	91.99245542		
Ficus recemosa	5	29.62962963	5.925925926	5.401234568		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	144.2386831	4	36.05967078	0.640816637	0.641072259	3.006917
Columns	22712.48285	4	5678.120713	100.9059191	3.88461E-11	3.006917
Error	900.3429355	16	56.27143347			
Total	23757.06447	24				

Table A 2: Species mean across treatment of MLD's of species in the field (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Biosolids+fertilizer	5	202	40	670.91		
Biosolids	5	151.33	30	493.19		
Compost+fertilizer	5	146.33	29	86.52		
Compost	5	221.00	44	650.31		
Control	5	161.33	32	181.30		
avg	5	176.40	35	255.19		
Afzelia xylocarpa	6	111.2	19	6.337777778		
Schleichera oleosa	6	150.4	25	6.328888889		
Eugenia cumini	6	313.2	52	223.7155556		
Gmelina arborea	6	168.4	28	85.39555556		
Ficua recemosa	6	315.2	53	499.4044444		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	880.7733333	5	176.1546667	1.092385373	0.395004402	2.71089
Columns	6124.554667	4	1531.138667	9.495027947	0.000180089	2.866081
Error	3225.137778	20	161.2568889			
Total	10230.46578	29				

Table A 3: Species mean across treatment of Seedlings establishment in the field (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
BS+f	5	113.8888889	22.77778	398.0624		
BS	5	100	20	496.6564		
COMPOST+F	5	89.81481481	17.96296	302.8978		
compost	5	100	20	371.9136		
control	5	107.4074074	21.48148	587.8772		
Afzelia xylocarpa	5	225.9259259	45.18519	13.03155		
Schleichera oleosa	5	200	40	54.18381		
Eugenia cumini	5	45.37037037	9.074074	6.601509		
Gmelina arborea	5	20.37037037	4.074074	5.401235		
Ficus recemosa	5	19.44444444	3.888889	12.17421		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	65.36351166	4	16.34088	0.870916	0.502657	3.00691728
Columns	8329.423868	4	2082.356	110.9829	1.87E-11	3.00691728
Error	300.2057613	16	18.76286			
Total	8694.993141	24				

Table A 4: Treatment means across species of percent germination (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	5	440.7407407	88.14814815	32.75034294		
Schleichera oleosa	5	337.962963	67.59259259	52.72633745		
Eugenia cumini	5	127.7777778	25.55555556	78.27503429		
Gmelina arborea	5	140.7407407	28.14814815	91.99245542		
Ficus recemosa	5	29.62962963	5.925925926	5.401234568		
BS+f	5	230.5555556	46.11111111	1043.124143		
BS	5	212.037037	42.40740741	1192.301097		
COMPOST+F	5	194.4444444	38.88888889	948.6454047		
compost	5	219.4444444	43.88888889	1090.792181		
control	5	220.3703704	44.07407407	1628.343621		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	22712.48285	4	5678.120713	100.9059191	3.88461E-11	3.006917
Columns	144.2386831	4	36.05967078	0.640816637	0.641072259	3.006917
Error	900.3429355	16	56.27143347			
Total	23757.06447	24				

Table A 5: Treatment mean across species of MLD'S in the field (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	5	92.66666667	18.53333333	7.922222222		
Schleichera oleosa	5	125.3333333	25.06666667	7.911111111		
Eugenia cumini	5	261	52.2	279.6444444		
Gmelina arborea	5	140.3333333	28.06666667	106.7444444		
Ficua recemosa	5	262.6666667	52.53333333	624.2555556		
Biosolids+fertilizer	5	202	40.4	670.9111111		
Biosolids	5	151.3333333	30.26666667	493.1888889		
Compost+fertilizer	5	146.3333333	29.26666667	86.52222222		
Compost	5	221	44.2	650.3111111		
Control	5	161.3333333	32.26666667	181.3		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	5103.795556	4	1275.948889	6.330018631	0.002983	3.006917
Columns	880.7733333	4	220.1933333	1.092385373	0.393602	3.006917
Error	3225.137778	16	201.5711111			
Total	9209.706667	24				

.

Table A 6: Treatment mean across species of percent establishment in the field (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	5	225.9259	45.18518519	13.03155		
Schleichera oleosa	5	200	40	54.18381		
Eugenia cumini	5	45.37037	9.074074074	6.601509		
Gmelina arborea	5	20.37037	4.074074074	5.401235		
Ficus recemosa	5	19.44444	3.888888889	12.17421		
Biosolids+fertilizer	5	113.8889	22.77777778	398.0624		
Biosolids	5	100	20	496.6564		
COMPOST+fertilizer	5	89.81481	17.96296296	302.8978		
compost	5	100	20	371.9136		
control	5	107.4074	21.48148148	587.8772		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	8329.423868	4	2082.355967	110.9829	1.87E-11	3.006917
Columns	65.36351166	4	16.34087791	0.870916	0.502657	3.006917
Error	300.2057613	16	18.76286008			
Total	8694.993141	24				

Table A 7: Treatment mean across species of percent germination (ANOVA, P<0.05).

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	3	150	50	43		
Schleichera oleosa	3	29	9.666666667	1.333333		
Gmelina arborea	3	12	4	7		
Ficus recemosa	3	19	6.333333333	37.33333		
Irvingia malayana	3	134	44.66666667	70.33333		
Spondias pinnata	3	155	51.66666667	292.3333		
Adenenthera pavonina	3	43	14.33333333	100.3333		
Catunaregum spathulifolia	3	130	43.33333333	161.3333		
avg for treatment	3	672	224	1051		
Biosolids+mine soil	9	506	56.22222222	6024.694		
Compost+mine soil	9	460	51.11111111	4919.111		
Control(mine soil)	9	378	42	3357.75		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	111818.6667	8	13977.33333	86.2207	1.08E-11	2.591096
Columns	934.2222222	2	467.1111111	2.881426	0.085356	3.633723
Error	2593.777778	16	162.1111111			
Total	115346.6667	26				

Table A 8: Species mean across treatment of percent germination.

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Biosolids+mine soil	8	1175.613333	146.9516667	4672.360425		
Compost+mine soil	8	1209.68	151.21	4309.754975		
Control(mine soil)	8	1180.448333	147.5560417	4893.449452		
	8	1188.580556	148.5725694	4609.470803		
Afzelia xylocarpa	4	154.1511111	38.53777778	25.81238765		
Spondias pinnata	4	732.7977778	183.1994444	2.113411728		
Irvingia malayana	4	749.6666667	187.4166667	1.023888889		
Catunaregum spathulifolia	4	777.2666667	194.3166667	19.365		
Adenenthera pavonina	4	156.44	39.11	66.01886667		
Schleichera oleosa	4	720	180	0		
Gmelina arborea	4	720	180	0		
Ficus recemosa	4	744	186	24		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	84.93355579	3	28.31118526	1.801254576	0.177843508	3.072467001
Columns	129065.1825	7	18437.88321	1173.081282	9.22205E-26	2.487577704
Error	330.067109	21	15.71748138			
Total	129480.1831	31				

Table A 9: Treatment mean across species of percent mortality.

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	3	150	50	43		
Schleichera oleosa	3	29	9.666666667	1.333333		
Gmelina arborea	3	12	4	7		
Ficus recemosa	3	19	6.333333333	37.33333		
Irvingia malayana	3	134	44.66666667	70.33333		
Spondias pinnata	3	155	51.66666667	292.3333		
Adenenthera pavonina	3	43	14.33333333	100.3333		
Catunaregum spathulifolia	3	130	43.33333333	161.3333		
avg for treatment	3	672	224	1051		
Biosolids+mine soil	9	506	56.22222222	6024.694		
Compost+mine soil	9	460	51.11111111	4919.111		
Control(mine soil)	9	378	42	3357.75		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	111818.6667	8	13977.33333	86.2207	1.08E-11	2.591096
Columns	934.2222222	2	467.1111111	2.881426	0.085356	3.633723
Error	2593.777778	16	162.1111111			
Total	115346.6667	26				

Table A-10: On average species mean across Treatment of percent mortality**.**

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Biosolids+fertilizer	5	250.5087309	50.10174618	985.349252		
Biosolids	5	303.9384971	60.78769942	369.1068522		
Compost+fertilizer	5	266.6496394	53.32992788	1102.364949		
Compost	5	310.9027214	62.18054429	232.6592328		
Control	5	331.8930928	66.37861856	755.7438364		
Afzelia xylocarpa	5	243.0463171	48.60926342	22.81503574		
Schleichera oleosa	5	287.0963646	57.41927292	169.2523625		
Eugenia cumini	5	306.0885734	61.21771467	216.4912242		
Gmelina arborea	5	417.6614266	83.53228532	182.7492452		
Ficus recemosa	5	210	42	1820		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	890.4870095	4	222.6217524	0.406859167	0.801021865	3.0069173
Columns	5026.152029	4	1256.538007	2.296424322	0.103935711	3.0069173
Error	8754.744461	16	547.1715288			
Total	14671.3835	24				

Table A-11: On average Treatment mean across species of percent mortality**.**

Anova: Two-Factor Without Replication						
SUMMARY	*Count*	*Sum*	*Average*	*Variance*		
Afzelia xylocarpa	5	243.0463171	48.60926342	22.81503574		
Schleichera oleosa	5	287.0963646	57.41927292	169.2523625		
Eugenia cumini	5	306.0885734	61.21771467	216.4912242		
Gmelina arborea	5	417.6614266	83.53228532	182.7492452		
Ficus recemosa	5	210	42	1820		
Biosolids+fertilizer	5	250.5087309	50.10174618	985.349252		
Biosolids	5	303.9384971	60.78769942	369.1068522		
Compost+fertilizer	5	266.6496394	53.32992788	1102.364949		
Compost	5	310.9027214	62.18054429	232.6592328		
Control	5	331.8930928	66.37861856	755.7438364		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	5026.152029	4	1256.538007	2.296424322	0.103935711	3.006917
Columns	890.4870095	4	222.6217524	0.406859167	0.801021865	3.006917
Error	8754.744461	16	547.1715288			
Total	14671.3835	24				

APPENDIX B

Table B 1: **Soil report of the field. (Analyzed by Chiang mai University agricultural faculty)**

Chwmical properties and Unit	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
pH 1:1	7.87	6.97	8.22	8.27	8.18	8.18
OM%	0.25	0.25	0.11	0.23	0.23	0.12
Total N(mg/kg)	130	130	60	150	150	60
Organic carbon(%)	0.15	0.15	0.06	0.13	0.13	0.07
Available P(mg/kg)	66.64	45.84	17.59	64.61	81.19	15.7
Extractable Nitrate NO3	7.54	5.45	6.36	5.71	7.96	6.59
Exchangeable K(mg/kg)	91.43	73.14	121.9	101.59	150.35	121.9
Exchangeable Ca(mg/kg)	1382.35	2617.65	1911.76	1852.94	2205.88	1088.24
Exchangeable Mg (mg/kg)	760.38	715.65	581.47	728.43	683.71	453.67
Available Iron, Fe (mg/kg)	42.91	56.92	77.93	49.91	56.92	49.91
Available Manganese, Mn (mg/kg)	0.44	2.84	1.57	1.71	0.44	0.65
Available Zinc, Zn (mg/kg)	0.43	0.5	0.43	0.99	0.72	0.92
Available Copper, Cu (mg/kg)	0.74	0.5	0.17	0.74	0.41	0.58
Soil moisture content(%)	7.24	7.62	7.55	6.94	8.5	6.75
Texture class	Sandy loam	Sandy clay loam	Sandy loam	Clay loam	Clay loam	Sandy Clay loam

- Total-N (Bremner &Mulvaney,1982).
- Available-P (Olsen& Sommers, 1982).
- Others chemical properties-Siwasil,1984.

Table B 2: Details of the soil texture (six soil samples used).

No.	% Sand	% Slit	% Clay	Texture Class
1	64	22	14	Sandy loam
2	50	26	24	Sandy clay loam
3	66	20	14	Sandy loam
4	38	34	28	Clay loam
5	38	30	32	Clay loam
6	48	30	22	Sandy clay loam

Table B 3: Solutions to the specific types of problems.

Category	Exposure path way	interaction	Solution
1.Low pH : Alkalinity	Anion solubility and metal micronutrient availability	High pH = more toxic High pH = >8	Add acid equivalent
3.Nutrient Deficiencies and Low Fertility			
3.1High Calcium-to-Magnesium Ratio (Ca:Mg)	Induced Mg deficiency in plants; Can reduce growth or kill plants	Very strong acidity causes loss of exchangeable cation (Ca, K, Mg), which makes Mg deficiency more likely; Addition of only calcite limestone to acidic site can more easily induce Mg deficiency. Dolomite or Mg-containing calcite lime stones do not cause this	Add Mg
High C:N 1 ratio	Limits nitrate availability to plant/ limit plant growth	NA	Add n or high-N soil amendments e.g.; biosolids

Table B 3: (continue)

category	Exposure path way	interaction	Solution
High P	Runoff of soluble P or movement of soil particles to water can cause eutrophication; Limits Pb bioavailability; Reduces Cu, Cd, Ni, Zn Phyto availability; Supports legumes	Increases As availability High P is a concern in cases of As contamination. Since P and As are chemically related, high P increases As availability. Tests, including water soluble P and Fe strip P, are available to determine P status in cases where high P is suspected. For more information, see http://www.sera17.ext.vt.edu.	Add Ca to alkaline soils to bind P; Drinking Water Residuals may be an effective source of Al or Fe for this purpose
Low Nitrogen (N)	Limits growth	High C:N 1 ratio = low N availability	Add N and/or high-nitrogen OM
Manganese (Mn)	Limits growth	NA	Add Mn or lower pH to less than 6.0

APPENDIX C

Deciduous, Seasonal, Hardwood + Bamboo Forest

Most of the herbaceous ground flora is deciduous and becomes very combustible when fires are started by villagers. *Barleria cristata* L. (Acanthaceae), Sauropus *quadrangularis* (Willd.) M.A. (Euphorbiaceae), and *Munronia humilis*(Blanco) Harms (Meliaceae) are some common dicots. Monocots are abundant and diverse with *Zingiber smilesianum* Craib (Zingiberaceae), *Oryza meyeriana* (Zoll. & Mor.) Baill. var. *granulata*, (Watt) Duist. and *Cyrtococcum accrescens* (Trin.) Stapf (both Gramineae), *Selaginella ostenfeldii* Hier. (Selaginellaceae), and *Tectaria impressa* (Fee) Holtt. (Dryopteridaceae)—an evergreen fern.

Vines are mostly deciduous with *Cyclea varians* Craib (Menispermaceae), *Paederia pallida* Craib (Rubiaceae), both dicots, the monocot *Stemona kerrii* Craib (Stemonaceae), and the pteridophyte *Lygodium flexuosum* (L.) Sw. (Schizaeaceae). Seedling and coppices are also abundant along with occasional bryophytes.

Ellipeliopsis cherrevensis (Pierre *ex* Fin. & Gagnep.) R.E.Fr.(Annonaceae),a shrub, and *Grewia hirsuta* Vahl (Tiliaceae), a shrub or treelet, are common and both deciduous. Gramineae, Bambusoideae (bamboos) are abundant with *Thyrsostachys siamensis* (Kurz *ex* Munro) Gamb. And *Dendrocalamus membranaceu*s Munro (Figures 3 and 4). *Bambusa bambos* (L.) Voss. *ex* Vilm. is less common and is found in disturbed places. *Dendrocalamus nudus* Pilg. (Thai = pie rai and the namesake of Mawn Pie Rai (hill) was not found. Scandent plants are conspicuous with *Calycopteris floribunda* (Roxb.) Lmk. (Combretaceae), *Harrisonia perforata* (Blanco) Merr. (Simaroubaceae, Figure 5), with wicked spines on older parts, and *Hymenopyramis cana* Craib (Verbenaceae)—all of which are deciduous. All woody climbers are deciduous and are represented with *Acacia concinna* (Willd.) DC. (Leguminosae, Mimosoideae), *Bauhinia bracteata* (Grah. *ex* Bth.) Bak. and *Pterolobium macroca*rpum Kurz (both Leguminosae, Caesalpinioideae), *Congea tomentosa* Roxb. var. *tomentosa*

(Verbenaceae), *Cissus repens* Lmk. (Vitaceae), and *Anomianthus dulcis* (Dun.) Sincl. (Annonaceae).

Trees have been extensively harvested to the extent that individuals over 15m tall and with a dbh of more than 50 cm are rare. Most species are deciduous, but *Irvingia malayana* Oliv. *ex* Benn. is evergreen. Some of the more common deciduous trees are *Adenanthera microsperma* Teijsm. & Binn. and *Xylia xylocarpa* (Roxb.) Taub. var. *kerrii* (Craib & Hutch.) Niels. (both Leguminosae, Mimosoideae), *Millettia xylocarpa* Miq. and *Pterocarpus macrocarpus* Kurz (both Leguminosae, Papilionoideae; Figure 6), *Mitragyna rotundifolia* (Roxb.) 0.K. (Rubiaceae), *Canariam subulatum* Guill. (Burseraceae); *Tectona grandis* L. f. (teak, Figure 3) and *Vitex limoniifolia* Wall. *ex* Kurz (both Verbenaceae), and *Lagerstroemia cochinchinensis* Pierre var. *ovalifolia* Furt. & Mont. (Lythraceae). Some unco- mon deciduous trees are *Anogeissus acuminata* (Roxb. *ex* DC.) Guill.& Perr. (Combretaceae), *Sindora siamensis* Teijsm. *ex* Miq. var. *siamensis* (Leguminosae, Cesapinioideae), and *Barringtonia acutangula* (L.) Gaertn. (Lecythidaceae). *Meliantha suavis* Pierre ssp. *suavis* (Opiliaceae), *Murraya koenigii* (L.) Spreng. and *Naringi crenulata* (Roxb.) Nicol. (both Rutaceae) are rare trees. *Colona winitii* (Craib) Craib (Tiliaceae) and *Croton roxburghii* Balak. (Euphorbiaceae), both deciduous trees, grow in disturbed places in bb-df.

Deciduous Dipterocarp-Oak, Seasonal, Hardwood Forest

This kind of forest is named after the dominant deciduous tree species in Dipterocarpaceae and Fagaceae (oaks) which are found in this habitat. The oak component is very poorly represented with only occasional individuals of *Quercus kerrii* Craib. This is due to selective, excessive, and rampant extirpation of this tree by villagers because it has several important uses, mainly the wood. In general, the trees found in bb-df and dof differ, the latter facies also lacking bamboos. Because of human disturbance there are many places on both hills where the two forest types merge and become mixed, but in most instances the distinctions are obvious because of the vegetation. I suspect that the soil quality differs in these two forest facies, dof being more degraded and rocky than bb-df (Figure 7).

As in bb-df the vegetation is diverse, mostly deciduous, and includes similar plant habits. Annual herbs, most conspicuous during the rainy season (May-October), include *Blumea lacera*(Burm. f.) DC. (Compositae), *Polycarpaea corymbosa* (L.) Lmk. (Caryophyllaceae), and *Andrographis laxiflora* (Bl.) Lindau (Acanthaceae). Dediduous herbs are more diverse with *Uraria lagopodioides* (L.) Desf. *ex* DC. (Leguminosae, Papilionoideae), *Vernonia sutepensis* Kerr (Compositae), *Dipteracanthus repens* (L.) Hassk. and *Lepidagathis similis* Im.(both Acanthaceae)—which are all dicots. Monocarp examples are *Curcuma plicata* Wall. *ex* Bak., *Globba nuda* K. Lar. and *G. reflexa* Craib (all Zingiberaceae), and *Arundinella setosa* Trin. var. *setosa* (Gramineae). Pteridophytes are common with *Selaginella ostenfeldii* Hier. (Selaginellaceae), *Adianturn philippense* L. and *A.zollingeri* Mett. *ex* Kuhn (Parkeriaceae). *Eupatorium odoratum* L. (Compositae), a naturalised deciduous herb from tropical America,has become established in very disturbed places, *i.e.* clearings and severely burned areas.

Vines are mostly deciduous dicots, *viz.* *Cyclea varians* Craib (Menispermaceae),*Dunbaria bella* Prain (Leguminosae, Papilionoideae), *Raphistemma pulchellum* (Roxb.) Wall. and *Streptocaulon juventas* (Lour.) Merr. (both Asclepiadaceae), *Thunbergia similis* Craib (Acanthaceae); *Aristolochia kerrii* Craib, *A. pierrei* Lec., and *A. pothieri* Pierre *ex* Lec. (Aristolochiaceae), and *Argyreia siamensis* (Craib) Stap. (Convolvulaceae). *Dioscorea arachnida* Pr. & Burk., *D. glabra* Roxb. (Dioscoreaceae), and *Smilax verticalis* Gagnep. (Smilacaceae) are some monocot counterparts. *Rhaphidophora peepla* (Roxb.) Schott (Araceae), a robust, deciduous, succulent creeper up tree trunks, produces spreading branches in tree crowns. Shrubs are plentiful and mostly deciduous. Some common examples are *Ellipeliopsis cherrevensis* (Pierre *ex* Fin. & Gagnep.) R.E.Fr. (Annonaceae), *Grewia sessilifolia* Gagnep. (Tiliaceae); *Tephrosia kerrii* Drumm. & Craib, *Indigofera cassioides* Rottl. *ex* DC., and *Desmodium lanceolatum* (Dunn) Schindl. *ex* Gagnep. var. *microcarpa* Oha. (all Leguminosae, Papilionoideae). *Ixora butterwickii* Hole (Rubiaceae) is evergreen.

Treelets, often appearing as shrubs by coppicing after being cut or burned, are common and include *Desmodium pulchellum* (L.) Bth., *D. oblon*gum Wall. *ex* Bth., and *D. velutinum* (Willd.) DC. ssp. *velutinum* var. *velutinum*

(Leguminosae,Papilionoideae). Woody climbers are also present with common examples of *Spatholobus parviflorus* (Roxb.) O.K. (Leguminosae, Papilionoideae), *Aphineuron marginatum* (Roxb.) Mabb. (Apocynaceae), and *Cissus repens* Lmk. (Vitaceae)—all deciduous. *Cansjera rheedii* Gmel. (Opiliaceae) is evergreen.

The majority of trees in dof are deciduous. Dominant species are Dipterocarpaceae with *Dipterocarpus obtusifolius* Teijsm. *ex* Miq. var. *obtusifolius, Shorea obtusa* Wall. *ex* Bl.(Figure 8), and *S. siamensis* Miq. var. *siamensis*. *Dipterocaprus tuberculatus* Roxb. var.*tubercu1atus* (Dipterocarpaceae), *Terminalia alata* Hey. *ex* Roth (Combretaceae), *Gardenia sootepenais* Hutch. and *Mitragyna rotundifolia* (Roxb.) O.K.(both Rubiaceae), *Gluta usitata* (Wall.) Hou and *Buchanania lanzan* Spreng. (both Anacardiaceae) , *Dalbergia cult*rata Grah. *ex* Bth. and *D. oliveri* Gamb. *ex* Prain (Leguminosae, Papilionoideae), *Adenanthera microsperma* Teijsm. & Binn. (Leguminosae, Mimosoideae), *Phyllanthus emblica* L. and *Aporosa vi11osa* (Wall. *ex* Lindl.) Baill. (both Euphorbiaceae), and *Ficus virens* Ait. (Moraceae), which is initially epiphytic. *Irvingia malayana* Oliv. *ex* Benn. (Irvingiaceae) and *Mammea siamensis* (Miq.) T. And. (Guttiferae) are evergreen. *Melecylon scutellatum* (Lour.)Hk.& Arn. (Melastomataceae) is an evergreen shrub, treelet or understorey tree in open, very disturbed places (Figure 9). *Quercus kerrii* Craib (Fagaceae), *Pterocarpus macrocarpus* Kurz (Leguminosae, Papilionoideae) and *Melientha suavis* Pierre ssp. *suavis* (Opiliaceae) are rare because of unsustainable exploitation by villagers. As *in* bb-df the ground flora has many immature or damaged woody plants, mostly coppicing trees, and fewer seedlings which are killed or burned by fire(Figure 7).

Secondary Growth (sg)

Vegetation which has been severely disturbed by fire logging, or clearing does not initially recover to its original composition (Figure 10). Secondary growth is replacement vegetation which can eventually be succeeded by more permanent, climax vegetation. Tree indicators of this kind of facies are *Colona winitii* (Craib) Craib and *Grewia eriocarpa* Juss. (both Tiliaceae), *Croton roxburghii* Balak. (Euphorbiaceae),

and *Oroxylum indicum* (L.) Bth. *ex* Kurz (Bignoniaceae). These species are also found in bb-df and dof, especially in places wrhere there has been extensive logging.

Weeds

Cleared areas, such as roadsides and mine rubble dumping sites, are initially invaded by herbaceous growth, *i.e.* weeds, which often develop into secondary growth (Figure). Annual dicot weeds are plentiful with *Amaranthus viridis* L. (Amaranthaceae), *Tridax procumbens* L. and *Blumea fistulosa* (Roxb.) Kurz (both Compositae) *Euphorbia hirta* L., *Phyllanthus amarus* Schum. & Thonn. and *P. urinaria* L. (all Euphorbiaceae). Perennial representatives are *Eupatorium odoratum* L. (Compositae); *Mimosa pigra* L., which becomes a treelet, and *M. pudica* L. (Leguminosae, Mimosoideae), all from tropical America; *Alysicarpus vaginalis* (L.) DC. and *Stylosanthes humills* Kunth (both Leguminosae, Papilionoideae, the latter native to tropical America), and *Alernanthera sessilis* (L.) DC. var. *sessilis* (Amaranthaceae).

Vines and creppers in disturbed places include *Macroptilium atropurpureum* (DC.) Urb.(from tropical America), *Vigna dalzelliana* (O.K.) Verdc. var. *dalzelliana*, *Cajanus scarabaeoides* (L.) P.T. var. *scarabaeoides* and *C. volubilis* (Blanco) Blanco (all Leguminosae, Papilionoideae). Monocot weeds include many Gramineae (grasses) with *Chloris barbata* Sw. , *Dichanthium caricosum* (L.) A. Camus, *Eriochloa procera* (Retz.) Hubb., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., and *Pennisetum polystachyon* (L.) Schult..

Roadside Trees

Some of the dirt roadsides have been successfully planted, at least in some places, with *Casuarina equisetifolia* L.(Casuarinaceae), a seaside tree; *Eucalyptus camadulensis* Dehn. (Myrtaceae), from Australia; *Pithecellobium dulce* (Roxb.) Bth., *Leucaena leucocephala* (Lmk.) De Wit, and *Samanea saman* (Jacq.) Merr.(all Leguminosae, Mimosoideae and native to tropical America), *Acacia mangium* willd. (Leguminosae, Mimosoideae; from east Malesia-Australia), and *Azadirachta indica* A. Juss.(Meliaceae), a native deciduous tree. Some of these trees have had mine rubble

dumped on or near them and still seem to be healthy. More observations of these trees are needed since they may be suitable for reforestation in the area.

CURRICULAM VITAE

Name Ms. Farzana Hossain

Date of Birth 13th July 1987

Educational Background

B. Sc. (Zoology), Chittagong University, Chittagong, Bangladesh. Duration: 2004-2008.

M.Sc.in Environmental Science, Chiang Mai University,

Chiang Mai, Thailand.

Duration: 2011-present.

Scholarship

From Elephant Nature Park got sponsorship to continue

M.Sc. in Thailand.