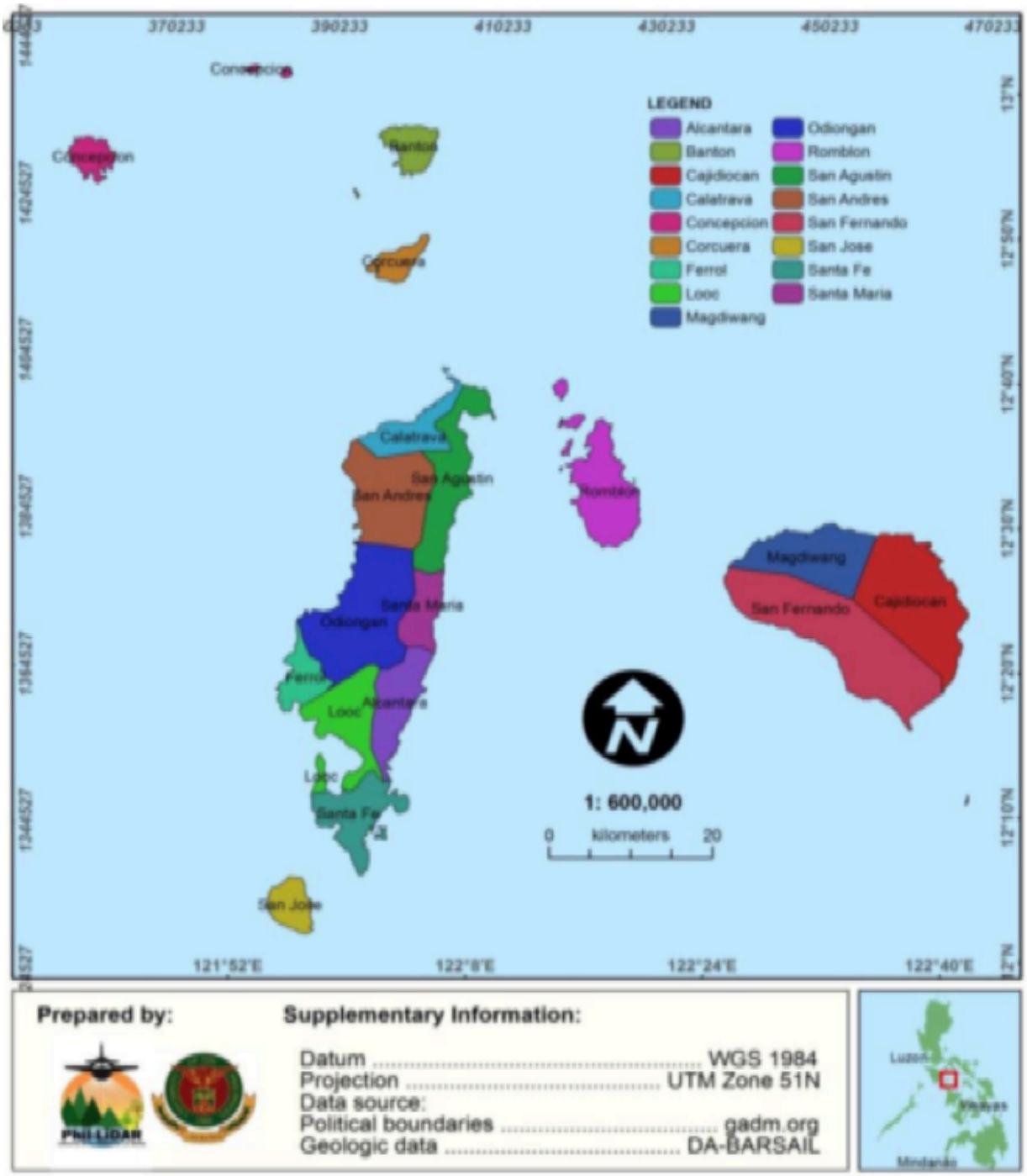
Appendices

Appendix A. Location Map of Romblon



Appendix B. Coastal Barangays of Romblon

MUNICIPALITY	COASTAL BARANGAYS OF ROMBLON
Alcantara (9 out of 12)	Bonlao; Calagonsao; Comod-om; Gui-ob; Lawan; Poblacion; San Isidro; San Roque; Tugdan
Banton (16 out of 17)	Balogo; Banice; Hambian; Lagang; Libtong; Mainit; Nabalay; Nasunogan; Poblacion; Sibay; Toctoc; Togong; Togbongan; Tumalum; Tungonan; Yabawon
Cajidocan (11 out of 14)	Alibagon; Cambajao; Cambijang; Cantagda; Cambalo; Danao; Gutivan; Poblacion; Marigondon; Sugod; Taguilos
Calatrava (6 out of 7)	Balogo; Linao; Pangulo; Poblacion; San Roque; Talisay
Concepcion (9 out of 9)	Bachawan; Calabasahan; Dalahican; Masadya; Masudsud; Poblacion; Sampong; San Pedro; San Vicente
Corcuera (11 out of15)	Alegria; Ambulong; Colong-colong; Ilijan; Labnig; Mabini; Mahaba; Mangansag; Poblacion; San Roque; Tacasan
Ferrol (5 out of 6)	Bunsoran; HInag-uman; Agnocnoc; Poblacion; Tubigon
Looc (10 out of 12)	Agojo; Balatucan; Buenavista; Camandag; Guinhayaan; Manhac; Pili; Poblacion; Punta; Tuguis
Magdiwang (7 out of 9)	Agsao; Agutay; Ambulong; Ipil; Poblacion; Silum; Tampayan
Odiongan (11 out of 25)	Batiano; Budiong; Canduyong; Dapawan; Gabawan; Libertad; Ligaya; Panique; Poctoy; Tabing-Dagat; Tumingad
Romblon (25 out of 31)	Agbudia, Agnaga; Agnay; Agnipa; Agpanabat; Agtongo; Alad; Bagacay; Cajimos; Calabogo; Capaclan; Cobrador; Ginablan; Guimpingan; Lamao; Li-o; Logbon; Lonos; Lunas; Mapola; Palje; Poblacion I; Poblacion II; Sablayan; Sawang
San Agustin (15 out of 15)	Bachawan; Binonga-an; Buli; Cabulutan; Cagboaya; Camantaya; Carmen; Cawayan; Doña Juan; Dubduba; Lusong; Hinugusan; Mahabang Baybay; Poblacion; Sugod
San Andres (7 out of 13)	Agpudlos; Calunacon; Linawan; Mabini; Matutuna; Poblacion; Tan-agan
San Fernando (12 out of 12)	Agtiwa; Mabini; Mabulo; España; Taclobo; Pili; Poblacion; Panangcalan; Camapingo; Azagra; Otod; Canjalon
Santa Fe (9 out of 11)	Agmanic; Canyayo; Guintigbasan; Guinbirayan; Mat-l; Magsaysay; Pandan; Poblacion; Tabugon
San Jose (4 out of 5)	Busay; Lanas; Pinamihagan; Poblacion
Sta Maria (5 out of 6)	Bonga, Concepcion Norte; Concepcion Sur; Paroyhog; Sto Niño

Appendix C. Coastal Areas of Palawan

LIST OF COASTAL BARANGAYS IN THE PROVICE OF PALAWAN			
BARANGAY NAME	MUNICIPALITY	BARANGAY NAME	MUNICIPALITY
Apo-aporawan	Aborlan	Malihud	Bataraza
Aporawan	Aborlan	Malitub	Bataraza
Culandanum (AB)	Aborlan	Marangas	Bataraza
Isaub	Aborlan	Puring	Bataraza
Ramon Magsaysay	Aborlan	Rio Tuba	Bataraza
San Juan (AB)	Aborlan	Sapa	Bataraza
Tagpait	Aborlan	Sarong	Bataraza
Tigman	Aborlan	Sumbiling	Bataraza
		Tabud	Bataraza
Balogo	Araceli	Tagnato	Bataraza
Dagman	Araceli	Tagolango	Bataraza
Dalayawon	Araceli	Taratak	Bataraza
Madoldolon	Araceli	Tarusan	Bataraza
Mauringuen	Araceli		
Osme±a (AC)	Araceli	Barong-barong	Brooke's Point
Poblacion (AC)	Araceli	Calasaguen (BP)	Brooke's Point
San Jose De Oro	Araceli	Ipilan (BP)	Brooke's Point
Sto. Ni±o (AC)	Araceli	Maasin (BP)	Brooke's Point
Taloto	Araceli	Malis	Brooke's Point
Tinintinan	Araceli	Mambalot	Brooke's Point
Tudela	Araceli	Oring-oring	Brooke's Point
		Pangobilian	Brooke's Point
Agutayan	Balabac	Poblacion I (BP)	Brooke's Point
Bancalaan	Balabac	Poblacion II (BP)	Brooke's Point
Bugsuk	Balabac	Salogon	Brooke's Point
Catagupan	Balabac	Samare±ana	Brooke's Point
Indalawan	Balabac	Saraza	Brooke's Point
Malaking ilog	Balabac	Tubtub	Brooke's Point
Mangsee	Balabac		
Melville	Balabac	Bogtong	Busuanga
Pandanan	Balabac	Buluang	Busuanga
Pasig	Balabac	Cheey	Busuanga
Poblacion I (BC)	Balabac	Concepcion (BG)	Busuanga
Poblacion II (BC)	Balabac	Maglalambay	Busuanga
Poblacion III	Balabac	New Busuanga	Busuanga
Rabor	Balabac	New Quezon	Busuanga
Ramos	Balabac	Old Busuanga	Busuanga
Salang	Balabac	Panlaitan	Busuanga
Sebaring	Balabac	Sagrada	Busuanga
		Salvacion (BG)	Busuanga
Bono-bono	Bataraza	San Isidro (BG)	Busuanga
Bulalacao (BZ)	Bataraza	San Rafael (BG)	Busuanga
Buliluyan	Bataraza	Santo Ni±o (BG)	Busuanga
Igang-igang	Bataraza		
Inogbong	Bataraza		

Appendix C continued...

Nusa	Cagayancillo	Jardin	Culion
Mampio	Cagayancillo	Libis	Culion
Santa Cruz (CG)	Cagayancillo	Libis	Culion
Talaga	Cagayancillo	Luac	Culion
Tacas	Cagayancillo	Luac	Culion
Calsada	Cagayancillo	Malaking Patag	Culion
Bantayan	Cagayancillo	Osme±a	Culion
Convento	Cagayancillo	Tiza	Culion
Magsaysay (CG)	Cagayancillo		
Lipot North	Cagayancillo	Balading	Cuyo
Lipot South	Cagayancillo	Bancal	Cuyo
Wahig	Cagayancillo	Cabigsing	Cuyo
Calsada	Cagayancillo	Caburian	Cuyo
Bantayan	Cagayancillo	Caponayan	Cuyo
		Catadman	Cuyo
Banuang Daan	Coron	Funda	Cuyo
Barangay I (CR)	Coron	Lagaoriao	Cuyo
Barangay II (CR)	Coron	Lubid	Cuyo
Barangay III (CR)	Coron	Lungsod	Cuyo
Barangay IV (CR)	Coron	Manamoc	Cuyo
Barangay V (CR)	Coron	Maringian	Cuyo
Barangay VI (CR)	Coron	Pawa	Cuyo
Bintuan	Coron	San Carlos	Cuyo
Borac	Coron	Suba	Cuyo
Buenavista (CR)	Coron	Tenga-tenga	Cuyo
Bulalacao	Coron	Tocadan	Cuyo
Cabugao	Coron		
Decabobo	Coron	Bacao	Dumaran
Decalachao	Coron	Bohol	Dumaran
Guadalupe	Coron	Calasag	Dumaran
Lajala	Coron	Capayas	Dumaran
Malawig	Coron	Catep	Dumaran
Marcilla	Coron	Culasian (DM)	Dumaran
San Jose (CR)	Coron	Danleg	Dumaran
San Nicolas (CR)	Coron	Ilian	Dumaran
Tagumpay (CR)	Coron	Latungay	Dumaran
Tara	Coron	Magsaysay (DM)	Dumaran
Turda	Coron	Poblacion (DM)	Dumaran
YKR	Coron	Poblacion (DM)	Dumaran
		San Juan (DM)	Dumaran
Balala	Culion	Santa Teresita	Dumaran
Baldat	Culion	Santo Tomas (DM)	Dumaran
Binudac	Culion		
Burabod	Culion	Aberawan	El Nido
Carabao Lumber*	Culion	Corong-corong	El Nido
Culango	Culion	Mabini (EL)	El Nido
Galoc	Culion	Manlag	El Nido
Halsey	Culion	Masagana	El Nido

Appendix C continued...

New ibahay	El Nido	Bagong Sikat (PP)	Puerto Princesa City
San Fernando	El Nido	Bagong Silang	Puerto Princesa City
Sibaltan	El Nido	Bahile	Puerto Princesa City
Teneguiban	El Nido	Bancao-bancao	Puerto Princesa City
Villa Libertad	El Nido	Barangay ng mga Mangi	Puerto Princesa City
Villa Paz	El Nido	Binduyan	Puerto Princesa City
		Buenavista (PP)	Puerto Princesa City
Kalayaan	Kalayaan	Cabayugan	Puerto Princesa City
		Concepcion (PP)	Puerto Princesa City
Barangonan	Linapacan	Inagawan	Puerto Princesa City
Cabunlawan	Linapacan	Inagawan sub-colony	Puerto Princesa City
Calibangbangan	Linapacan	Irawan	Puerto Princesa City
Decabaitot	Linapacan	Iwahig (PP)	Puerto Princesa City
Maroyogroyog	Linapacan	Kamuning	Puerto Princesa City
Nangalao	Linapacan	Langogan	Puerto Princesa City
New Culaylayan	Linapacan	Liwanag	Puerto Princesa City
Pical	Linapacan	Lucbuan (PP)	Puerto Princesa City
San Miguel (LP)	Linapacan	Luzviminda	Puerto Princesa City
San Nicolas (LP)	Linapacan	Mabuhay	Puerto Princesa City
		Macarascas	Puerto Princesa City
Alcoba	Magsaysay	Manalo	Puerto Princesa City
Balaguen	Magsaysay	Mandaragat	Puerto Princesa City
Canipo	Magsaysay	Marufinas	Puerto Princesa City
Cocoro	Magsaysay	Maruyogon	Puerto Princesa City
Emilod	Magsaysay	Masigla	Puerto Princesa City
Igabas	Magsaysay	Masipag	Puerto Princesa City
Los Angeles	Magsaysay	Matahimik	Puerto Princesa City
Lucbuan (MG)	Magsaysay	Maunlad	Puerto Princesa City
Rizal (MG)	Magsaysay	Napsan	Puerto Princesa City
		New Panggangan	Puerto Princesa City
Antipuluan	Narra	Pagkakaisa	Puerto Princesa City
Aramaywan (NR)	Narra	Salvacion (PP)	Puerto Princesa City
Batang-batang	Narra	San Jose (PP)	Puerto Princesa City
Burirao	Narra	San Manuel	Puerto Princesa City
Caguisan	Narra	San Miguel (PP)	Puerto Princesa City
Calategas	Narra	San Pedro	Puerto Princesa City
Ipilan (NR)	Narra	San Rafael (PP)	Puerto Princesa City
Malatgao (NR)	Narra	Santa Cruz (PP)	Puerto Princesa City
Panacan	Narra	Santa Lourdes	Puerto Princesa City
San Isidro	Narra	Santa Lucia	Puerto Princesa City
Tacras	Narra	Santa Monica	Puerto Princesa City
Teresa	Narra	Seaside	Puerto Princesa City
Tinagong Dagat	Narra	Sicsican	Puerto Princesa City
		Simpocan	Puerto Princesa City
Babuyan	Puerto Princesa City	Tagburos	Puerto Princesa City
Bacungan	Puerto Princesa City	Tagumpay (PP)	Puerto Princesa City
Bagong Bayan (PP)	Puerto Princesa City	Tanabag	Puerto Princesa City
Bagong Pag-Asa	Puerto Princesa City	Tiniguiban	Puerto Princesa City

Appendix C continued...

Aramaywan (QZ)	Quezon	Kemdeng	San Vicente
Berong	Quezon	New Agutaya	San Vicente
Calumpang	Quezon	New Canipo	San Vicente
Isugod	Quezon	Poblacion (SV)	San Vicente
Maasin (QZ)	Quezon	Port Barton	San Vicente
Panitian (QZ)	Quezon	San Isidro (SV)	San Vicente
Quinlogan	Quezon	Santo Ni±o (SV)	San Vicente
Sowangan	Quezon		
Tabon	Quezon	Banbanan	Tay
Tagusao	Quezon	Alacalian	Tay
Bunog	Rizal	Abo-abo	Espa±ola
Campong Ulay	Rizal	Calasaguen (ES)	Espa±ola
Candawaga	Rizal	Iraray	Espa±ola
Canipaan	Rizal	Isumbo	Espa±ola
Culasian (RZ)	Rizal	Labog	Espa±ola
Iraan (RZ)	Rizal	Panitian (ES)	Espa±ola
Latud	Rizal	Pulot Shore	Espa±ola
Panalingaan	Rizal	Punang	Espa±ola
Punta Baja	Rizal		
Ransang	Rizal	Abongan	Taytay
Taburi	Rizal	Alacalian	Taytay
		Banbanan	Taytay
Abaroan	Roxas	Bantulan	Taytay
Barangay I (RX)	Roxas	Baras	Taytay
Barangay II (RX)	Roxas	Batas	Taytay
Barangay III (RX)	Roxas	Bato	Taytay
Barangay IV (RX)	Roxas	Biton	Taytay
Barangay V (RX)	Roxas	Busy bees	Taytay
Barangay VI (RX)	Roxas	Calawag	Taytay
Caramay	Roxas	Casian	Taytay
Jolo	Roxas	Debangan	Taytay
Malcampo	Roxas	Depla	Taytay
Minara	Roxas	Liminangcong	Taytay
New Cuyo	Roxas	Mayteguid	Taytay
Nicanor Zabala	Roxas	Minapla	Taytay
Retac	Roxas	New Guinlo	Taytay
Rizal (RX)	Roxas	Old Guinlo	Taytay
Salvacion (RX)	Roxas	Paly	Taytay
San Miguel (RX)	Roxas	Pamantolon	Taytay
San Nicolas (RX)	Roxas	Pancol	Taytay
Sandoval (RX)	Roxas	Poblacion	Taytay
Taradungan	Roxas	Polariquen	Taytay
Tinitian	Roxas	San Jose	Taytay
Tumarbong	Roxas	Sandoval	Taytay
		Silanga	Taytay
Alimanguan	San Vicente	Tumbod	Taytay
Binga	San Vicente		
Caruray	San Vicente		

Appendix D. List of coastal barangays in Occidental Mindoro

MUNICIPALITIES	BARANGAYS
Abra de Ilog	Lumangbayan, Udalo (Camurong), Wawa
Calintaan	Concepcion, Iriron, Poblacion
Looc	Agkawayan, Ambil, Balikyas, Bonbon, Bulacan, Guitna, Kanluran
Lubang	Binakas, Cabra, Maligaya, Maliig, Tagbac, Tangal, Tilik, Vigo, Banaag at Pag-asa, Maguinhawa, Ninikat ng Pag-asa
Mamburao	Balansay, Fatima (Tii), Payompon, Talabaan, Tayamaan, Brgy. 2 (Pob), Brgy. 5 (Pob), Brgy 7 (Pob)
Paluan	Harrison, Lumangbayan, Mananao, Marikit, Brgy. 1, Brgy. 2, Brgy. 3, Brgy. 4, Brgy. 5, Brgy. 6, Tubili
Magsaysay	Alibog, Caguray, Calawag, Laste, Sta. Teresa, Sibalat
Sta. Cruz	Barahan, Dayap, Lumangbayan, Pob. 1, San Vicente, Pob. 2
Sablayan	Burgos, Gen. Emilio Aguinaldo, Ligaya, Poblacion, Sta. Lucia, Caludio Salgado
San Jose	Ambulong, Ansiray, Bagong Sikat, Bangkal, Bubog, Buri, Camburay, Caminawit, Catayungan, Ilin Proper, INasakan, Ipil, Labangan ilin, Natandol, Pag-asa, Pawican, San Roque
Rizal	Adela, Rumbang, Salvacion

Appendix E. List of coastal barangays in Oriental Mindoro

MUNICIPALITY	BARANGAY
Pto. Galera	Aninuan, Sinandigan, San Antonio, Poblacion, Dulangan, Balatero, Sto Nino, San Isidro, Sabang, Palangan, Tabinay, Villaflor,
San Teodoro	Ilag, Poblacio, Tacligan, Lumangbayan
Baco	Water, San Andres, Cabulo, Pulang-Tubis, Pambisan, Tabon tabon,
Calapan City	Wawa, Mahal na Pangalan, Baruyan Balite, Pachoca, Tibag, Ibaba East, Ibaba West, Calero, San Rafael, San Antonio, Lazareto, Silonay, Parang, Suqui, Gutad, Nag-iba 1, Navotas, Maidlang
Naujan	Nag-iba 2, San Antonio, Estrella, Sta Cruz, San Jose I, Melgar A, Melgar B, Montemayor, Masaguing, Hererra, Kalinisan,
Pola	Bacawan, Buhay na Tubig, Calima, Batuhan, Zone I (Bayanan), Zone 2 (Poblacion), Tiguihan, Putting cacao, Tagumpay, Misong,
Pinamalayan	Ranzo, Banilad, Pili, Quinabigan, Guinhawa, Wawa, Zone 1 (Poblacion), Lumangbayan, Papandayan.
Gloria	Tambong, Balite, Sta Theresa, Kawit, San Antonio, Maragooc, Guimbonan, Agsalin
Bansud	Proper Bansud, Proper Tiguisan, Sumagui, Salcedo
Bongabong	Labasan, Anilao, Cawayan, Poblacion, Aplaya, Masaguisi, Camantigue, Dayhagan,
Roxas	San Isidro, Paclasan, Danggay, San Jose-Dalahica, Bagumbayan
Mansalay	Wasig, Sta Brigida, B del Mundo, Cagulong, Poblacion, Cabalwa, Manaul, Budburan
Bulalacao	San Roque, San Juan, Poblacion, Milagrosa, San Francisco, Maujan, Balatasan, Maasin

Appendix F. List of Districts, Cities, Municipalities and Barangays of Cavite including its land area

CITY/MUNICIPALITY	LAND AREA (ha)	% DISTR.	NO. OF BRGYS
1st DISTRICT	3,631	2.54	143
Cavite City	1,183	0.83	84
Kawit	1,340	0.94	23
Noveleta	567	0.4	16
Rosario	541	0.38	20
2nd DISTRICT	5,240	3.67	73
City of Bacoor	5,240	3.67	73
3rd DISTRICT	9,701	6.8	97
City of Imus	9,701	6.8	97
4th DISTRICT	8,234	5.77	73
City of Dasmariñas	8,234	5.77	73
5th DISTRICT	19,671	13.78	105
Carmona	3,092	2.17	14
Silang	15,641	10.96	27
GMA	938	0.66	64
6th DISTRICT	30,105	21.1	119
Trece Martires City	3,917	2.74	13
Gen. Trias	11,768	8.25	32
Tanza	9,630	6.75	33
Amadeo	4,790	3.36	41
7th DISTRICT	66,124	46.34	219
Tagaytay City	6,615	4.63	35
Allfonso	6,460	4.53	26
GEA/BAILEN	5,103	3.58	14
Indang	8,920	6.25	36
Magallanes	7,860	5.5	16
Maragondon	16,549	11.6	27
Mendez	1,667	1.17	25
Naic	8,600	6.03	30
Ternate	4,350	3.05	10
TOTAL	**142,706**	**100**	**829**

Appendix G. Coastal Barangays of the National Capital Region

BARANGAY ALONG MANILA BAY

NAME_3	Shape_Length	Shape_Area
Daniel Fajardo	2400.438112	197725.477505
Elias Aldana	2717.785132	233345.050265
Ilaya	2161.73583	114262.941032
Manuyo Uno	5911.44474	977206.881029
Pulang Lupa Uno	7850.976365	1667364.815951
Barangay 100	900.474949	45774.082059
Barangay 101	1785.57928	132075.274271
Barangay 105	744.375727	33091.269389
Barangay 106	352.717598	7291.008809
Barangay 107	1144.04482	78869.069912
Barangay 110	625.991818	24427.133176
Barangay 112	752.023943	35342.391413
Barangay 116	654.647846	26081.739911
Barangay 118	988.050653	48336.098836
Barangay 119	895.036115	35068.563335
Barangay 123	408.426768	10325.131006
Barangay 124	814.473464	12995.92674
Barangay 125	334.230294	5129.897982
Barangay 127	741.195506	29562.295442
Barangay 129	1336.901282	41617.567605
Barangay 131	921.975786	30376.340936
Barangay 138	696.600333	26988.050133
Barangay 20	5888.63235	509013.623662
Barangay 275	6858.828669	1151743.127692
Barangay 30	1681.049647	78351.054269
Barangay 39	1045.052341	33648.174343
Barangay 44	765.017137	28473.663031
Barangay 649	7743.561239	848725.238791
Barangay 650	1455.539089	113887.967025
Barangay 651	1010.689934	62470.94385
Barangay 652	864.250753	45320.890184
Barangay 653	9012.414324	1059198.914989
Barangay 666	1848.000654	99033.118897
Barangay 667	1366.341745	114746.035749
Barangay 668	1410.31497	122631.830006
Barangay 699	1624.248309	141024.954901
Barangay 700	915.644655	32835.524459
Barangay 701	1546.418192	156567.310783
Barangay 704	785.222284	26820.318693
Barangay 715	313.618977	5468.763683
Barangay 719	1802.496821	164383.976764
Barangay 72	677.959153	25463.270481
Barangay 720	307.698183	5378.49272
Barangay 721	767.961245	32321.240716
Bagumbayan North	511.910231	16662.323849
Bagumbayan South	716.511817	27081.399973
Bangculasi	2820.481882	295376.392925
Daanghari	2608.494252	376847.966842
Navotas East	1103.705076	37916.672117
North Bay Blvd., North	1981.674894	217092.999331
North Bay Blvd., South	4242.557135	895324.307005
San Jose	2475.133266	337616.559779
San Rafael Village	4704.615577	376153.497528
San Roque	1962.2115	215475.003338
Sipac-Almacen	1549.623713	110411.298562
Tangos	1947.268133	221310.272365
Baclaran	6208.520688	1850170.860272
Don Galo	2262.665511	313708.63947
La Huerta	7360.815633	1013089.35307
San Dionisio	13569.196182	3518750.489189
Tambo	11475.642769	4606300.02832
Barangay 1	778.490715	32388.463249
Barangay 10	732.636489	28084.516028
Barangay 11	659.899401	18452.562488
Barangay 12	667.403274	18606.890126
Barangay 13	1557.679759	135957.2741
Barangay 15	915.45747	42864.549656
Barangay 2	658.596735	22950.352102
Barangay 3	639.434034	18017.429819
Barangay 33	1259.156821	72791.289087
Barangay 4	731.990408	27910.843642
Barangay 5	610.266347	13090.347751
Barangay 6	621.525169	14623.430658
Barangay 7	718.941803	25121.494081
Barangay 76	6345.238108	2216271.250202
Barangay 8	663.706526	19739.764518
Barangay 9	615.856097	14778.90811

ERDB TECHNICAL BULLETIN NO. 1

MBFDP - SITE VALIDATION AND ASSESSMENT

RATIONALE

The Mangrove and Beach Forest Development Project (MBFDP) is intended to develop and rehabilitate mangrove and beach forests in disaster-affected areas as a means to improve and enhance the natural defenses and resilience of the country's coastlines and its environs vis-à-vis the impacts of climate change. Following a systematic approach, **site validatio**n covers activities to confirm the geographical location (GPS points) of planting sites that were initially identified and mapped (shapefiles) by the CENROs/PENROs based on agreed targets. Assessment determines the suitability of the site including the identification of species most suitable to the site and other environmental conditions that need to be considered in the actual planting activities. A multi-disciplinary team comprised of members with sufficient experience in GIS and mapping, mangrove ecology and marine or environmental science will conduct the site validation and assessment. The output of the activity serves as reference for baselining and plantation establishment.

METHODOLOGY

2.1. Upload waypoints or shapefiles generated from the site identification and mapping using a Global Position System (GPS) or Android device. Using the uploaded data, locate on the ground the boundaries of identified/delineated mangrove and beach forest areas.

2.2. Obtain a site-specific tide table prior to ground validation. Tide table or information can be obtained online (e.g. http://www.mobilegeographics.com) or in commercial calendars.

2.3. Conduct the ground validation for mangroves during low tide and high tide to get the range of the intertidal area suitable for plantation establighment. Assessment of the identified sites must be done in terms of species composition, zonation, substrate type, tidal inundation, occurrence of barnacles, and exposure to waves and monsoon wind.

2.4. For beach forest area, extant vegetation, species distribution or zonation, soil type and existing land use within the beach forest area must be recorded. These information must be added as attributes during the preparation of validated map (Table1). Geotagged photos of validated sites (HD quality) using GeoCam android application must also be submitted to ERDB. KMLZ applications may be used to create KMZ files from geotagged photos.

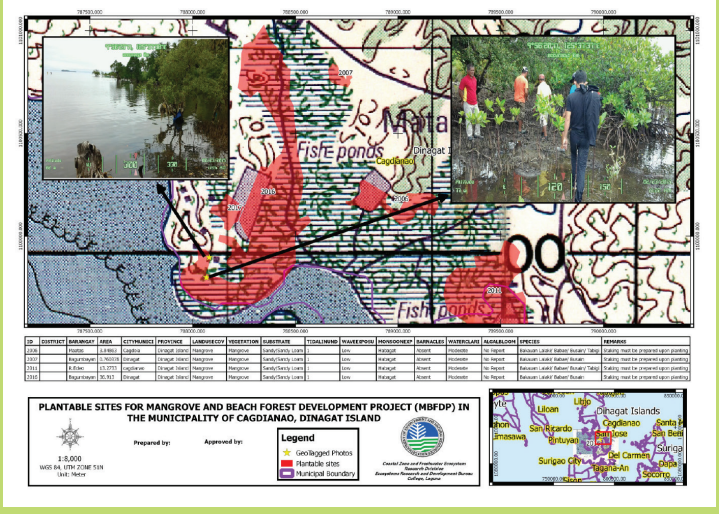
2.5. Determination of the suitability of the site for mangrove plantation establishment shall be based on the four criteria: (1) areas with remnant mangrove vegetation, (2) exposed 3-4 hours after highest tide, (3) areas with low energy waves (Melana et al., 2000; Primavera et al., 2012), and (4) firm substrate (foot do not sink above ankle). Areas with seagrasses and heavy barnacle infestation are not recommended planting sites for mangroves, and those areas with land use conflict. For beach forest, the proposed planting site should have existing or adjacent beach vegetation, mother trees and wildlings.

EXPECTED OUTPUT

The expected output includes a preliminary report on the biophysical characteristics and maps of the potential or suitable planting sites. Maps may be generated using ArcGIS or Manifold software. Map files must be in shapefile format with UTM projection and WGS84 datum. If site validation and assessment are undertaken by the CENROs/PENROs, the report and map files should be submitted to their respective Regional Offices for consolidation. The Regional Office should provide the ERDB-MBFDP Project Management Office with the consolidated report and map files.

Table 1. List of attributes that will be included in the validation map.

Required Field	Field Properties	Description	Sample Entry
Province	Text (50 Char)	Name of Province	Palawan
Mun_City	Text (50 Char)	Name of City/Municipality	Coron
District	Text (50 Char)	District Number	District I
Brgy	Text (50 Char)	Name of Barangay	Barangay I
Veg_Type	Text (100 Char)	Mangrove/Associate/Beach Forest	Mangrove
Area	Double (10, 4)	Area of Mangrove/Beach Forest Plantation Site (ha)	200 ha
LUC	Text (100 Char)	Close/Open Forest; Built up areas; Agricultural; Commercial/Recreational	Commercial (Beach Resort)
Species	Text (300 Char)	Species Present	Rhizophora sp.; Avicennia sp.
Substrat	Text (100 Char)	Sandy/Muddy/Clay/Rubble	Sandy-Muddy
Tidal_In	Double	Depth (meters)	0.5
Wave_Ex	Text (100 Char)	High, Moderate, Low	Low
ME	Text (100 Char)	Amihan (NEM)/Habagat (SWM)	Habagat
Barnacle	Text (100 Char)	Present/Absent	Present
Water_C	Text (100 Char)	Poor/Moderate/High	Poor
Algal_B	Text (100 Char)	Frequent/Seldom/No Report	No Report
Remarks	Text (300 Char)	Other Information (e.g. other government/NGO projects in the site/presence of claimants, etc)	



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ERDB TECHNICAL BULLETIN NO. 2
MBFDP - BASELINE SURVEY

RATIONALE

The Mangrove and Beach Forest Development Project (MBFDP) is intended to develop and rehabilitate mangrove and beach forest in disaster-affected areas as a means to improve and enhance the natural defenses and resilience of the country's coastlines and its environs vis-a-vis the impacts of climate change. Baseline survey of duly validated project sites for mangrove and beach forest development is intended to provide quantitative information on the present condition of the sites measured in terms of flora and fauna diversity indices, soil and water physico-chemical properties, and socioeconomic characteristics of nearby coastal communities. Results of the survey are essential in project monitoring and evaluation and impact assessment measured in terms of improvement in species composition of flora and fauna including the overall environmental condition. Baselining shall be carried out by a multidisciplinary core team with adequate knowledge in the abovementioned fields of science.

Specific sites for baselining shall be selected from validated sites that will be used for mangrove and beach forest planting for 2015 under MBFDP upon the recommendation of the PENRO/CENRO. Each province shall have one (1) candidate site for baselining. Criteria for site identification are as follows: 1) a contiguous area of 50 to 100 ha; 2) in proximal distance to a community who will also be tapped in mangrove planting and maintenance; 3) relatively peaceful; and 4) accessible.

METHODOLOGY

A. Mangrove Vegetation Assessment

1. A transect line shall be established perpendicular to the coastline from the seaward to landward extent of the mangrove forest. The transect shall run twice or thrice depending on the width of the mangrove. The interval between transect lines shall be between 50m or 100m depending on the size of the area. The length of the transect line shall depend on mangrove seaward-landward extent reckoned from the farthest low tide of neap tide. For each transect line, six (6) circular plots of 7-m radius (0.00154 ha or 154 m2) shall be established at an interval of 10-20m. These plots shall be used for trees with diameter at breast height (dbh) > 5cm. For each circular plot with a 7-m radius, a smaller plot (2-m radius from the plot center) shall be delineated and used for trees with dbh of less than 5cm (Figure 1). Two 1m x 1m plots at the front and rear ends of each 7m-radius shall be located to quantify the plants with height below 1.3m (e.g. seedlings, shrubs and herbaceous plants). All vegetation within each duly designated plot shall be identified and counted. The main stem tree diameter or dbh shall be at 1.3m above the ground. For stilt rooted species (e.g. *Rhizophora* spp.), the dbh shall be measured above the highest stilt root (Figure 2) (FAO, 1994; Kauffman and Donato, 2012).

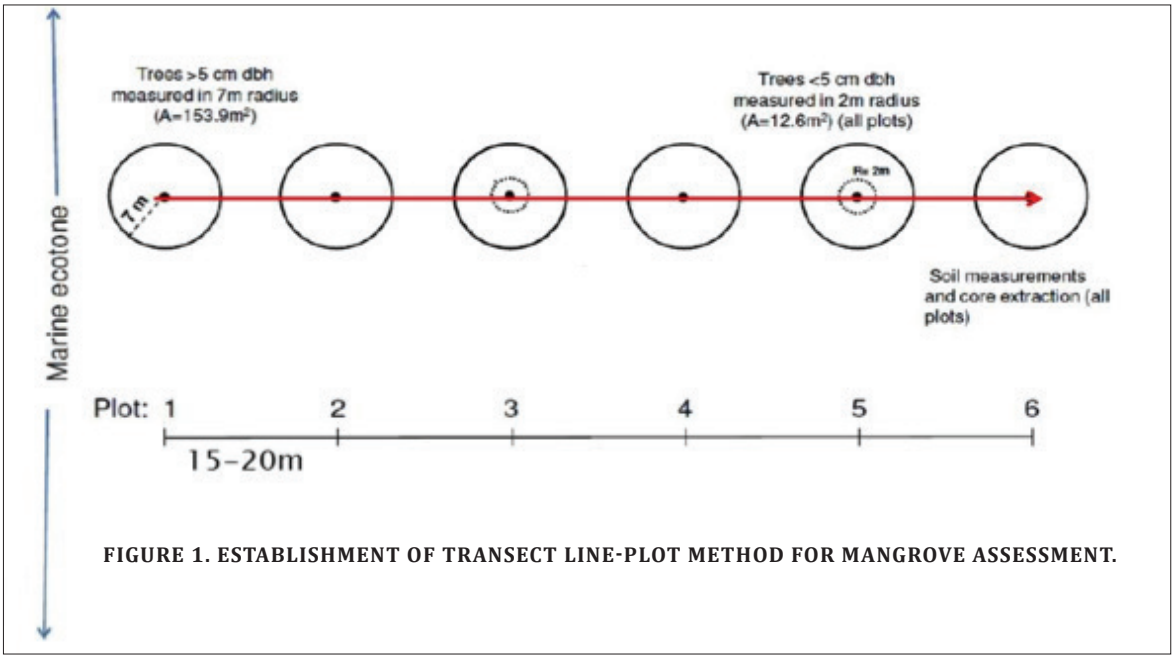


FIGURE 1. ESTABLISHMENT OF TRANSECT LINE-PLOT METHOD FOR MANGROVE ASSESSMENT.

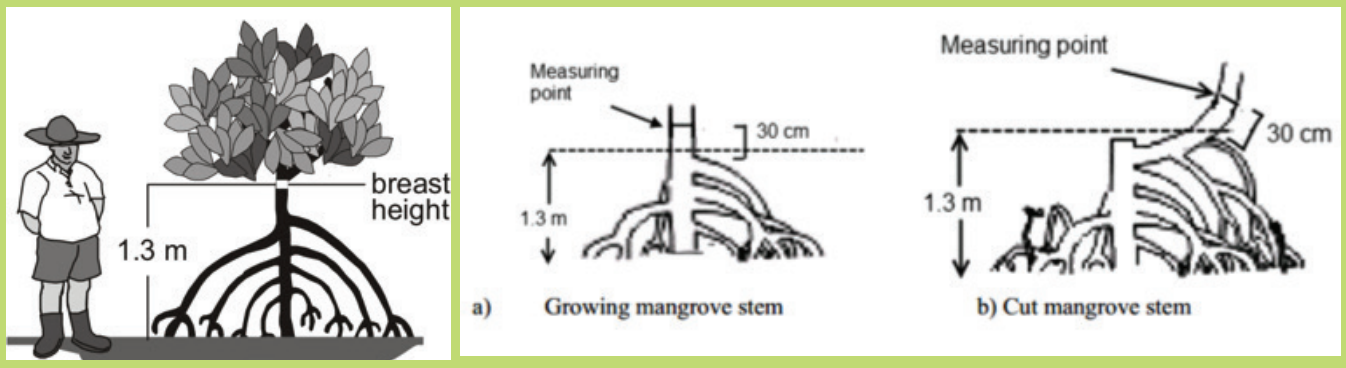


FIGURE 2. MEASURING THE DBH OF MANGROVE (SOURCE: DEGUIT ET AL., 2004) AND MANGROVE TREES WITH AERIAL ROOTS. (IMAGE SOURCE: NAFORMA, 2010).

B. Beach Forest Vegetation Assessment

A beach forest is a type of forest in sandy beaches above high tide limits and thus not influenced by tidal fluctuation. Beach tree species include Talisai (*Terminalia catappa*), Agoho (*Casuarina equisitifolia*) and Dapdap (*Crythrina variegata*) among others. Ecologically a beach forest serves as a protection forest, a line of defense protecting the coastal communities and their livestock and agricultural crops against the onslaught of strong winds and the storm surges.

Up to this time, published information on beach forest are very few. Information such as species composition, structure, density, dominant taxa and geographic locations are among the important inputs for effective beach forest rehabilitation, as part of coastal zone management.

Belt-transect Method

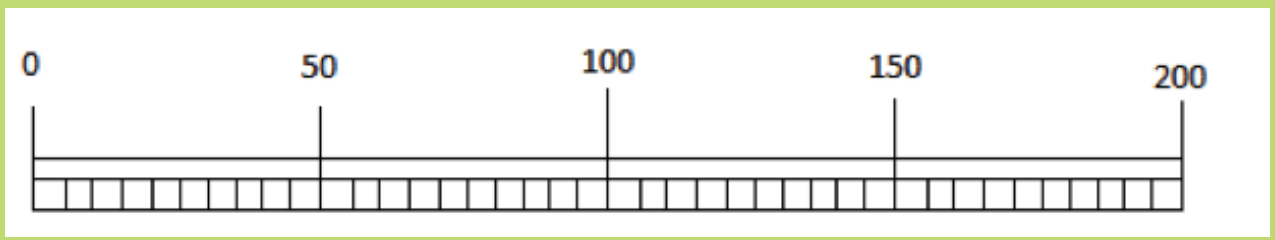
A 200m transect line shall be established parallel to the shoreline. The transect shall be divided into four (4) sub-plots each with a length of 50m (Figure 3). In each transect line, ten (10) quadrats measuring 5m x 5m will be established for a total of 40 quadrats (Smith, 2003). It is ideal to establish five (5) 200m transect lines spread in a beach forest, all of which are parallel to the shoreline. The distance of each transect line shall not be less than 50 meters. In each quadrat, all trees with 5cm of dbh shall be properly recorded (correct identification, total height (TH), merchantable height (MH), dbh, crown diameter and GPS reading). Each transect and sub-plot shall be geotagged using the Android application GeoCam. Every picture shall be properly interpolated in the base map using KML/Z technology and Google Earth.

The criterion for selecting a site for vegetation analysis is the presence of beach tree species. In beach areas with shrubs, vines, and weeds, a 3m x 3m quadrat shall be established for a complete enumeration of species within the said quadrat.

Data Analysis

Data shall be analyzed using the following statistical analysis:

1. Density, Frequency and Dominance, and Species Importance Value
2. Descriptive Statistics
3. Diversity Indices



☐ - sub-plot measuring 5m x 5m
Trees > 5cm dbh measured inside the sub-plot

FIGURE 3. ESTABLISHMENT OF BELT-TRANSECT FOR BEACH FOREST ASSESSMENT

C. Fauna Assessment

1. Avifauna assessment in mangrove and beach forests

a. **Timed species-counts (TSCs)** method shall be used. At least four (4) 30-minute observation posts shall be selected at intervals of at least 100m to 250m or 10 to 15 minutes walking distance from each post. The survey shall start at exactly 15 minutes after sunrise and end no later than 3.5 hours after sunrise. All bird species seen or heard during observation period shall be listed. The coordinates of each observation post shall also be recorded including period of survey. Photos of the species observed must be taken, whenever possible.

b. **Opportunistic Sampling** – Species that may be detected and identified opportunistically either by their call or by their appearance while travelling to and from survey sites or outside standard survey times or survey sites shall also be recorded. If the bird is seen perching on a tree, the trees' species shall be recorded. If there are nesting birds observed, the bird's species, the date observed, the number of eggs in a clutch (if accessible) shall be recorded. The dates and times of observation including GPS locations of the sighting shall also be recorded.

c. **Ethnobiological Account**s - Some species may not be encountered or observed during the survey period; thus the use of survey through interviews from the local folks shall also be considered to include small mammals, reptiles, amphibians, and birds.

2. Macrobenthos in mangroves

a. Within the established plots for vegetation, sampling for macrobenthos shall be done using a 0.5m x 0.5m (0.25 m^2) quadrat. A minimum of three quadrat will be sampled per vegetation plot.

b. Location of the quadrats shall be: one at the seaward periphery, one at the center, and one at the landward periphery for each circular plot (Figure 4). The location of each quadrat shall be marked using handheld GPS for mapping purposes.

c. For each quadrat, soil samples shall be collected at a depth between 25 and 30cm using a corer or spade. The soil samples must be placed in a 0.5-mm sieve and rinsed with water immediately after collection. All organisms that are retained in the sieve must be collected and placed in plastic bottles or Ziploc bags with ethyl alcohol. Each bottle or Ziploc bag shall be labeled as follows: Location (e.g. Barangay, Municipality, and Province), Transect No., Quadrat No., and Plot No. (e.g. Brgy. San Fernando, Barotac Viejo, Iloilo - T1Q1P1).

d. For each quadrat, the epifauna shall be counted and identified to the lowest taxonomic rank. Reference samples shall be collected to verify taxonomic identifications.

e. High definition photographs of the quadrat and associated organisms must be taken. For macrofauna, photographs of the whole organism must be taken; macro shots of the head/oral region, aperture, segmentations, whorls and other key structures must also be taken for identification. A dark background and lamps or strobe lights shall be used whenever possible, for better results. The size of the organisms must also be taken. Measurement may be done using a caliper, ruler, or ImageJ software. For microfauna, photographs shall be taken using a camera fitted in the dissecting microscope. Post-processing of the photos may be done using a digital image editor (e.g. Photoshop, GIMP, Photofiltre). Reference collections with tissue must be preserved in ethanol or diluted formalin. For molluscan shells, samples must be stored in dry plastic or paper boxes.

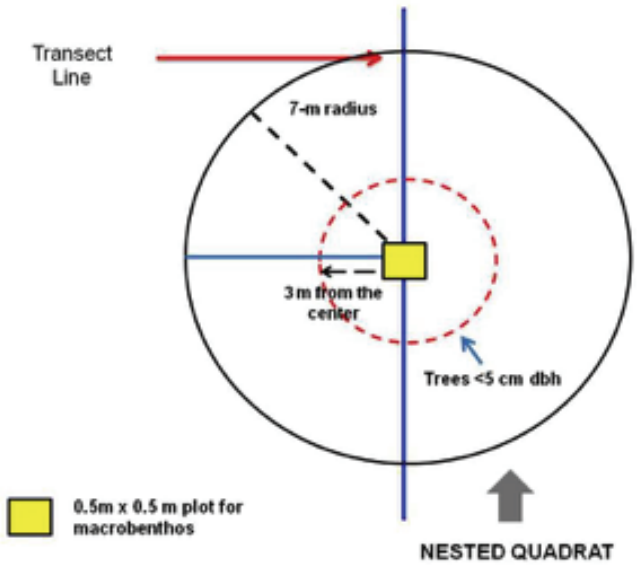


FIGURE 4. SAMPLING PLOTS FOR ASSOCIATED MACROBENTHIC/MACROINVERTEBRATES

3. Mangrove Pests (Arthropods and disease-causing organisms)

Mangrove Pest assessment shall be done in both mangrove and beach forests.

Sampling Design:

Within the established plots (main circular plot) for vegetation, sampling for pests including insects, barnacles and diseases shall be done using smaller subplot (5-m radius). Sampling intensity of 20% shall be used. Mangrove trees within the sample plots shall be examined for the presence of pests using assessment form and appropriate sampling techniques.

Walk though survey (McMaugh, 2005) shall also be done in the vicinity of the established transect lines.

Sampling techniques:

A. Net sweeping is a technique for collecting flying arthropods, across vegetation or onto the ground. This can be done by walking a transect of a fixed length at each site and making a fixed number of sweeps over the vegetation on the transect or fixing the search time.

B. For crawling insects, yellow sticky traps shall be placed on tree trunks and other suitable vertical surfaces to collect arthropods that orient on vertical surfaces (Bickel and Tasker, 2004).

Field Diagnosis

Using the DENR Forest Pests Surveillance Field Form presented in Annex 1, the following shall be noted on mangrove trees per sampling plot as well as those encountered through the walk through survey:

A. The host shall be identified (tree species).

B. External evidence of damage shall be determined (insect pests).

C. Symptoms and signs of diseases shall be located (e. g. mycelia of fungal agent, fungal spores, fruiting bodies).

D. Patterns such as distribution of symptoms (e. g. localized or widespread) and host specificity (Is the problem occurring in only one plant species or are different plant species also affected?) shall be observed.

E. Affected plant parts shall be identified (flowers and fruits, leaves, stems, roots).

F. Severity of infection shall be determined (% of trees infected/infested).

Laboratory Test

Sometimes neither symptoms nor signs provide enough specific or characteristic information to decide the cause of an infectious plant disease. In such cases, it may be necessary to bring a sample back to the laboratory for further tests to isolate and identify the causal agent (Riley, Williamson, and Maloy, 2002).

Samples for laboratory analysis can include those from diseased roots, stems, or foliage.
When collecting diseased specimens, newly diseased tissues for isolation shall be selected. Do not use

older diseased tissue as it will be colonised externally by saprophytic fungi and bacteria. Collected insects, barnacles and other arthropods may be preserved in 70-80 % ethyl alcohol.

D. Water Quality Assessment

1. Sample collection - A minimum of three (3) water samples shall be collected for each zonation (Kauffman and Donato, 2012) through surface grab sampling. A boat or raft will be required for deep sites where other means of access do not exist. This shall be done by submerging the container, mouth or opening first, and allowing the water to run slowly into the container until full. If water quality probe is available, in situ measurement, as well as probe's calibration and maintenance, must follow the probe's instruction manual.

2. Sample label - Sample labels shall include the following information: sample number, sample type, name of collector, date, time, place of collection and sample preservative.

3. Sample Preservation (Bacteriological Analysis) - Water samples must reach the laboratory in less than 2 hours. Preservation is not required. If it exceeds 2 hours to reach the laboratory, the samples must be rapidly chilled to about 4 °C by placing them in a cold water or ice mixture in an insulated container. If the time exceeds 6 hours, the condition must be noted in the laboratory report. The time between sample collection and analysis shall, in general, not exceed 6 hours, and 24 hours is considered the absolute maximum.

4. Sample Preservation (Physico-chemical Analysis) - Storage in glass or polyethylene bottles at a low temperature (e.g. 4°C) in the dark is recommended. Sample bottles must be clean but need not be sterile. The pH and turbidity must be immediately tested after sampling as they will change during storage and transport. The temperature and dissolved gases must be measured in situ. Nearest laboratory/ies must be coordinated for recommended sample preservation and analysis.

5. Laboratory Methods - Laboratory analysis is needed when the water quality parameters being studied cannot be measured with field instruments. The following methods can be used:

Water Quality Parameter	**Method**
Temperature (oC)	Thermometer
pH	Potentiometric Method
Dissolved oxygen (mg/L)	Winkler method
Total Dissolved Solids (mg/L)	Gravimetric method
Phosphate (mg/L)	Stannous chloride method
Nitrate (mg/L)	Brucine method for saline water, specific ion
Salinity (ppt)	Salinimeter

Water quality analysis shall only be conducted at the mangrove forests, as the water quality parameters influence the presence of macrobenthic organisms at mangrove intertidal flats.

E. Soil Properties

1. ***Sample container and label*** – Ziploc (polyethylene) bags shall be labeled with sample number, sampling date, location, soil depth, and sample description.

2. ***Sample collection*** – A sharp-edged steel cylinder with circumference of ~20cm and length of 40cm must be used for soil collection. Upon establishment of transect along mangrove sites (Kauffman and Donato, 2012), one soil sample per plot must be collected. Soil samples must be composited according to each zonation area. A minimum of 3 kilograms of the composited soil shall be collected for transport and analysis.

3. ***Sample preservation*** – The collected soil samples must be air-dried before transport. A subsample (~100 g) for moisture content analysis must be separated and must not be air-dried and properly sealed.

4. ***Soil Physico-Chemical Analysis*** - The following methods can be used:

Soil Parameter	**Method**
Moisture content	Oven-drying
Organic Matter Content	Walkley-Black Method
Soil pH	Potentiometric method
Nitrogen	Kjeldahl method
Phosphorous	Olsen method or Flame Photometer
Potassium	Ammonium acetate method
Soil Texture	Hydrometer method

Soil analysis shall be done both at mangrove and beach forests.

Socio-Economic Component. The socio-economic status of adjacent local community shall be determined through survey questionnaires (Annex 2). Supplemental tools (e.g. PCRA, FGD, KII) shall be used to obtain information on the knowledge and perception of the community, private organization and local government with regards to mangrove and beach forest rehabilitation.

Data Management and Analysis

a. Calculation of Basal Area, Stem Density and Importance Value

Basal Area (BA) – the cross-sectional area (m^2) of each tree stem shall be measured at breast height (1.3m).

To determine Tree Basal Area simply measure the diameter at breast height in centimeters (DBH) and calculate the basal area (m^2) using an equation based on the formula for the area of a circle (area = p r^2 where r = radius and p = 3.142) and the formula for radius (r=diameter/2 = DBH/2).

Therefore:

$$\text{Tree Basal Area } (m^2) = \pi r^2$$
$$= 3.142 \times (DBH/200)^2$$

Where: DBH is in cm

This formula also converts the diameter in centimeters to the basal area in square meters.

Stand Basal Area (m^2/ha)= (Sum of the basal area of each tree in the plot)/(Area of the plot (ha))

b. Calculation of stem density per hectare

Stems per ha= (No.of stems in plot x 10,000)/(Area of the plot)

c. ***Importance Value Percentage -*** The importance of the contribution of each component species to the stand in terms of density, contribution to basal area (dominance) and probability of occurrence throughout the plot (frequency) are described by the following parameters:

Relative density= (no.of individuals of a species)/(total of no.of individuals [all species]) × 100

Relative frequency= (frequency of a species)/(frequency of all species) × 100

Relative dominance= (total basal area of species)/(basal area of all species) × 100

d. Density of Macrobenthos

Density (individuals m^{-2})= (no.of individuals × 4)

Diversity Indices - Free statistical tools such as Biopro, MVSP, or PAST software shall be used to compute the diversity indices. Comparison of community through cluster analysis may also be done. Diversity indices can be computed in MS Excel using the formula below (Krebs, 1999; Magurran, 2004):

Species Richness

Margalef's index was used as a simple measure of species richness (Margalef, 1958).

$$\text{Margalef's index} = (S - 1) / \ln N$$

Where:
S = total number of species
N = total number of individuals in the sample
ln = natural logarithm

Species Diversity

Shannon Diversity Index (H')

$$H' = -\sum p_i \ln p_i$$

Where;
P_i = The proportion of individuals in the population that belong to species i

Simpson's Diversity Index (D)

$$D = 1 - \sum[n(n-1)/N(N-1)]$$

Where:
N = Total number of individuals of all species
n = Total number of individuals of a particular species

Index of Evenness

Pielou's Evenness Index (Pielou, 1966) (e) will be used to calculate Evenness Index.

$$e = H / \ln S$$

Where:
H = Shannon Diversity index
S = Total number of species in the sample

Expected Output

The activity is expected to produce a detailed baseline report of the bio-physical status of the project site including the socio-related aspects. The report will also contain photographs and maps. Maps may be generated using ArcGIS or Manifold software. Map files must be in shapefile format with UTM projection and WGS84 datum. Baseline report and supporting files (photographs, map files, among others) shall be submitted to the ERDB-MBFDP Project Management Office for documentation, databasing, and consolidation.

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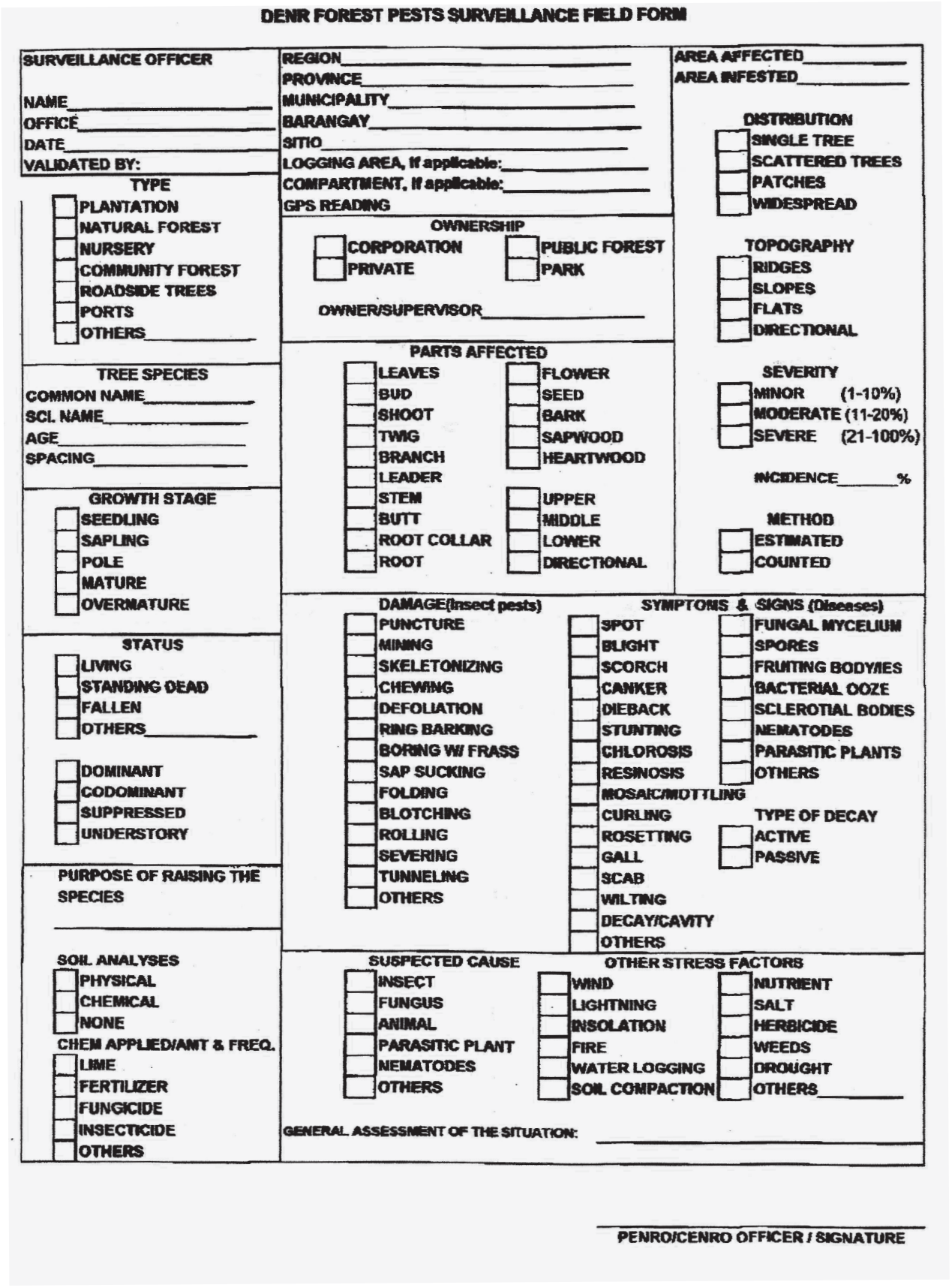
Annex 1. Pest Surveillance Form.



DENR FOREST PESTS SURVEILLANCE FIELD FORM

SURVEILLANCE OFFICER

NAME_____
OFFICE_____
DATE_____
VALIDATED BY:

TYPE
- ☐ PLANTATION
- ☐ NATURAL FOREST
- ☐ NURSERY
- ☐ COMMUNITY FOREST
- ☐ ROADSIDE TREES
- ☐ PORTS
- ☐ OTHERS_____

TREE SPECIES
COMMON NAME_____
SCI. NAME_____
AGE_____
SPACING_____

GROWTH STAGE
- ☐ SEEDLING
- ☐ SAPLING
- ☐ POLE
- ☐ MATURE
- ☐ OVERMATURE

STATUS
- ☐ LIVING
- ☐ STANDING DEAD
- ☐ FALLEN
- ☐ OTHERS_____

- ☐ DOMINANT
- ☐ CODOMINANT
- ☐ SUPPRESSED
- ☐ UNDERSTORY

PURPOSE OF RAISING THE SPECIES

SOIL ANALYSES
- ☐ PHYSICAL
- ☐ CHEMICAL
- ☐ NONE

CHEM APPLIED/AMT & FREQ.
- ☐ LIME
- ☐ FERTILIZER
- ☐ FUNGICIDE
- ☐ INSECTICIDE
- ☐ OTHERS

REGION_____
PROVINCE_____
MUNICIPALITY_____
BARANGAY_____
SITIO_____
LOGGING AREA, If applicable:_____
COMPARTMENT, If applicable:_____
GPS READING

OWNERSHIP
- ☐ CORPORATION
- ☐ PRIVATE
- ☐ PUBLIC FOREST
- ☐ PARK

OWNER/SUPERVISOR_____

PARTS AFFECTED
- ☐ LEAVES
- ☐ BUD
- ☐ SHOOT
- ☐ TWIG
- ☐ BRANCH
- ☐ LEADER
- ☐ STEM
- ☐ BUTT
- ☐ ROOT COLLAR
- ☐ ROOT
- ☐ FLOWER
- ☐ SEED
- ☐ BARK
- ☐ SAPWOOD
- ☐ HEARTWOOD
- ☐ UPPER
- ☐ MIDDLE
- ☐ LOWER
- ☐ DIRECTIONAL

AREA AFFECTED_____
AREA INFESTED_____

DISTRIBUTION
- ☐ SINGLE TREE
- ☐ SCATTERED TREES
- ☐ PATCHES
- ☐ WIDESPREAD

TOPOGRAPHY
- ☐ RIDGES
- ☐ SLOPES
- ☐ FLATS
- ☐ DIRECTIONAL

SEVERITY
- ☐ MINOR (1-10%)
- ☐ MODERATE (11-20%)
- ☐ SEVERE (21-100%)

INCIDENCE_____%

METHOD
- ☐ ESTIMATED
- ☐ COUNTED

DAMAGE(Insect pests)
- ☐ PUNCTURE
- ☐ MINING
- ☐ SKELETONIZING
- ☐ CHEWING
- ☐ DEFOLIATION
- ☐ RING BARKING
- ☐ BORING W/ FRASS
- ☐ SAP SUCKING
- ☐ FOLDING
- ☐ BLOTCHING
- ☐ ROLLING
- ☐ SEVERING
- ☐ TUNNELING
- ☐ OTHERS

SYMPTOMS & SIGNS (Diseases)
- ☐ SPOT
- ☐ BLIGHT
- ☐ SCORCH
- ☐ CANKER
- ☐ DIEBACK
- ☐ STUNTING
- ☐ CHLOROSIS
- ☐ RESINOSIS
- ☐ MOSAIC/MOTTLING
- ☐ CURLING
- ☐ ROSETTING
- ☐ GALL
- ☐ SCAB
- ☐ WILTING
- ☐ DECAY/CAVITY
- ☐ OTHERS

- ☐ FUNGAL MYCELIUM
- ☐ SPORES
- ☐ FRUITING BODY/IES
- ☐ BACTERIAL OOZE
- ☐ SCLEROTIAL BODIES
- ☐ NEMATODES
- ☐ PARASITIC PLANTS
- ☐ OTHERS

TYPE OF DECAY
- ☐ ACTIVE
- ☐ PASSIVE

SUSPECTED CAUSE
- ☐ INSECT
- ☐ FUNGUS
- ☐ ANIMAL
- ☐ PARASITIC PLANT
- ☐ NEMATODES
- ☐ OTHERS

OTHER STRESS FACTORS
- ☐ WIND
- ☐ LIGHTNING
- ☐ INSOLATION
- ☐ FIRE
- ☐ WATER LOGGING
- ☐ SOIL COMPACTION
- ☐ NUTRIENT
- ☐ SALT
- ☐ HERBICIDE
- ☐ WEEDS
- ☐ DROUGHT
- ☐ OTHERS_____

GENERAL ASSESSMENT OF THE SITUATION: _____

_____
PENRO/CENRO OFFICER / SIGNATURE

Annex 2. Household Summary Form.

Socio-economic survey of households affected by Yolanda
(Baseline study)

Interview schedule

Sitio _____ Municipality_____
Barangay_____ Province _____
GPS reading_____

Demographic information

Name of respondent_____Sex _____ Age_____Religion _____
Educational attainment_____Civil status_____
Household size (including the respondent) _____

Settlement and Migration history

Nature of settlement [ ] Born-resident [ ] Migrant
Place of origin _____ Place of birth_____
Ethnic group _____ Length of stay in the area_____
Access to the area
[ ] Place of birth [ ] Seeking employment
[ ] Parental migration [ ] Access to land
[ ] Invitation from relatives/ friends [ ] Association through marriage
[ ] Others, specify_____

Settlement plans
[ ] Permanent stay
[ ] Place of birth [ ] Employment
[ ] Conducive environment [ ] Acquisition of property
[ ] No place to go [ ] Place attachment
[ ] Access to land [ ] Others, specify_____
[ ] Transfer of residence, explain_____
_____

Economic profile

A. Main occupation _____Estd. monthly income _____

B. Secondary occupation_____Estd. Monthly income_____

C. Total monthly income from main and secondary occupations_____

D. Property ownership and Housing amenities

Residential lot: [ ] Inheritance [ ] CSC/CBFMA [ ] Tenant [ ] Rent
[ ] Bought rights [ ] Informal settler [ ] Others, specify_____

House: [ ] Owned {_____Bought; _____Inherited; _____Built}
[ ] Rented {How much per month? _____}
[ ] Others, specify_____

Housing materials [ ] Nipa/Cogon [ ] Wood/Bamboo with GI roof
[ ] Concrete [ ] Combination of concrete and wood with GI roof
[ ] Others, specify_____

Cooking fuel [ ] LPG [ ] Charcoal
[ ] Kerosene [ ] Others, specify_____
[ ] Firewood

Lighting facility [ ] Electric current {Meralco/Coop} [ ] Kerosene
[ ] Others, specify_____

Health and Sanitation

Domestic/ Drinking water
[ ] Stream/Spring [ ] Local water utility (LOWA)
[ ] Water pump [ ] Deep well
[ ] Open tank (Sahod ulan) [ ] Others, specify _____

Illness/Disease
[ ] Cough and cold [ ] Diarrhea
[ ] Malaria [ ] Infections
[ ] Headache [ ] Tuberculosis
[ ] Asthma [ ] Skin allergy
[ ] Hypertension [ ] Others, specify_____

Toilet facility [ ] Open pit [ ] Close pit [ ] Shared with relatives
[ ] Communal [ ] Others, specify_____

Septic tank location [ ] Land [ ] River [ ] Others, specify_____

Quality/Condition of the air
[ ] Fresh air [ ] Humid air (maalinsangan)
[ ] Polluted air [ ] Others, specify_____

Solid waste disposal
[ ] Open pit [ ] Waste segregation
[ ] Burning [ ] Throw in river/creek
[ ] Composting [ ] Others, specify_____

Environmental condition

Coastal geohazards

Coastal geohazards common in the community
[ ] Coastal flooding [ ] Super typhoon
[ ] Storm surge [ ] Tsunami
[ ] Subsidence [ ] Accretion/Sediment build-up
[ ] Salt water intrusion [ ] Coastal/Beach erosion
[ ] Shoreline retreat [ ] Others, specify_____

Structures present in the community to mitigate effects/impacts of coastal geohazards
[ ] Mangrove plantation [ ] Beach forest
[ ] Seawall [ ] Sandbag
[ ] Breakwater [ ] Dike
[ ] Riprap [ ] Others, specify_____

State of mangroves

Condition of mangroves in the community
[ ] Dense/thick plantation [ ] Sparsely planted
[ ] Patch or cluster [ ] Absence or non-existent
[ ] Remnants of plantation [ ] Others, specify_____

Health of Mangroves
[ ] Disease(s)
[ ] Foliar [ ] Insect pest
[ ] Root/dead saplings [ ] Others, specify_____
[ ] Fruits

Uses/Functions of mangroves in the community
[ ] Firewood [ ] Material for construction of house
[ ] Medicine [ ] Protection from storm damage and river bank erosion

[ ] Windbreaker [ ] Dissipate impacts of tidal movement
[ ] Food for animals [ ] Spawning/Nursery ground of aquatic resources
[ ] Ecotourism [ ] Others, specify_____

Benefits derived/obtained from mangroves by households
[ ] Food for households [ ] Material for house construction
[ ] Medicine [ ] Income from fish, shrimp culture and wood gathering
[ ] Firewood [ ] Income from cottage industries (e.g., tanning)
[ ] Shelterbelt [ ] Others, specify_____

Observed fauna in mangrove area
[ ] Birds [ ] Amphibians (frog, toad)
[ ] Mammals (bat, rat) [ ] Reptiles (monitor lizard/bayawak, snake)
[ ] Others, specify_____

State of beach forest

Condition of beach forest in the community
[ ] Dense/thick plantation [ ] Sparsely planted
[ ] Patch or cluster [ ] Absence or non-existent
[ ] Remnants of plantation [ ] Others, specify_____

Health of Beach Forest
[ ] Disease(s)
[ ] Foliar [ ] Insect pest
[ ] Root/dead saplings [ ] Others, specify_____
[ ] Fruits

Uses/Functions of beach forest in the community
[ ] Firewood [ ] Material for construction of house
[ ] Medicine [ ] Protection from storm damage and river bank erosion
[ ] Windbreaker [ ] Dissipate impacts of tidal movement
[ ] Food for animals [ ] Ecotourism
[ ] Others, specify_____

Benefits derived/obtained from beach forest by households
[ ] Food for households [ ] Material for house construction
[ ] Medicine [ ] Firewood
[ ] Shelterbelt [ ] Material for Christmas tree
[ ] Shade against sunlight [ ] Others, specify_____

Skills and Aspirations of households

Skills
[ ] Fish culture [ ] Aqua-culture
[ ] Salt making [ ] Fish processing (patis, bagoong, dried fish)
[ ] Vinegar making [ ] Handicraft-making (necklace or bracelet made of shells)
[ ] Nipa shingle [ ] Seedling production
[ ] Wine making (e.g. tuba) [ ] Plantation establishment
[ ] Others, specify_____

Aspiration/Vision in life

[ ] For my children to finish their studies
[ ] Build a concrete house to withstand typhoon and other coastal geohazards
[ ] Food security for my family
[ ] Have our own house and lot
[ ] Have stable source of income
[ ] Good health for my family
[ ] Others, specify_____

ERDB TECHNICAL BULLETIN NO. 3
MBFDP - NURSERY ESTABLISHMENT AND MANAGEMENT

RATIONALE

The Mangrove and Beach Forest Development Project (MBFDP) is intended to rehabilitate and develop mangrove and beach forests in disaster-affected areas as a means to improve and enhance the natural defenses and resilience of the country's coastlines and its environs vis-a-vis the impacts of climate change. **Establishment of a mangrove nursery** is very important in order to provide the required number of mangrove seedlings anytime they are needed without depending on seasonal availability of propagules or wildlings. The seedlings raised in the nursery can be used for planting in degraded areas with the absence of natural planting material. A mangrove nursery enables the production of large numbers of seedlings required to plant larger areas, even if they are found distant to the sources of seeds/seedlings. In effect, nursery-raised seedlings have a higher survival rate compared to directly planted propagules and wildlings due to a well developed root system. Depending on the intended use of seedlings, permanent nurseries are intended for mangrove planting over a period of time. Subsidiary nurseries are areas located at a distance from a permanent nursery while temporary nurseries are generally set up where there is a small area. For the MBFDP, the intention is to initially develop permanent nurseries that can be managed by the community for sufficient maintenance and management of plantation sites under MBFDP.

PREFERRED SITES FOR NURSERY ESTABLISHMENT

1. Relatively flat land
2. Close to freshwater sources
3. Easy transportation access
4. Good drainaige (not waterlogged)
5. Close proximity to planting site

BUILDING THE NURSERY

1. **Site preparation** – The nursery site must be located in an open area to avoid the cutting of trees. If the cutting cannot be avoided, extra care should be exercised in trimming branches to let in more sunlight (Fig. 1).

2. **Seed boxes** – The number of required seed boxes depends on the species to be raised. Materials include: Boards 1 centimeter thick, 10 centimeters wide and at least 2 meters long; plywood (at least 1 centimeter thick) for the box base; and nails.

3. **Seed beds for germination** – For big seeded species like tabigi or piagao, the beds must be raised slightly by about 5 to 10 centimeters above the level of the surrounding area by adding potting soil to each bed or by digging out the soil from the 40-centimeter wide area immediately next to the beds. The soil must be kept from spreading by lining each bed with a wood or bamboo curb. If boards are used, a 2- to 3-centimeter groove must be dug around the bed to slot the board in.

4. **Germination shed** - The germinating shed needs only simple roofing materials like banana or coconut fronds with no walls. Roughly 3 x 5 meters in area, it is constructed by simply putting in four pieces of bamboo with a woven cogon grass roof. Under this roof is a simple bamboo table for the seed boxes. The legs of the table must be placed in cans filled with water to prevent ants and other crawling insects from reaching the seedlings (Fig. 2).

5. **Storage area** – The storage shed, which can be made out of nipa, will be used to store all materials required for a nursery such as dry soil and nursery tools and therefore should be enclosed and locked.

6. **Potting sheds** – This can be made out of nipa shingles, typically not smaller than 3 x 4 meters in area.

7. **Potting media** – This can be a combination of sand and ordinary garden soil. These materials may be brought in by truck and should be staged close to the bagging shed.

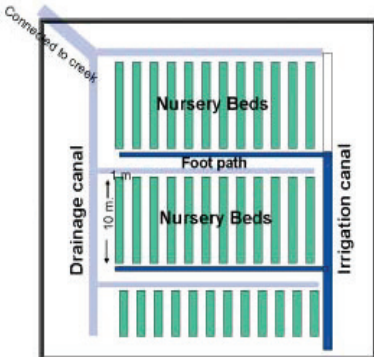


FIGURE 1. IDEAL AREA FOR NURSERY ESTABLISHMENT

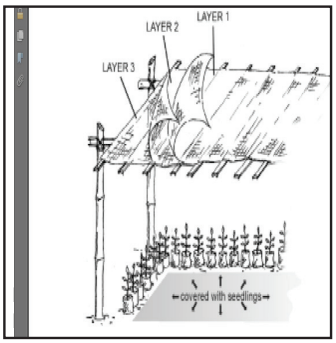


FIGURE 2. A SAMPLE HARDENING BED.

8. **Potted soil** – This should be protected with a roof similar to the potting shed.

9. **Hardening beds** – Hardening beds need not be raised from the ground as long as it is on level ground. Level ground hardening beds require a temporary roof with several layers of (coconut leaves or nipa shingles but typically mesh nets gauge 14 to control the amount of light reaching the seedlings. These beds are 20 to 30 meters long and 1 meter wide; bamboo poles can be used to support the roof. The roof should be at least 1.5 meters above the ground to allow easy access to the seedlings. Hardening beds should be located near the loading area.

NURSERY MANAGEMENT AND OPERATION

After nursery construction, The nursery shall be operated and managed on a daily basis. This requires caretakers to manage the nursery. Typically it takes 4 to 6 months for *Rhizophora* species. For *Avicennia* species, it takes more than a year to grow out seedlings to the point where they can be outplanted (Fig. 3). The typical nursery activities include:

- Collecting and transporting seeds and propagules,
- Propagation practices and maintenance of the seedlings and
- Preparation for outplanting.

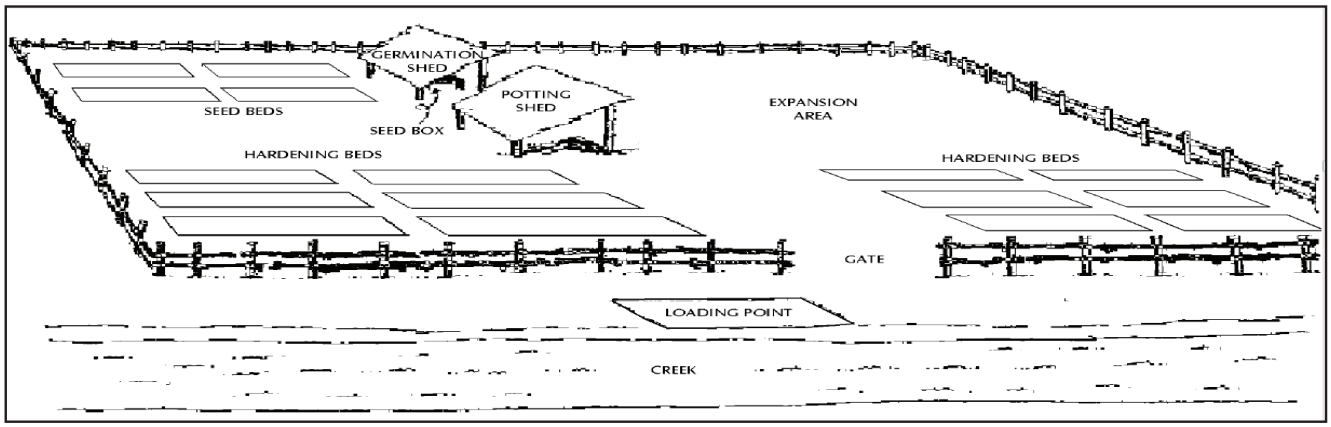


FIGURE 3. A TYPICAL NURSERY LAYOUT. (SOURCE: MELANA, D. M. ET AL. 2000)

Collecting and Transporting Seeds and Propagules

Supply of mangrove seeds and propagules is one of the most important considerations in massive reforestations, especially for less common species such as pototan and bakauan babae, busain, tangal, and tabigi. This is one of the reasons that the monoculture plantation of bakauan bato is very common. Another problem is the large number of seedlings that a mangrove plantation needs about 10,000 to 40,000 seedlings per hectare (at 1 x 1 meter to 0.5 x 0.5 meter spacing) respectively.

Timing of collection – Collecting propagules and seeds at the right time is critical. While collection is possible from some mangrove species almost every month of the year, peak seasons vary by area and date. Knowing the right time to collect the seeds or propagules also makes the operation quicker and more efficient.

Wildlings are uprooted by balling with a spade. For a 10-centimeter wildling, the diameter of the excavation should be approximately 10 centimeters; for a 20 cm wildling, 20 cm; for a 30 cm wildling, 30 cm.

Uprooting wildlings:
- Right after heavy rains
- No direct pulling of plants
- Use leverage: bolo/spade
  For small ones, flat bar for big ones

Use wildlings:
- In the absence of seedlings
- Short nursery time
- Lesser cost

Root/Shoot Pruning:
- Prune leaves by 50% (individual leaf)
- Prune tap

For seeds and propagules, collect only mature and healthy propagules (Tables 1 & 2).

Table 1. Maturity indicator of propagules of mangrove species.

Species/common name	Color	
	Immature	Mature
Avicennia marina (Bungalon)	green	Yellowish fruit skin
Rhizophora apiculata(Bakauan lalaki)	Dark green	Pale to red brown
Rhizophora mucronata (Bakauan babae)	Dark green	Pale green
Ceriops tagal (Tangal)	green	Pale to red brown
Sonneratia caseolaris (Pedada)	Pale green	Dark green
Lumnitzera racemosa (Kulasi)	green	Red brown
Heritiera littoralis (Dungon late)	green	Brown
Xylocarpus sp.	green	Brown
Aegiceras sp.	green	Pink

Source: Melana and Gonzales, 2000; Hoang Van Thoi and Pham Trong Thinh. 2010.

Table 2. Best collection time for selected mangrove species (adapted from Palis et al. 1988)

SPECIES	Climatic Type*1	Climatic Type 2	Climatic Type 3	Climatic Type 4
Bakauanbato	Jan. & May	Feb.-July	Feb.-April	Jan. & Feb.
Bakauanbabae	Oct.-Dec.	Jan-Aug.	April-June	Jan.-Feb.
Bakauanlalaki	Aug. & Sept.	Feb. & March; April-June	March & April	Jan. & March; May & June
Tangal	May	Jan. & Feb; May	May; Nov.& Dec.	**
Busain	Jan.; Oct.-Dec.	Jan. & Feb.; May -July	Feb. & May	May-Aug.
Pototanlalaki	Jan.-May; Oct.	May	April-June	**
Api-api	Jan.-Feb.; May & July	Jan. & Feb.; June-Aug.	**	August
Bungalon	April-July; Nov. & Dec.	Jan.; May-Oct.	Jan. & March	Jan.– Oct.
Pagatpat	Aug.-Nov.	Jan.	Feb.-March	Jan.-March
Tabigi	Aug.-Nov.	Jan.-Aug.	Jan.-April	March

*Climate type refers to rainfall pattern. Type I - Two pronounced seasons; dry from November to April, and wet during the rest of the year. Type 2 - No dry season. Very pronounced rainfall in November. Type 3 - Seasons are not very pronounced. Relatively dry from November to April and wet during the rest of the year. Type 4 - Rainfall more or less evenly distributed throughout the year.

**months not identified in this climatic type

Sorting, Packaging and Transport of seeds and propagules

Sorting. Materials should be inspected carefully to see whether it is mature, healthy, and free of pest and diseases damage and physical injury.

Packaging:

- Wildlings must be filed in bunch by size in 50s/100s
- Roots must be covered with thin, wet mud
- Roots must be wrapped with newsprint/used cloths
- 3-4 bunches on banana folded leaf sheets, whose ends are at the same height with wildlings, should be placed.
- For short distance collection – wildlings must be placed in an enclosed big plastic bag to maintain soil moisture
- Wildlings like propagules should also be packed in groups of 50 or 100 in a folded banana leaf, palm sheet, or gunny sack to protect plants from the sun while in transit.

Recommended storage of some seeds/propagules:

- *Avicennia marina* 4 – 6 days under moist conditions in plastic bags
- *Aegiceras corniculatum* 15 days
- *Sonneratia sp, Heritiera* 4 weeks
- *Xylocarpus* sp. 2 months
- *Rhizophora* propagules can be stored in plastic bags for 40 - 45 days under moist and shady conditions

Transport

- Wildlings must be placed on shaded places
- Wildlings must be piled properly
- Wildlings in banana leaf sheet could be piled on top of the other in case of limited space.

Propagation Techniques

Potting media preparation – Root development is enhanced when the potting soil is porous. Sandy-loam soil that is high in organic matter or compost mixed with cured sawdust or rice stalks should be utilized. The soil and organic matter should be pulverized, screened, and thoroughly mixed. A ratio of 50:50 is best. Potting soil should always be prepared in advance to avoid unnecessary delays in potting which can result in high seedling mortality, especially for wildlings. Thus, it is a good idea to prepare potting soil of several cubic meters.

Germination techniques – Mangrove plantations in the country are in monoculture. This is due to abundant supply of propagules all year round.

Bakauan, tangal and busain groups - These species have viviparous seeds or propagules that are sown or planted directly in the field and have a high survival rate in areas which are generally not exposed to strong waves. In cases where there is a need for nursery raised seedling, the species may be germinated in plastic bags.

Pagatpat group (pagatpat/pedada) – Pagatpat has big potentital for reforestation due to its wide range of habitat from the seaward side and high salinity to the landward portion. The boomerang-shape of seeds are planted or sown in assed box with sandy soil. Seeds are then covered with a thin layer of soil and watered daily with brackish water. For early and uniform germination, soak the fruit in fresh water for 7 days and sow the macerated seeds in depressed seed bed.

Tabigi group – its big angular seeds are germinated in seed beds or potted directly.

A**pi-api group (api-api, piapi, bungalon and bungalon puti)** – This group is considered semi-viviparous because of its emerging radical and split seed coat while still attached to the mother tree. It is the easiest to germinate, either in seed beds or directly in bags. Seeds are sown in upright position half buried with emerging leaf or the cracked portion of the seed at ground level.

Nursery care

- Wildlings must be immediately potted upon arrival in the nursery
- Plants must be placed under 100% shades for 2-3 days then gradual exposure to 40% shade in 2 weeks
- Regular watering should be done until hardening
- Hardening – full sunlight and reduced watering

Protection from pests, diseases and stray animals

- All trash, bottles, plastic and other garbage must be removed from the surroundings.
- The grass and weeds must be kept short.
- Weeds from nursery bags should be pulled. Weeds harbour pests and diseases.
- Diseased plants from the nursery must be removed so as not to spread the disease.
- Air should be allowed to circulate freely in the nursery. Poor air circulation promotes ocurrence of diseases.

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ERDB TECHNICAL BULLETIN NO. 4
MBFDP - MANGROVE FOREST ESTABLISHMENT AND MANAGEMENT

RATIONALE

The Mangrove and Beach Forest Development Project (MBFDP) is intended to develop and rehabilitate mangrove and beach forest in disaster-affected areas as a means to improve and enhance the natural defenses and resilience of the country's coastlines and its environs vis-a-vis the impacts of climate change.
Mangrove species are distributed in the swamps in distinct zonation patterns as influenced by salinity, tidal fluctuations, waves and water current; soil properties, water and soil salinity and plant morphology. Proper mangrove establishment and management is required to keep the efficiency of both the nursery and the potential plantation in terms of survival. Specifically, certain mangrove species are suited for one or more zones and varying environmental conditions.

As soon as the site for rehabilitation has been identified, the target sites must be delineated and mapped out on a scale of 1:10,000, where boundaries (natural, political, and administrative, location of passages, blocks, etc.) and coordinates are well-identified.

WHERE TO PLANT MANGROVES

- Areas previously occupied by mangroves with remnant mangrove individuals
- Areas exposed during low tide of neap tide
- Near or at the edge of a river in places affected by tide
- Areas not exposed to strong winds and wave actions
- Areas devoid of seagrasses and barnacle infestation
- Secondary growth, sparsely vegetated areas and abandoned fishponds with clearance from proper authorities for reforestation or enrichment planting.

Table 1. Zonation pattern and site species matching of mangrove plants. (Agaloos, BD. 1994)

Zone	Tidal regime	Soil types	Species recommended for planting
Seaward	Daily, including neap tides	Coral rubble, sandy, sandy loam	*Avicennia marina* (bungalon); *Sonnaratio alba* (pagatpat); *Rhizophora stylosa* (bakauan bato); *R. apiculata* (bakauan lalaki)
Middle	Daily except during neap tides	Silty to silty clay	*Avicennia alba* (bungalon puti); *A. officinalis* (api-api); *Rhizophora apiculata* (bakauan lalaki); *R. mucronata* (bakauan babae); *Aegiceras floridum* (tinduk-tindukan); *A. corniculatum* (saging-saging); *Bruguiera gymnorrhiza* (busain)
Landward	Inundated only during spring tides	Silty to silty-clay to clay	*Bruguiera sexagula* (pototan); *Ceriops tagal* (tangal); *C. zippeliana* (malatangal); *Excoecaria agallocha* (buta-buta); *Lumnitzera racemosa* (kulasi); *Nypa fruticans* (nipa)
Riverine: (Rivermouth and upstream forebank/ backbank)	Variable inundation brackish/ freshwater influence	Sandy to silty-clay to clay	Rivermouth: *Avicennia alba* (bungalon puti); *A. marina* (bungalon); *Aegiceras floridum* (tinduk-tindukan), *A. corniculatum* (saging-saging); *Rhizophora mucronata* (bakauan babe); *R. apiculata* (b. lalaki); *R. stylosa* (b. bato) Upstream : *Avicennia alba* (bungalon puti); *Aegiceras floridum* (tinduk-tindukan); *A. corniculatum* (saging-saging); *Bruguiera cylindrica* (pototan lalaki); *B. gymorrhiza* (busain); *Nypa fruticans* (nipa); *Rhizophora mucronata* (b. babae); *R. apiculata* (b. lalaki)

SITE PREPARATION

- The site must be cleared of debris such as stumps, tree branches, other unwanted vegetation and solid wastes to avoid injury of the young plants as tide recedes.
- The whole plantation area should be divided into compartments with size manageable by a planter (i.e. 20 m x 30 m) and 10 m for the passage of bancas/boats.
- Re-establishment of tidal flow by breaking dikes and other similar structures that block the natural flow of the tide in the areas to be planted.

COLLECTION, HANDLING AND TRANSPORT OF SEEDLINGS

- Collect mature *Rhizophora* spp. propagules with at least 1cm long ring like mark (abscission layer) below the pericarp.
- Mature propagules may be collected by climbing the mother tree, or by reaching out to the underneath canopy.
- Propagules must be collected from places with similar climatic and edaphic conditions as the planting sites.
- Collected propagules should be bundled in 50s or 100s to facilitate transport. They must be placed inside sacks which should be kept cool/open at all times. In transporting, the propagules must be kept in horizontal position and protected from heat.

PLANTING DESIGN

While the number of seedlings to be planted per hectare must be determined, actual planting should be done in random, irregular intervals to mimic the natural distribution of individuals in each zone.

Cluster planting

- Cluster planting is highly recommended in areas seaward zone areas.
- To maximize survival, spacing is much closer (25 x 25 cm) between *Rhizophora stylosa* propagules/seedlings of *Sonneratia alba* and *Avicennia marina*.
- Each cluster has a dimension of 5m x 5m containing 400 *Rhizophora stylosa* propagules per cluster.
- Distance between clusters is approximately 19 meters.
- A hectare can accommodate 25 clusters.

FIG. 1. CLUSTER PLANTING METHODS. (MELANA, ET. AL. 2000)

Advantages:

- Increased survival rate compared to standard planting
- More open space for gleaners and push nets
- Evenly distributed seedlings/propagules in the planting site

Strip planting:

- Strip planting is a common practice in plantation development.
- Strips (10 or 20 x 100 or 150 meters) are established 100-200 meters from the shore at very close spacing to withstand strong waves.
- Once established, the open areas between the bakauan strips and shoreline may now be planted at a wider spacing

SEEDLING DENSITY AND SPACING

- Spacing can range from 16 individuals per square meter to 1 individual per square meter.
- The closer the spacing, the greater the ability of the propagules to withstand wave impact.
- Inner sites along the seafront and in abandoned ponds with little wave action can be planted at 1.5-2m intervals.
- Spacing maybe widened to reduce competition for sunlight and nutrients.
- Deciding on the spacing will help to determine what the total requirement for your seedlings will be.
- Seaward sites exposed to frequent wave action and debris brought by incoming tide need to be planted at closer intervals of 0.5-1m and/or in clusters of 2-3m of 2-3 seedlings each.
- The planting of seedlings must be offset in consecutive rows so that the columns appear in zigzag pattern, avoiding uniformly empty rows between rows of plants.
- For *Avicennia* species, Seedlings/wildlings must be planted into the mud, or holes previously prepared at a depth of 6 cm. The holes must be filled with soil to protect the seedlings from toppling.

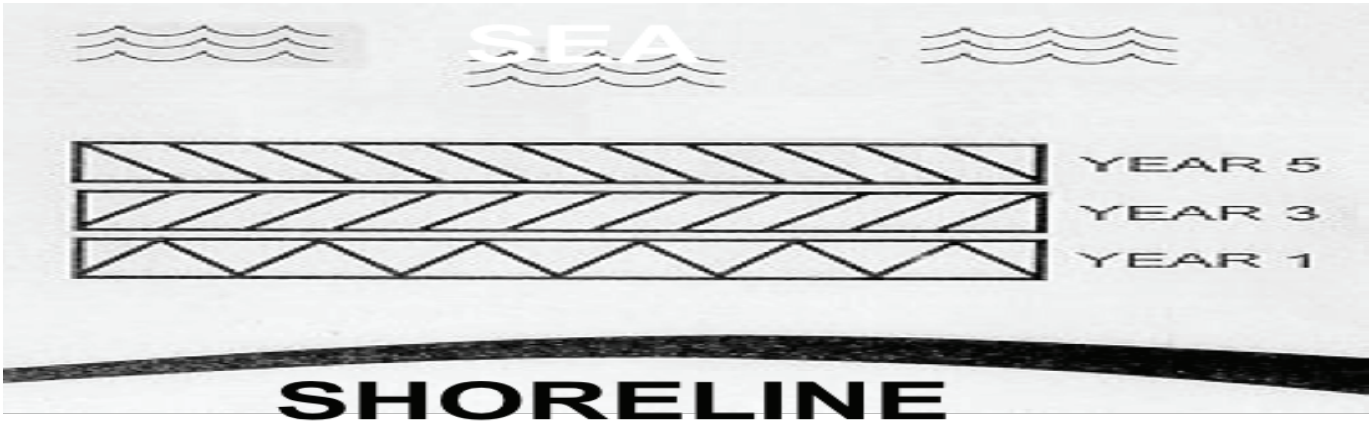

FIG. 2S. STRIP PLANTING METHODS (MELANA, ET. AL. 2000)

- Regular visits must be conducted daily for the first month.
- Debris that might hamper the growth of the seedlings must be removed.
- Dead seedlings must be replaced to maintain the spacing of the plants.
- Plantation must be enclosed with fence to prevent debris and stray animals in damaging the plants.
- Barnacles and other pest must be removed.

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ERDB TECHNICAL BULLETIN NO. 5
MBFDP - BEACH FOREST ESTABLISHMENT AND MANAGEMENT

RATIONALE

Beach forest species enhance the natural defenses and resilience of the country's coastlines and its environs vis-à-vis the impacts of climate change. FAO (2005) provides that this type of forest is found above the high-tide mark on sandy soil and may merge into agricultural land or upland forest. Sand dune and beach vegetation are mostly shrub-like with a high presence of stunted tree growths. These coastal forest ecosystems are adapted to growing conditions that are often difficult as a result of edaphic or climactic extremes such as strong winds, salinity, and a lack or excess of humidity. They are very sensitive to modifications of the ecosystem. A slight change in the groundwater level for example might eliminate the existing shrub vegetation.

Beach forests have not been given much attention given its nature of being part of coastal areas that are often private lands and cultivated. Its inclusion in forestry activities are limited to the 20-meter easement zones designed for shoreline protection. The protective role of beach forest species have been highlighted as it occupies areas where there are no mangroves serving as a first line of defense for the coastal areas. It can withstand strong waves, rocky substrates, and barnacle infestations among others. Beach forests serve as a natural barrier from storm surges, while arresting sedimentation of sea grasses and corals.

Beach forest rehabilitation includes two groups of beach forest species: a) the traditional beach forest species (TBFS) like agojo, bogo, dapdap; and b) the mangrove associate species (MAS) like bani, bitaog, and talisay. The two groups need to be differentiated because the former is not tolerant to sea-water intrusion while the latter is. This means only MAS should be planted within the first 10m of the easement zone. The marked distinction between the traditional beach species and the mangrove associates provides an easy guide on what to plant along the 20m easement zones.

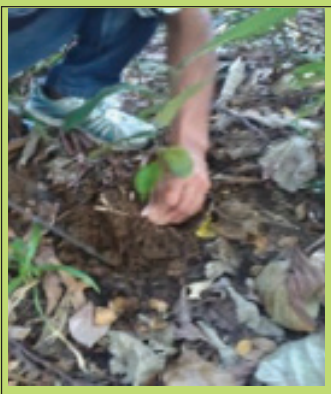
The success of plantation establishment largely depends on the kind of nursery operation that produces high quality seedlings at the least cost and at the earliest possible time. To produce quality seedlings, all nursery activities must be properly and efficiently done. This includes: using the right mix of potting soil for rapid development of the root system; proper seed/wildling collection from healthy mother trees for higher germination percentage; appropriate shading on the seedling beds; seedling care and hardening

SEEDLING PRODUCTION

- Seed collection/germination – Collect mature and healthy seeds for germination. Tiny, winged seeds like agoho, should be germinated on seed box with extra fine sand, sterilized, if possible, with seed box protection from ants. Use fungicides as agoho is highly susceptible to damping-off. Other tiny seeds need no treatments (dita, batino, bogo). Big seeds (banalo, bani, bitaog, butong, kalumpang) may be sown directly on plastic bags or on a seed bed.
- Wildling collection – In case of limited seedlings, wildlings may be used provided quality standards are followed. Following the procedure in mangroves: ready pots before collection; observe extra care in uprooting, packaging and transport; leaf/root pruning; and immediate planting in the nursery (Figure 1).
- Pot wildlings in 4cm x 6cm plastic pots with ordinary garden soil plus saw dust.
- Potted wildlings should be placed under full shade (100%) for the first three days for fast recovery. Shade is gradually reduced up to one half (50%) within two weeks.
- Conduct maintenance activities such as regular watering, weeding and segregation of overtopped seedling from the seedling bed for recovery.
- Seedling segregation – Overtopped seedlings in the nursery is very common, resulting in slow death of seedlings unless rehabilitated early. Seedlings in the seedling beds may look robust but underneath are 10-20% suppressed plants that needs immediate rehabilitation. The segregated seedlings — filed in two rows, four inches apart to accommodate more sunlight — will be watered with an organic fertilizer solution for fast recovery.
- Hardening – The seedlings are totally exposed to sunlight with watering gradually reduced before out-planting. The seedling must be really well-hardened to withstand the strong wind and intense heat of beach areas (2-6 weeks).

PLANTATION ESTABLISHMENT

If nursery establishment affects the success of the plantation, the various planting practices have a direct effect on the quality and survival rate of the plantation. In other words, no matter how good the nursery operation was, if planting practices are not properly done, the plantation may be at risk from factors such as stunted growth and low survival rate -- especially in beach areas, which are generally sandy and nutrient deficient.



Uprooting of wildling with leverage using bolo to minimize root damage.

Puddling of wildling with moss or wet newsprint to avoid root dehydration.

Placing wildling bundle on a cross banana leafsheet before folding.

Wildlings on a banana leafsheet pack ready for transport.

FIGURE 1: WILDLING COLLECTION AND PACKAGING.

Mapping and delineation

As soon as the site for rehabilitation has been identified, the target sites must be delineated and mapped out on a scale of 1:10,000, where boundaries (natural, political, and administrative, location of passages, blocks, etc.) and coordinates are well-identified.

Why plant beach forest species?

- They serve as the first line of defense against tsunamis and storm surges in areas with no mangroves.
- Beach areas are much longer than mangroves.
- Beach forests arrest sedimentations of sea grasses and corals.

Where to plant?

- Within the 20m of the easement zone.
- Within the 40m of the easement zone in cases where the area is timberland.

What is an easement?

- A right of an individual or entity to trespass a land not his own.

What is an easement zone?

- An easement zone is government land along a beach and riverbank indicated by dotted lines in the land tile and allows a title holder to use the area if the government is not yet using the said area.
- PD 1067, Art. 51, states that the easement zone along the shore is 20m, (40m if timberland), from the highest tide. In rivers and urban creeks they are 20m and 3m, respectively.

What to plant?

- Use MAS within the first 10m of the easement zone. MAS tolerates sea-water intrusion.
- Use TBFS behind the MAS. TBFS is not tolerant to sea-water, and may die when inundated (Table 1).

How to plant?

- Multi- storey – mixed planting of fast and slow growing species. First three rows of MAS: bitaog, balu, banalo and TBFS: agoho, dita, bogo at the back of MAS (Figure 2).
- Phase planting – use of creepers/vines: Ipomea pes capre at Year 1, brushes (sea lettuce) at Year 2 and MAS/TBFS at Year 3.

Yr 1- vines/creeper
Yr 2- shrubs
Yr 3- trees

Use of large planting materials (LPM), O.5m, up.

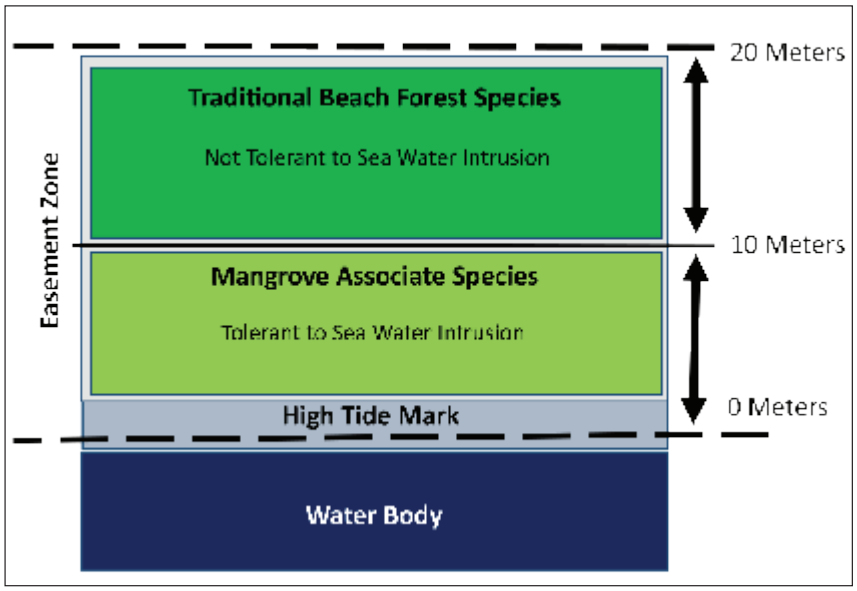


FIGURE 2: BEACH FOREST PLANTING LAYOUT.

Site Preparation/Planting

- Staking
- Strip brushing (2m x 2m spacing) or spot clearing of 1m diameter (4m x 4m).
- Hole-digging, 1cu.ft.
- Hauling/planting.
- Mulching, 3-4 inches thick topped with stones to avoid being windblown.
- Acclimatization — 2-3 weeks before outplanting
- Use tree guard

Table 1. Recommended Beach Forest Species.

Species	Characteristics	Uses
Agoho (*Casuarina equisetifolia*)	Fast Growing Nitrogen-Fixing Trees (FGNFT)	Timber, tool handle, medicinal
Akleng-parang (*Albizia procera*)	FGNFT,	Timber, firewood
Antipolo (*Artocarpus blancoi*)	Cylindrical bole, fast growth,	Food, fodder, timber
Batino (*Alstonia macrophylla*)	Prolific seeders, 2-3 times a year	Woodcraft, timber, ornamental
Balinghasay (*Buchanania arborescens*)	Prolific seeders	Woodcraft
Bakong (*Pandanus dubius*)	Spreading prop-roots	Mat making
Bogo (*Garuga floribunda*)	On rocky soil, flaking bark, prominent buttress.	Timber, propagated by cuttings
Camachile (*Pithecellobium dulce*)	FGNFT	Food, firewood, tannin
Dapdap (*Erythrina variegata*)	Red flower	Ornamental
Dita (*Alstonia scholaris*)	Horizontal branching	Ornamental, medicinal
Duhat (*Syzygium cumini*)	Sturdy trunk	Timber, food,
Kalumpang (*Sterculia foetida*)	Fast growth	Live fence, fodder
Katmon (*Dillenia philippinensis*)	Dense foliage	Ornamental, food
Malabog (*Parishia malabog*)	Cylindrical bole on rocky shores	Timber
Malambingan (*Broussonetia luzonica* var. *glabra*)	Himbabao look-alike, fruit bat favorite	Timber
Molave (*Vitex parviflora*)	Trifoliate leaves	Furniture, hard wood
Pandan Dagat (*Pandanus tectorius*)	Prop roots	Mat making
Tabon-tabon (*Atuna racemosa*)	Wide, low crown, dense foliage	Spice (kinilaw condiment)
Talisay Gubat (*Terminalia foetidissima*)	Towering tree, horizontal branching	Timber

Table 1. Recommended Beach Forest Species (continuation).

Species	Characteristics	Uses
Bani (*Millettia pinnata*)	Wide spaced branchin , sparse foliage, allows more sunlight for underplants	Medicinal
Balu (*Cordia subcordata*)	Fast growing, big bright yellow flower	Bast fiber, ornamental
Balitbitan (*Cynometra ramiflora*)	Pinkish to whitish pendulous shoots	Ornamental
Banalo (*Thespesia populnea*)	Propagated by rooted stem cutting dense foliage	Woodcraft, bast fiber
Bitaog (*Calophyllum inophyllum*)	Sturdy trunk, solid crown, extra	Ornamental, timber, medicinal
Botong (*Barringtonia asiatica*)	Wide crown, dense foliage	Ornamental, medicinal
Dungon-late (*Heritiera littoralis*)	Backmangroves, clay substrate	Spice (kinilaw) timber
Ipil (*Instia bijuga*)	Backmangroves, sandy-clay soil	Luxury lumber
Mala-piagau (*Xylocarpus rumphii*)	Multiple stems	Timber
Malubago (*Talipariti tiliaceum*)	Dense, creeping branches	Bast fiber, live fence
Boto (*Scaevola taccada*)	Propagated by stem cutting	
Talisay (*Terminalia catappa*)	Wide crown, horizontal branching	Shades, timber
Shrubs and Vines		
Pataning dagat (*Canavalia maritima*)	Creeper with developing roots in nodes, sand benders	Sand stabilizer
Lagaylay (*Ipomoea pes-caprae*)	Perennial vine/creeper	Sand stabilizer

Source: Palis, H.G. 2013. Handbook of on the Identification of Beach Plants in the Philippines; Primavera, JH and R. B. Sadaba. 2012. Beach Forest Species and Mangrove Associates in the Philippines.

CARE AND MAINTENANCE

After raising high quality seedlings in the nursery and planting them in a harsh environment like beach areas, extra care and maintenance are necessary for the newly planted seedlings to survive the first onset of the dry season through the following interventions:

- Regular ring weeding/as needed, (05. radius).
- Monitoring for stray animals.
- Maintain mulching.
- Maintain tree guard

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State of the Mangrove Summit: Southern Luzon
1 -2 October 2015 | Faber Hall 302, Ateneo de Manila University

Background and Rationale

In the wake of the destruction left by Super Typhoon Yolanda, building natural coping mechanisms against climate change becomes more crucial as the world experiences the new "normal." This is especially significant for coastal inhabitants. Among these coping mechanisms, mangroves have proven to be life savers, protecting coastal dwellers and their livelihoods from storm surges and sea level rise (**see for example McIvor et al., 2013**). A press release by the **United Nations Development Program** entitled "Mangrove restoration saved our lives and our economy, says villager in Northern Samar, Philippines," published 13 November 2013, is just one of the many testaments to the value of mangroves. In the article, a resident of Northern Samar was quoted as saying, "Had we not protected the mangrove trees against illegal cutting and had we not planted the areas surrounding the fish farms, the super typhoon would have destroyed everything that the poor fisherfolk established."

The Role of Mangrove Systems

Mangroves perform several important ecological and socio-economic services. These plants do not only serve as protection against storms and strong waves, they are also habitat to marine organisms of commercial value (fisheries), residence to many threatened and endangered species, and can also be aesthetic and tourism areas (e.g. sport fishing, boating, bird watching, snorkeling). Mangroves may also serve as sources of fuel, wood and medicine (**Hogarth 2007**). In addition, mangroves are known to be an efficient sink of atmospheric CO2 and as such, play an important role in mitigating the impacts of climate change (**Chmura et al 2003**).

Like other coastal ecosystems, mangroves are threatened by both natural and human- induced stresses. Among these stresses are the occurrences of typhoons, pollution, siltation, land reclamation (e.g. wharf, pier, human settlement, etc.), obstruction of dikes and structures of waterways, tidal inundation, harvest of timber and fishery products, and conversion to fishponds (**Alongi 2009**). The latter appears to be the most significant factor, causing the decline of mangrove forests not only in the Philippines but also in Southeast Asia, where 40% of world's mangroves are located.

The loss of mangrove forests will result in the reduction in biodiversity and species richness that will lead to the reduction or loss of valuable ecosystem services naturally rendered by mangroves (**Duke et al. 2007**). Without mangroves, environmental catastrophes such as flooding, typhoons, coastal erosion and landslides will have more severe impacts on humans. With coastal development replacing mangroves and other coastal vegetation, humans are becoming more vulnerable to ecological disasters (**Danielsen et al. 2005**; **Kathiresan and Rajendran 2005**). Unless properly conserved or managed, the loss of mangroves will result in less stable coastal environments. The capacity of planted mangroves to effectively restore forest cover and function as a carbon sink largely depends on its growth performance. Unfortunately, there are very few monitoring reports on the success or failure of mangrove planting programs in the Philippines.

Mangroves in the Philippines: Southern Luzon

Out of the 255,448.85 hectares of mangroves left in the Philippines (Long and Giri, 2011), 94,549.86 ha (37%) is found in Mindanao, 51,547.98 ha (20.18%) in Visayas and 109,351.01 ha (42.81%) in Luzon. Of the mangrove forests found in Luzon, more than half are in the western side of Southern Luzon, namely in the provinces of Cavite, Batangas, Oriental Mindoro, Occidental Mindoro, Marinduque, Romblon, and Palawan. These provinces belong to parts of the West Philippine Sea and Visayan Sea biogeographic regions.

The island province of Palawan alone accounts for 22.23% of mangrove forests of the whole country and includes several key marine biodiversity areas for mangroves, such as Puerto Princesa Bay, Balabac Island, Pandanan Island, Calamianes Group of Islands, El Nido, and Malampaya Sound. Also located within the Southern Luzon region is the Verde Island Passage Marine Corridor, which has a wealth of coastal and marine resources, including highly diverse coral reefs, seagrass beds, and mangrove forests. Despite the extent and diversity of mangroves in the region, they are still threatened by natural and anthropogenic hazards. These areas are highly vulnerable to typhoons, tsunamis, storm surges, and sea level rise. In addition, unsustainable coastal development and land use practices also contribute to the destruction of mangrove forests in the area.

In response, most provinces regularly conduct mangrove-planting activities. However, planting sites are usually along the shoreline using species from the genus *Rhizophora* (Salmo and Duke 2010). Thus, survival rate is low, usually attributed to wrong species-substrate matching, and the inappropriate location and timing of planting. Similar to most mangrove rehabilitation programs in the country, most mangrove planting activities in the region are more of afforestation (which affects the nearby habitat – seagrass bed and mudflats) rather than reforestation of denuded mangrove areas. The planted stands are usually mono-specific (Walters 2004; Lewis 2005; Primavera and Esteban 2008) with stunted growth and poor survival (Samson and Rollon 2008).

The Need for a Mangrove Summit

The Mangrove Summit will serve as a platform for each province to share data on the extent of their mangrove forests as well as their practices in managing these resources. Taking-off from the success of the 1st State of the Mangroves Summit held for provinces in Northwestern Luzon, succeeding summit will be held in the remaining areas of Luzon, t be followed by Visayas, and then Mindanao. These will all lead to a bigger national summit on mangroves to take place on a regular biannual basis, and serve as an initial step towards the formulation of a national plan of action to enhance mangrove management in the vountry.

Summit Objective

The proposed **State of the Mangroves Summit: Southern Luzon** aims to complement the State of the Coast Reports of the UP Marine Science Institute by opening up the stage for provinces across the Philippines to discuss the status of mangrove forests in the country.

Specifically, the summit aims to accomplish the following objectives:

1. Provide avenue for provinces to share and discuss the status of mangrove forests in the Philippines, especially in the light of climate change vulnerability;
2. Invite experts in the field of mangrove ecology and management, climate change vulnerability, and blue carbon sequestration to share state of the art knowledge to enrich the workshop and action planning
3. Consolidate “more” accurate data from each province; and
4. Come up with a plan of action to enhance mangrove management.

Summit Design

Participants
Two (2) representatives will be invited from the provinces of Cavite, Batangas, Oriental Mindoro, Occidental Mindoro, Marinduque, Romblon, and Palawan and from the Regional Offices of the Department of Environment and Natural Resources in the National Capital Region, and Regions IV-A and IV-B. In addition, representatives from the academe, non- government organizations and national government agencies such as the Biodiversity Management Bureau of DENR (DENR-BMB), Bureau of Fisheries and Aquatic Resources (DA-BFAR) of the Department of Agriculture, Commission on Higher Education (CHED), and Department of Science and Technology (DOST).

A total of fifty (50) guests are expected to attend the summit.

Appendix I continued...

Day 1	
8:30 AM	**Registration**
09:30AM	**Welcome Remarks** John Paul C. Vergara, PhD *Vice President for the Loyola Schools – Ateneo de Manila University* Mr. Enrique A. Nunez, Jr. *Country Executive Director* *Conservation International – Philippines*
10:00 AM	**Summit Introduction and Overview** Dr. Severino G. Salmo III *Assistant Professor, Department of Environmental Science* *Ateneo de Manila University*
10:30 AM	**Status of Mangroves and Mangrove Management in the Philippines** Carmelita I. Villamor *Supervisor Scientific Research Specialist/ OIC-Chief* *Coastal Zone and Freshwater Ecosystems Research Division* *Ecosystems Research and Development Bureau* **State of mangrove research and management in the Philippines: challenges and opportunities** Dr. Miguel D. Fortes *Professor (ret.)* *The Marine Science Institute, University of the Philippines*
11:30 AM	**Open Forum**
12:00 NN	**Lunch Break**
01:00 PM	**Presentation and Update of Mangrove Status per Province**
04:30 PM	**Synthesis** Dr. Severino G. Salmo III *Assistant Professor, Department of Environmental Science* *Ateneo de Manila University*
06:00 PM	**Welcome Dinner**

Appendix I continued...

Day 2	
8:30 AM	**Day 1 Synthesis and Workshop Introduction** Abigail Marie T. Favis *Instructor, Department of Environmental Science* *Ateneo de Manila University*
9:30 AM	**Mangrove Mapping in Southern Luzon** Alvin B. Baloloy, Senior RS/GIS Research Associate *CCC-RAPID Natural Resource Assessment* *Department of Engineering, University of the Philippines, Diliman* Al Jayson Songcuan *Senior Research Assistant* *Coral Reef Visualization and Assessment (CORVA)* *Department of Engineering, University of the Philippines, Diliman*
11:30 AM	**Resiliency and vulnerability of the coastal zone against sea level rise** Dr. Samuel Mamauag *The Marine Science Institute, University of the Philippines* **Incorporating Mangroves in Integrated Coastal Management** Dr. Porfirio M. Aliño *Deputy Director for Research* *The Marine Science Institute, University of the Philippines* **Open Forum**
12:00 NN	**Lunch Break**
01:00 PM	**Blue Carbon Initiatives in the Philippines** Ma. Josella Pangilinan *Project Manager – Ecosystem-based Adaptation to Climate Change* *Conservation International – Philippines*
01:20 PM	**Workshop Proper** **Action Planning and Recommendations**
04:30 PM	**Summit Synthesis and Closing** Dr. Severino G. Salmo III *Assistant Professor, Department of Environmental Science* *Ateneo de Manila University*
06:00 PM	**Dinner**