App.Table-32 Measurement value of average crown diameter and crown density

(Independent variables and Dependent variables in the regression estimate)

Plot No.	Forest types (Stratum)	Volume Y	Average of crown diameter	Grade of crown diameter (X_1)	Grade of crown density (X_2)	$X_t = X_1X_2$
1	3.1(1)	448.38	6.44	1	5	5
2	3.1(2)	333.21	9.58	2	4	8
3	3.1(2)	283.06	8.35	2	3	6
4	2.1(1)	273.74	7.59	2	4	8
5	2.1(1)	186.21	6.73	1	2	2
6	3.3(3)	505.31	11.30	3	4	12
7	3.1(2)	555.35	9.60	2	5	10
8	5(2)	275.18	10.14	3	3	9
9	5(2)	392.31	9.34	2	4	8
10	5(2)	441.44	9.94	3	3	9
11	5(4)	453.87	11.50	3	3	9
12	5(2)	454.10	8.26	2	4	8
13	5(2.EX)	129.11	6.72	1	3	3
14	5(2.EX)	264.04	8.74	2	3	6
15	3.2(2)	180.96	8.06	2	2	4
16	3.5(1)	489.04	7.26	2	5	10
17	3.2(2)	570.57	8.87	2	5	10
18	3.1(1.EX)	260.46	7.39	2	3	6
19	5(2.EX)	227.03	9.85	2	3	6
20	5(2)	325.98	8.06	2	4	8
21	2.2(1)	319.03	5.78	1	5	5
22	3.3(3)	577.59	11.42	3	5	15
23	3.3(3)	691.26	12.77	3	5	15
24	3.2(2)	350.86	7.52	2	4	8
25	3.2(2)	257.67	9.40	2	3	6
26	3.3(3)	564.54	11.42	3	5	15
27	5(2)	488.39	8.60	2	4	8
28	5(2)	244.44	8.06	2	3	6
29	5(4)	351.14	11.42	3	3	9
30	5(4)	565.92	12.36	3	4	12
31	5(4)	387.67	12.09	3	3	9
32	3.1(2)	412.17	7.39	2	4	8
33	8	129.81	5.24	1	2	2
34	5(2.EX)	327.23	9.41	2	3	6
35	2.2(1)	226.51	5.38	1	4	4
36	3.2(2)	294.98	7.48	2	3	6
37	8	220.49	5.28	1	3	3
38	3.5(1)	567.52	7.22	2	5	10

App.Table-33 Sampling number of large sample plots by stratum

Stratum	Sampling number of large sample plots n'	Average of interpreted value $\bar{X}'_h$
2.1(1)	10	3.9
2.2(1)	10	4.3
2.2(1.EX)	5	2.0
3.1(1)	5	6.0
3.1(1.EX)	5	2.8
3.1(2)	10	8.0
3.1(2.EX)	5	3.4
3.2(2)	10	6.4
3.2(2.EX)	5	3.6
3.3(3)	10	13.3
3.3(3.EX)	10	3.9
3.5(1)	10	9.0
5(2)	20	7.9
5(2.EX)	20	4.7
5(3)	10	9.0
5(4)	10	10.4
5(4.EX)	2	4.0
8	10	2.4
Total	167	

Notes : Average of interpreted value($\bar{X}'_h$) is average within strata of the product of average crown diameter grade (X_1) and crown density grade (X_2).

Front

PLOFILE DESCRIPTION SHEET(Sample)

Soil Profile

SKN

ACf (Ferric Acrisols)

1bc

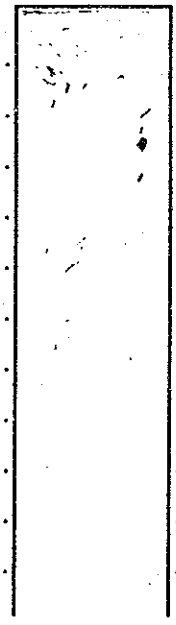
Bukit Sawat No 2. stock No 9

Profile No. 19	Location Bukit Sawat Plantation Area	Date 10. Sept. '92	Weather ① ⓞ	Surveyor H. TAKATOH
Land form Steep terrain		Elevation 44 m	Slope 25°	Land use or Vegetation clear cut after planting (A. mangium)
Parent Material Sand Stone Shale	Drainage good	Moisture Condition dry		Groundwater table (m)

		I	II	III	IV	V	VI
1. Horizon symbol		OF(AE)	II AB(E)	III B	IV Bs	V Bs	VI
2. Depth of top and bottom of horizon		0 - 2	2 - 6	6 - 16	16 - 80	80 -	-
3. Boundary of horizon		a (c) g d	a c (g) d	a c (g) d	a c (g) d	a c (g) d	a c g d
4. Form of boundary		s (w) i b	s (w) i b	s w (i) b	s w i b	s w i b	s w i b
5. Colour	· wet	2.5YR 5/3	2.5YR 5/4	10YR 7/6	10YR 7/8	7.5YR 7/8	
	· dry						
6. Mottling	· abundance	f c m	f c m	f c m	f c m	f c m	f c m
	· size	f m c	f m c	f m c	f m c	f m c	f m c
	· contrast	f d p	f d p	f d p	f d p	f d p	f d p
	· colour						
7. Texture	· fine earth	(S) L Si C	(S) L Si C	(S) L Si C	(S) L Si C	(S) L Si C	S L Si C
		S L Si C	S L Si C	S L Si C	S L Si C	S L Si C	S L Si C
	· large particle · Size (cm)					LS	
	· %						
8. Structure	· grade	(1) w m s	1 (w) m s	1 w (m) s	1 w (m) s	1 w (m) s	1 w m s
	· type	p c (b) s p g v	p c (b) s p g v	p c (b) s p g v	p c (b) s p g v	p c (b) s p g v	p c b s p g v
	· size	f m c	f m c	f m c	f m c	f m c	f m c
9. Consistence	· wet · stickness	nS sS S vS	(nS) sS S vS	(nS) sS S vS	(nS) sS S vS	(nS) sS S vS	nS sS S vS
	· plasticity	nP sP P vP	(nP) sP P vP	(nP) sP P vP	(nP) sP P vP	(nP) sP P vP	nP sP P vP
	· moist	lo, vl, fr, Fi, vF, eF	(lo) vl, fr, Fi, vF, eF	lo, (vl) fr, Fi, vF, eF	lo, (vl) fr, Fi, vF, eF	lo, (vl) fr, Fi, vF, eF	lo, vl, fr, Fi, vF, eF
	· dry	lo, S, sH, H, vH, eH	(lo) S, sH, H, vH, eH	lo, (S) sH, H, vH, eH	lo, (S) sH, H, vH, eH	lo, (S) sH, H, vH, eH	lo, S, sH, H, vH, eH
10. Others (Cutans, Cementation, pores pans, Efflorescene, pH, Roots, Humus Dip, Ben. Hardness (mm), etc)		H = 4 mm Leaf (F) Roots (f) white (clear) pH 4.61	H = 8~11 mm Roots (f) pH 4.40	H = 24~26 mm Roots (f) pH 4.49	H = 20~22 mm (Fe) Roots (Red) (Weathering stone) pH 4.73	~ = 20~22 mm (Fe) pH 4.71	

Back

Profile Sketch



Clear Cut

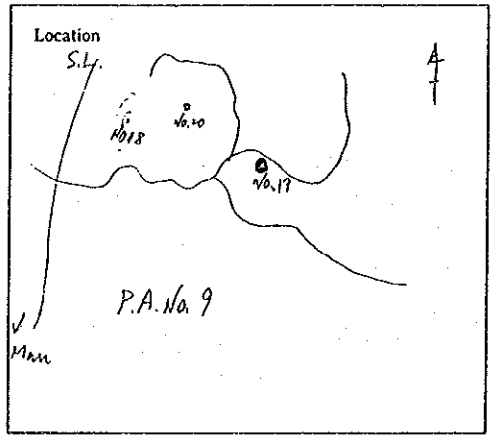
After Planting

Acacia mangium (1992)

Profile pit Under 2m (Shale / Fe pan)

color 2.5YR 5/8

10YR 4/2



App.Figure-2 Soil profile chart (sample)

App.Table-34 Guideline for soil profile descriprion

I. General Information

Profile No., Location, Date, Weather, Surveyor, Land form, Elevation, Slope, Land use or Vegetation, Parent Material, Drainage, Moisture Condition, Groundwater table(m)

II. Description of Individual Soil Horizons

1. Horizon symbol

Master horizons

H : An organic horizon formed or forming from accumulations of organic material deposited on the surface, that is saturated water for prolonged periods.

H(P) : Peat layer · H(M) : Muck layer.

O : An organic horizon formed ···, that is not saturated with water for more than a few days a year.

A : A mineral horizon formed or forming at or adjacent to the surface.

E : Eluviation layer.

B : A mineral horizon in which rock structure is obliterated or is but faintly evident, characterized by one or more of the following features:

(a) an illuvial concentration of silicate clay, iron, alluminium, or humus, alone or in combinations:

(b) a residual concentration of sesquioxides relative to source materials:

(c) an alteration of material from its original condition to the extent that silicate clays are formed, oxides are liberated, or both, or granular, blocky or prismatic structure is formed.

C : A mineral horizon (or layer) of unconsolidated material from which the solum is presumed to have formed which the does not show properties diagnostic of any other master horizons.

R : A layer of continuous indurated rock.

Letter suffixes

The suffix letters used to qualify the master horizons are follows:

b : Buried or bisequal soil horizon.

c : Accumulation in concretionary form.

g : Mottling reflecting variations in oxidation and reduction.

h : Accumulation of organic matter in mineral horizons.

k : Accumulation of calcium carbonate.

m : Strongry cemented, consolidated, indulated.

n : Accumulation of sodium.

p : Disturbed by ploughing or other tillage practices.

q : Accumulation of silica.

r : Strong reduction as a result of groundwater influence.

s : Accumulation of sesquioxides.

t : Illuvial accumulation of clay.

u : Unspecified.

w : Alteration in situ as reflected by clay content, colour, structure.

x : Occurrence of fragipan.

y : Accumulation of gypsum.

z : Accumulation of salts more soluble than gypsum.

2. Depth of top and bottom horizon (cm)

3. Boundary of horizon

a : abrupt, less than 2.5 cm · c : clear, 2.6 to 6.3 cm · g : gradual, 6.4 to 12.5 cm · d : diffuse, more than 12.6 cm

(continued)

4. Form of boundary
s : smooth • w : wavy • i : irregular • b : broken
5. Colour
- wet, - dry (Munsell Soil colour charts-Hue Value/Chroma)
6. Mottling
- abundance- f : few, less than 2 % of profile • c : common, 2 to 20 % • m : many, more than 20 %
- size- f : fine, less than 5 mm wide • m : medium, 5 to 15 mm • c : coarse, more than 15 mm
- contrast- f : faint • d : distinct • p : prominent
- colour
7. Texture(Sandy, Loamy, Silty, Clay)
8. Structure
- grade- l : structureless • w : weak • m : moderate • s : strong
- type- p : prismatic • c : columner • b : (angular) blocky • s : sub-angular blocky • p : platy
g : granular • v : non-structure
- size- f : fine • m : medium • c : coarse
9. Consistence
- wet
= stickness- nS : non-sticky • sS : slightly sticky • S : sticky • vS : very sticky
= plasticity- nP : non-plastic • sP : slightly plastic • P : plastic • vP : very plastic
- moist - lo : loose • vf : very friable • fr : friable • Fi : firm • vF : very firm •
eF : extremely firm
- dry - lo : loose • S : soft • sH : slightly hard • H : hard • vH : very hard •
eH : extremely hard
10. Roots
- abundance - abundant, very frequent, frequent, common, few, very few
- size - coarse, medium, fine

App.Table-35 Soil classification from profile surveys

Point No.	Land form	Land use or Vegetation	Brunei Soil Symbol	FAO/UNESCO Soil classification
1	Undulating to terrain	Secondary forest (Non Dipterocarp)	AND/BKT	CMd(Dystric Cambisols)
2	Upland site	Mixed Dipterocarp forest	BKT	ACh(Haplic Acrisols)
3	Riverine bottomland	Secondary forest	AND/TTN	CMx(Chromic Cambisols)
4	Upland site	Secondary forest (After rubber tree)	BKT	ACf(Ferric Acrisols)
5	Undulating upland site	Secondary forest	BKT	ACf(Ferric Acrisols) /ACg(Gleyic Acrisols)
6	Riverside	Open area (Grass)	BDG/BUU	GLm(Mollic Gleysols)
7	Undulating upland site	Secondary forest	BKT	ACh(Haplic Acrisols) /ACf(Ferric Acrisols)
8	Riverine bottomland (Swamp plain)	Peat swamp forest	AND	HSf(Fibric Histosols) /HSs(Terric Histosols)
9	Steeper slope>20°	Secondary forest	BKT/BTN	ACf(Ferric Acrisols)
10	Undulating to hilly terrain	Secondary forest	BKT	ACh(Haplic Acrisols)
11	Riverine bottomland	Secondary forest	BDG/BUU	GLe(Eutric Gleysols) /CMg(Gleyic Cambisols)
12	Undulating to terrain	Secondary forest	BKT/BTN	ACg(Gleyic Acrisols)
13	Upland site	After logging (Mixed Dipterocarp)	SKN	ACf(Ferric Acrisols)
14	Upland site	After logging (Mixed Dipterocarp)	BKT	ACf(Ferric Acrisols)
15	Undulating upland	Mixed Dipterocarp forest	Kerangas (sandy)	ARa(Albic Arenosols)
16	Undulating to steep terrain	Mixed Dipterocarp forest	BKT	ACp(Plinthic Acrisols)
17	Riverine bottomland	Mixed Dipterocarp forest	AND/ALL	HSs(Terric Histosols) /HSf(Fibric Histosols)
18	Upland site	Acacia mangium planted	Kerangas (sandy)	ARa(Albic Arenosols)
19	Steep terrain	Acacia mangium planted	SKN	ACf(Ferric Acrisols)
20	Undulating to terrain bottomland (Swamp)	After logging (Peat swamp forest)	AND/ALL	HSs(Terric Histosols) /HSf(Fibric Histosols)
21	Undulating to hilly terrain (slope 30°)	Mixed Dipterocarp forest	BKT/SKN	ACh(Haplic Acrisols)
22	Undulating to hilly terrain (slope 15°)	Mixed Dipterocarp forest	BKT	ACf(Ferric Acrisols) ARa(Albic Arenosols)

(continued)

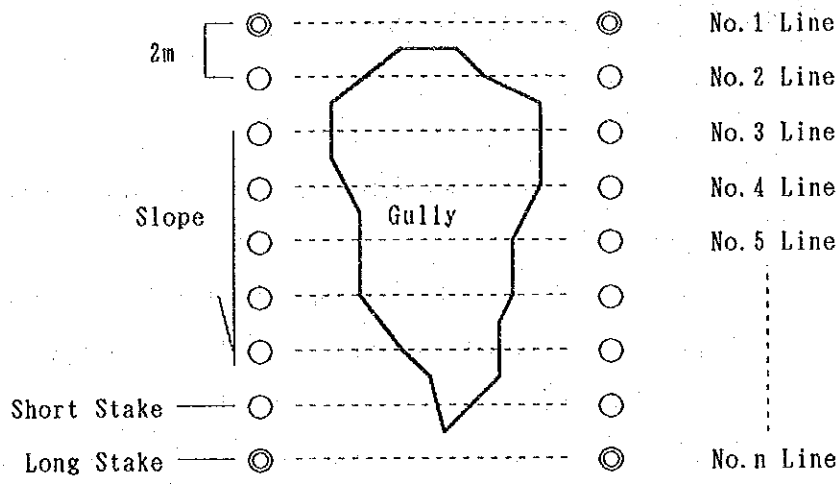
Point No.	Land form	Land use or Vegetation	Brunei Soil Symbol	FAO/UNESCO Soil classification
23	Upland site	After logging (Mixed Dipterocarp)	BKT/SKN	ACh(Haplic Acrisols)
24	Riverine bottomland	Mixed Dipterocarp forest	AND/ALL	CMd(Dystric Cambisols) /CMg(Gleyic Cambisols)
25	Undulating to hilly terrain	After logging (Mixed Dipterocarp)	BKT/SKN	ACf(Ferric Acrisols)
26	Upland site	After logging (Mixed Dipterocarp)	BKT/SKN	ACf(Ferric Acrisols)
27	Upland site	Mixed Dipterocarp forest	BTN	ACh(Haplic Acrisols)
28	Undulating to hilly terrain (slope 10°)	Mixed Dipterocarp forest	BTN	ACh(Haplic Acrisols)
29	Undulating to terrain	Agricultural field (Fruits)	BTN	ACh(Haplic Acrisols) /CMd(Dystric Cambisols)
30	Undulating to hilly terrain	Secondary forest	BKT/BTN	ACf(Ferric Acrisols)
31	Riverside bottomland	Secondary forest	BDG/TTN	GLd(Dystric Gleysols) /HSf(Fibric Histosols)
32	Riverine bottomland	Secondary forest	AND	HSf(Fibric Histosols)
33	Riverside	Secondary forest	AND/ALL	GLd(Dystric Gleysols) HSf(Fibric Histosols)
34	Undulating to hilly terrain	Mixed Dipterocarp (After Rubber tree)	BKT/BTN	CMd(Dystric Cambisols) /ACh(Haplic Acrisols)
35	Undulating to hilly terrain (slope 10°)	Mixed Dipterocarp forest	BKT/BTN	ACf(Ferric Acrisols)
36	Undulating to hilly terrain	Secondary forest	BKT/BTN	ACf(Ferric Acrisols)
37	Riverside bottomland	Secondary forest (Rotan plantation)	BKT/BTN	FLd(Dystric Fluvisols)
38	Undulating to hilly terrain	Before paddy field	BKT/BTN	ACh(Haplic Acrisols)
39	Riverine bottomland	Before paddy field	BDG/TTN	GLd(Dystric Gleysols) ACg(Gleyic Acrisols)
40	Undulating to hilly terrain	Rubber plantation	BKT/BTN	ACf(Ferric Acrisols)
41	Undulating to hilly terrain	Secondary forest	BKT/BTN	CMd(Dystric Cambisols)
42	Undulating to hilly terrain	Secondary forest	BTN/SKN	ACh(Haplic Acrisols)
43	Riverside bottomland	Secondary forest	ALL	CMd(Dystric Cambisols) /FLd(Dystric Fluvisols)
44	Undulating upland site	Secondary forest	BTN	ACf(Ferric Acrisols)

(continued)

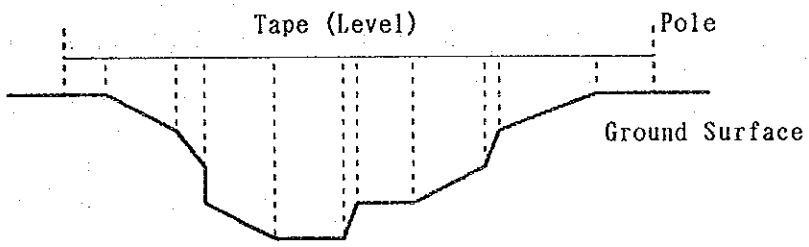
Point No.	Land form	Land use or Vegetation	Brunei Soil Symbol	FAO/UNESCO Soil classification
45	Undulating to terrain (Low land)	Scondary forest	BTN/ALL	FLd(Dystric Fluvisols) /CMd(Dystric Cambisols)
46	Swamp plain	Peat swamp forest	AND	HSf(Fibric Histosols) /HSs(Terric Histosols)
47	Riverside	Secondary forest	ALL	GLd(Dystric Gleysols)
48	Riverside bottomland	Secondary forest	ALL	GLd(Dystric Gleysols)
49	Undulating to hilly terrain (slope 15°)	Secondary forest	BKT/BTN	CMd(Dystric Cambisols)
50	Riverside	Secondary forest	BKT/BTN	ACh(Haplic Acrisols)
51	Undulating to hilly terrain (slope 10°)	Secondary forest	BKT/BTN	ACf(Ferric Acrisols)
52	Riverside	Secondary forest	BDG/TTN	GLd(Dystric Gleysols)
53	Riverside	Secondary forest	AND/TTN	ACg(Gleyic Acrisols) HSf(Fibric Histosols)
54	Swamp plain	Secondary forest (Freshwater swamp)	AND/TTN	GLd(Dystric Gleysols)
55	Undulating to hilly terrain (slope 20°)	Secondary forest	BKT/BTN	ACh(Haplic Acrisols)
56	Undulating to hilly terrain	Secondary forest	BKT/BTN	ACh(Haplic Acrisols)
57	Undulating to hilly terrain	Secondary forest	BKT/BTN	ACh(Haplic Acrisols) CMd(Dystric Cambisols)
58	Swamp plain	Secondary forest	ALL	GLd(Dystric Gleysols)
59	Undulating to hilly terrain	Secondary forest	BKT	ACf(Ferric Acrisols)
60	Undulating to terrain (Upland site)	Mixed Dipterocarp forest	BKT	ACf(Ferric Acrisols)
61	Undulating to terrain	Mixed Dipterocarp forest	BKT	ACf(Ferric Acrisols)
62	Undulating to terrain bottomland	Mixed Dipterocarp forest	BKT	ACf(Ferric Acrisols)
63	Undulating to terrain	Mixed Dipterocarp	BKT	CMx(Chromic Cambisols)
64	Riverside	Secondary forest	BDG	CMx(Chromic Cambisols) ACf(Ferric Acrisols)
65	Riverine bottomland (Freshwater swamp)	Secondary forest (Rubber plantation)	BDG/AND	GLe(Eutric Gleysols) CMg(Gleyic Cambisols)

App.Table-36 Simplified key diagnostic horizons

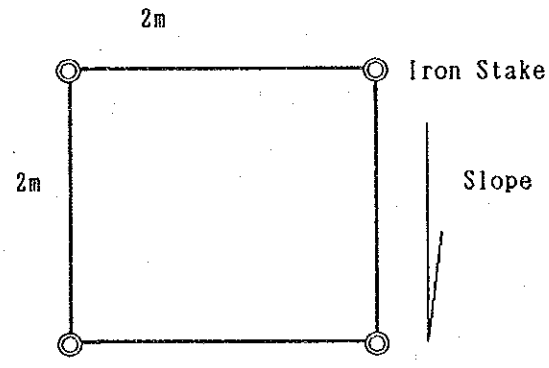
Diagnostic horizon	symbol	Characteristics
Albic E	E	Bleached, usually sandy material, lacking clay and free iron oxides
Argic B	Bt	Horizon with higher clay content than overlying horizon
Calcic	Ak, Bk, Ck	Secondary carbonate accumulation, with $CaCO_3$ equivalent > 15% and 5% more than underlying horizons
Cambic B	Bw	In situ altered B - most B horizons not meeting criteria for argic, natric, spodic or oxic
Ferralic B	Bws	Highly weathered SL or finer texture. Low CEC, illuvial clay and weatherable minerals
Gypsic	Ay, By, Cy	Secondary $CaSO_4$ accumulation > 5% more than underlying horizon
Histic H	H	High organic material and peaty
Mollic A	—	'Fertile earth' topsoil, well structured and dark moderately high organic material and base saturation > 50%
Ochric A	—	A horizon of dry area. Pale, low organic material and /or thin or hard and massive. Excluding finely stratified material, e.g. alluvium
Sulfuric	—	Oxidised sulfide-rich materials; pH < 3.5 and jarosite mottles
Umbric A	—	'Infertile earth' topsoil, with moderately high organic material and base saturation < 50% but excluding fimic horizons



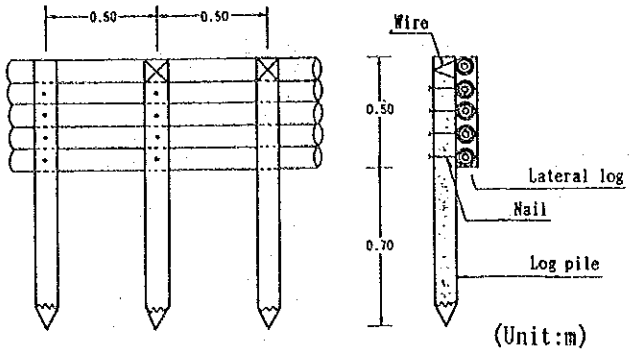
App.Figure-3 Plan of gully erosion experimental plot



App.Figure-4 Lateral profile of gully erosion experimental plot

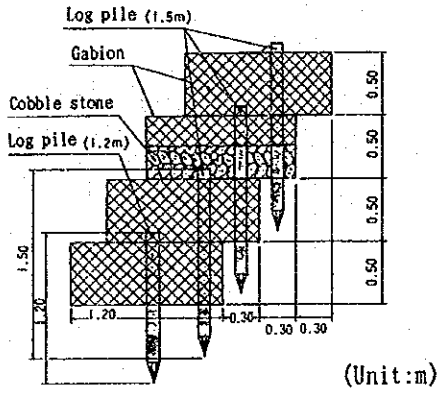


App.Figure-5 Plan of sheet erosion experimental plot



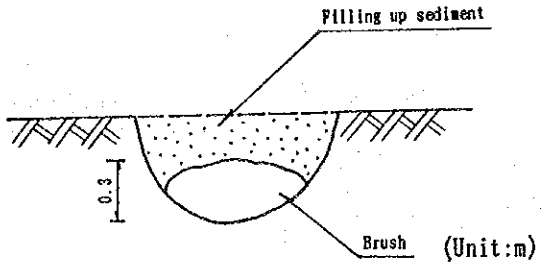
Standard table of log buried work	
Log pile	small diameter above 8cm length 1.2m
Lateral log	small diameter above 9cm length 1.8m
Wire	length 1.2m per point
Nail	length 15cm per point

App.Figure-6 Standard diagraph of log buried work



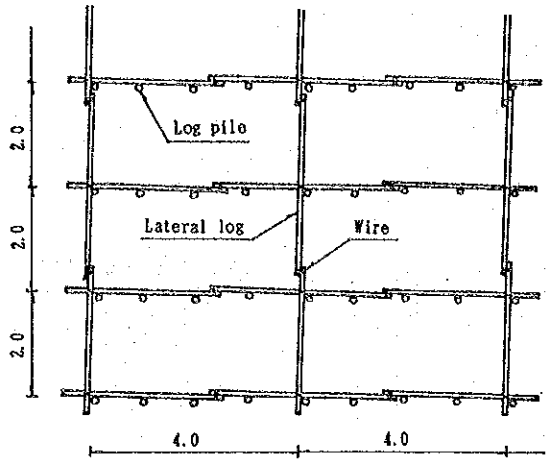
Standard table of gabion buried work	
Gabion	diameter 4.0mm meshes 13cm hight 0.5m width 1.2m
Log pile	small diameter above 8cm length 1.5m
Log pile	small diameter above 8cm length 1.2m
Cobble stone	diameter 15-30cm

App.Figure-7 Standard diagraph of gabion buried work



Standard table of brush culvert work	
Brush	length above 2.0m

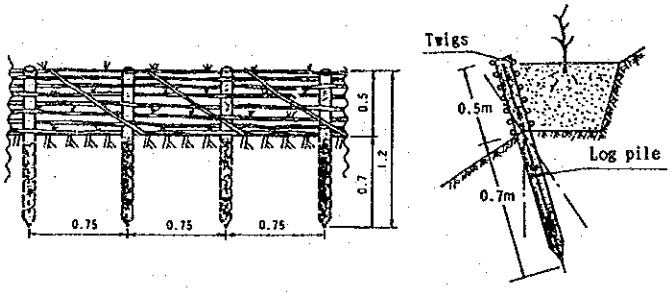
App.Figure-8 Standard diagraph of brush culvert work



(Unit:m)

Standard table of log crib work	
Log pile	small diameter above 6cm length 0.6m
Lateral log	small diameter above 6cm length 3.6m
Wire	length 1.2m per point

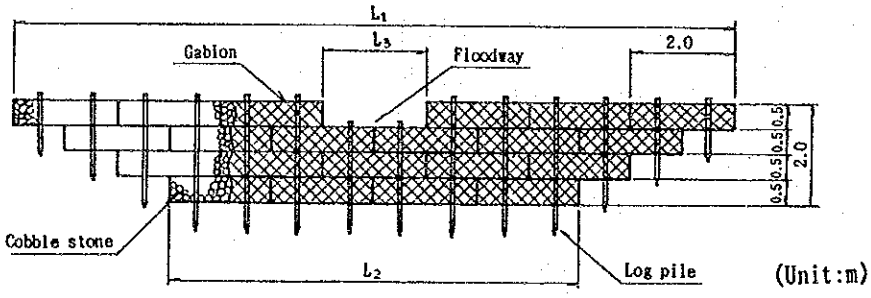
App.Figure-9 Standard diagraph of log crib work



(Unit:m)

Standard table of fence work	
Log pile	small diameter above 8cm length 1.2m
Twigs	butt-end diameter above 3cm length 3.5m

App.Figure-10 Standard diagraph of fence work

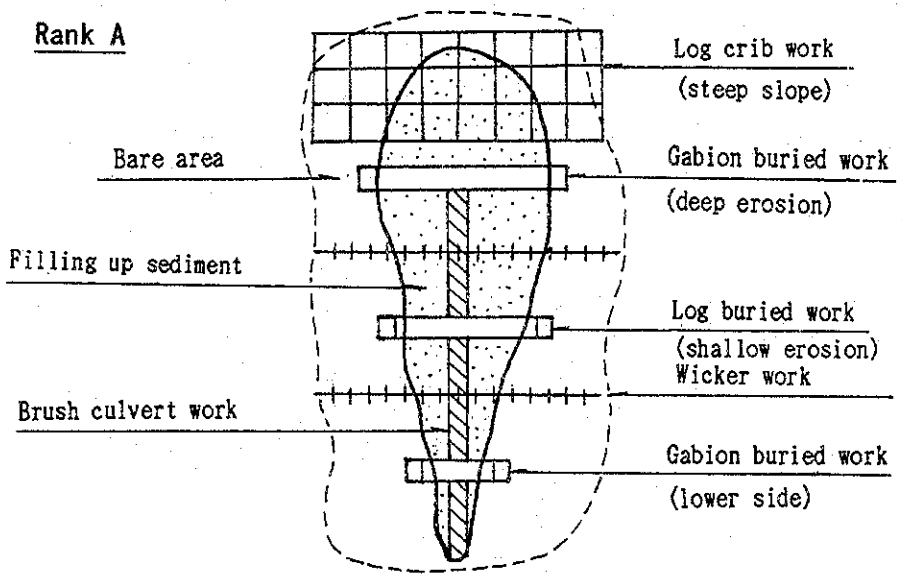


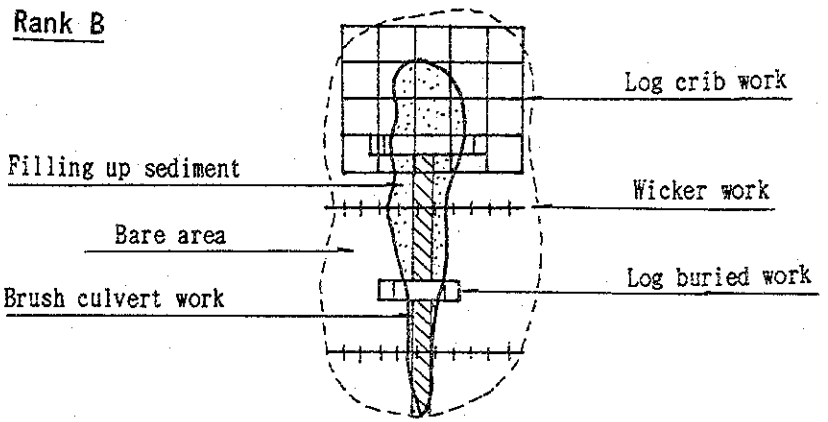
(Unit:m)

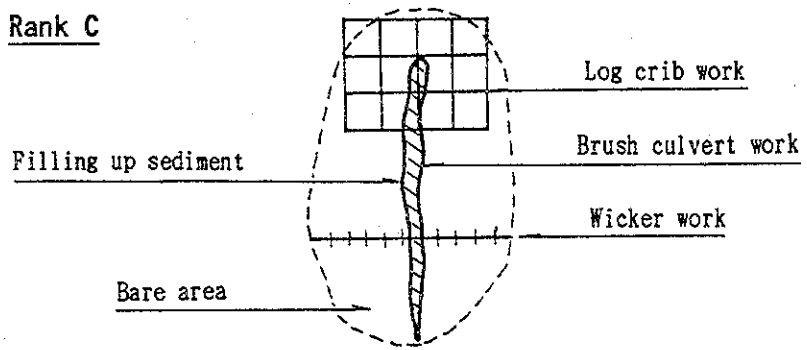
Standard table of gabion check dam	
Gabion	diameter 4.0mm meshes 13cm hight 0.5m width 1.2m
Log pile	small diameter above 8cm length 1.2m
Log pile	small diameter above 8cm length 1.7m
Log pile	small diameter above 8cm length 2.2m
Log pile	small diameter above 8cm length 2.7m
Cobble stone	diameter 15-30cm

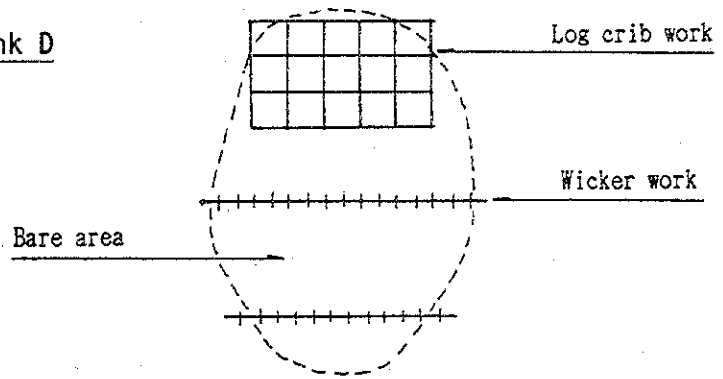
L_{1-3} : Appropriate lengths in accordance with catchment area

App.Figure-11 Standard diagraph of gabion check dam









App.Figure-12 Standard position of works