1. Site occupancy sampling (June-October 1966)

Week	June	July	August	Sept	Oct
1st	3rd - 9th	1st – 7th	5th –11th	2nd – 13th	7th – 13th
3rd	17th – 23rd	15th – 21st	19th – 25th	16th – 22nd	21st – 27th

2. Categorisation

40 sites related to natural and man-made facilities available within FRA. These include waterfalls, nature trails, bird watching hides, wooden shelters, benches, picnic sites, camping sites (not only frequented by visitors, but also subjected to varying degree of recreational use).

Basing on site occupancy "zones" of similar characters and visibly "self-contained areas" can be identified.

3. Site Ocupancy

No. Sampling Sites	Category	Mean No. of Visitors/Month	Total Occupancy (40 sites) Month	Year
10	H	>700	7,000	84,000
10	M	500 – 700	6,000	72,000
10	L	300 – 500	4,000	48,000
10	C	<300	2,000	24,000

4. Visitor's Distribution

Day	Visitor's Disn. (%)
Monday	4
Tuesday	4
Wednesday	10
Thursday	10
Friday	12
Saturday	25
Sunday	35

Appendix 2. Data Set of Recreational used Effects of Compaction on Bulk Density, Soil Moisture Contents, Total Pore Space and Air Filled Pore Space at 4 Sites, Sg. Tua, Selangor Recreational Area

		Sample 1			
		a	b	c	d
Recreational Intensity	Soil Depth (cm)	Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)
Light	0-5	1.060	10.530	0.600	0.493
I	5-10	1.081	10.980	0.592	0.492
	10-15	1.131	10.830	0.573	0.481
	15-20	1.211	11.860	0.543	0.476
Medium	0-5	1.237	12.000	0.528	0.433
II	5-10	1.283	11.140	0.516	0.417
	10-15	1.379	10.020	0.480	0.382
	15-20	1.470	9.580	0.445	0.339
Heavy	0-5	1.339	9.460	0.495	0.421
III	5-10	1.393	9.770	0.474	0.417
	10-15	1.379	10.290	0.480	0.379
	15-20	1.495	10.640	0.436	0.373
Control	0-5	1.098	12.320	0.586	0.497
IV	5-10	1.162	8.750	0.562	0.493
	10-15	1.237	9.930	0.533	0.486
	15-20	1.261	10.930	0.524	0.475

Sample 2				Sample 3			
a	b	c	d	a	b	c	d
Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)	Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)
1.142	15.500	0.569	0.477	1.053	6.760	0.603	0.494
1.196	9.960	0.549	0.471	1.091	9.260	0.588	0.487
1.223	9.970	0.538	0.438	1.238	9.790	0.533	0.468
1.287	10.900	0.514	0.421	1.364	10.570	0.485	0.442
1.299	8.450	0.510	0.413	1.141	8.090	0.569	0.506
1.504	8.570	0.432	0.341	1.324	8.990	0.500	0.413
1.599	9.670	0.397	0.306	1.394	6.620	0.474	0.385
1.608	10.110	0.393	0.295	1.417	8.310	0.465	0.369
1.373	11.210	0.482	0.416	1.336	6.550	0.496	0.434
1.388	8.970	0.476	0.393	1.343	6.300	0.493	0.434
1.392	11.630	0.475	0.384	1.445	7.710	0.455	0.383
1.401	10.460	0.471	0.383	1.459	7.540	0.449	0.379
1.062	11.430	0.599	0.497	1.119	15.590	0.578	0.477
1.117	10.810	0.578	0.491	1.119	10.070	0.578	0.483
1.189	12.840	0.511	0.475	1.248	9.690	0.529	0.480
1.292	15.770	0.512	0.463	1.267	7.730	0.522	0.476

Sample 4				Sample 5			
a	b	c	d	a	b	c	d
Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)	Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)
1.091	-	0.588	0.510	1.187	-	0.552	0.475
1.172	-	0.538	0.479	1.226	-	0.537	0.451
1.243	-	0.531	0.443	1.306	-	0.507	0.427
1.268	-	0.522	0.430	1.379	-	0.480	0.413
1.263	-	0.523	0.426	1.212	-	0.543	0.467
1.295	-	0.511	0.412	1.234	-	0.534	0.446
1.321	-	0.502	0.401	1.312	-	0.505	0.446
1.393	-	0.474	0.399	1.417	-	0.465	0.387
1.414	-	0.466	0.380	1.447	-	0.454	0.353
1.420	-	0.464	0.375	1.506	-	0.432	0.350
1.442	-	0.456	0.363	1.552	-	0.414	0.310
1.563	-	0.410	0.314	1.561	-	0.411	0.318
1.090	-	0.589	0.492	1.111	-	0.581	0.480
1.207	-	0.545	0.487	1.198	-	0.548	0.435
1.214	-	0.542	0.481	1.232	-	0.535	0.468
1.256	-	0.526	0.475	1.309	-	0.506	0.467

Sample 6				Mean			
a	b	c	d	a	b	c	d
Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)	Bulk Density gm/cc	Soil Moisture Contents (% of dry soil)	Total Pore Space (Fraction of total soil volume)	Air Filled Pore (Fraction of total soil volume)
1.211	-	0.543	0.469	1.124	10.930	0.576	0.486
1.282	-	0.516	0.423	1.175	10.070	0.553	0.467
1.304	-	0.508	0.411	1.241	10.200	0.532	0.445
1.391	-	0.475	0.398	1.317	11.110	0.503	0.430
1.203	-	0.546	0.452	1.226	9.510	0.537	0.450
1.236	-	0.534	0.437	1.313	9.570	0.505	0.411
1.307	-	0.507	0.421	1.385	8.770	0.478	0.390
1.385	-	0.477	0.409	1.448	9.330	0.453	0.366
1.368	-	0.484	0.412	1.380	9.070	0.480	0.403
1.403	-	0.467	0.386	1.409	8.350	0.468	0.393
1.447	-	0.454	0.392	1.443	9.880	0.456	0.369
1.545	-	0.451	0.374	1.504	9.550	0.438	0.357
1.092	-	0.588	0.496	1.095	13.110	0.587	0.490
1.121	-	0.577	0.489	1.154	9.880	0.565	0.480
1.168	-	0.559	0.476	1.215	10.820	0.542	0.478
1.221	-	0.539	0.477	1.268	11.480	0.522	0.472

Appendix 3. Formatting of Sg. Tua FRA Soil Compaction Data

Recreational Intensity	Soil Depth (cm)	Bulk Density gm/cc	Soil Moisture Contents	Total Pore Space	Air Filled Pore
I	0-5	1.06	10.53	0.6	0.493
I	5-10	1.081	10.98	0.592	0.492
I	10-15	1.131	10.83	0.573	0.481
I	15-20	1.211	11.86	0.543	0.476
II	0-5	1.237	12	0.526	0.433
II	5-10	1.283	11.14	0.516	0.417
II	10-15	1.379	10.02	0.48	0.382
II	15-20	1.47	9.58	0.445	0.339
III	0-5	1.339	9.46	0.495	0.421
III	5-10	1.393	9.77	0.474	0.417
III	10-15	1.379	10.29	0.48	0.379
III	15-20	1.495	10.64	0.436	0.373
IV	0-5	1.098	12.32	0.586	0.497
IV	5-10	1.162	8.75	0.562	0.493
IV	10-15	1.237	9.93	0.533	0.486
IV	15-20	1.261	10.93	0.524	0.475
I	0-5	1.142	15.5	0.569	0.477
I	5-10	1.196	9.96	0.549	0.471
I	10-15	1.223	9.97	0.538	0.438
I	15-20	1.287	10.9	0.514	0.421
II	0-5	1.299	8.45	0.51	0.413
II	5-10	1.504	8.57	0.432	0.341
II	10-15	1.599	9.67	0.397	0.306
II	15-20	1.608	10.11	0.393	0.295
III	0-5	1.373	11.21	0.482	0.416
III	5-10	1.388	8.97	0.476	0.393
III	10-15	1.392	11.63	0.475	0.384
III	15-20	1.401	10.46	0.471	0.383
IV	0-5	1.062	11.43	0.599	0.497
IV	5-10	1.117	10.81	0.578	0.491
IV	10-15	1.189	12.84	0.551	0.475
IV	15-20	1.292	15.77	0.512	0.463
I	0-5	1.053	6.76	0.603	0.477
I	5-10	1.091	9.26	0.588	0.471
I	10-15	1.238	9.79	0.533	0.438
I	15-20	1.364	10.57	0.485	0.421
II	0-5	1.141	8.09	0.569	0.413
II	5-10	1.324	8.99	0.5	0.341
II	10-15	1.394	6.662	0.474	0.306
II	15-20	1.417	8.31	0.465	0.295
III	0-5	1.336	6.55	0.496	0.416
III	5-10	1.343	6.3	0.493	0.393
III	10-15	1.445	7.71	0.455	0.384
III	15-20	1.459	7.54	0.449	0.383

IV	0-5	1.119	15.59	0.578	0.497
IV	5-10	1.119	10.07	0.578	0.491
IV	10-15	1.248	9.69	0.529	0.475
IV	15-20	1.267	7.73	0.522	0.463
I	0-5	1.091	-	0.588	0.51
I	5-10	1.172	-	0.538	0.479
I	10-15	1.243	-	0.531	0.443
I	15-20	1.268	-	0.522	0.43
II	0-5	1.263	-	0.523	0.426
II	5-10	1.295	-	0.511	0.412
II	10-15	1.321	-	0.502	0.401
II	15-20	1.393	-	0.474	0.399
III	0-5	1.414	-	0.466	0.38
III	5-10	1.42	-	0.464	0.375
III	10-15	1.442	-	0.456	0.363
III	15-20	1.563	-	0.41	0.314
IV	0-5	1.09	-	0.589	0.492
IV	5-10	1.207	-	0.545	0.487
IV	10-15	1.214	-	0.542	0.481
IV	15-20	1.256	-	0.526	0.475
I	0-5	1.187	-	0.552	0.475
I	5-10	1.226	-	0.537	0.451
I	10-15	1.306	-	0.507	0.427
I	15-20	1.379	-	0.48	0.413
II	0-5	1.212	-	0.543	0.467
II	5-10	1.234	-	0.534	0.446
II	10-15	1.312	-	0.505	0.446
II	15-20	1.417	-	0.465	0.387
III	0-5	1.447	-	0.454	0.353
III	5-10	1.505	-	0.432	0.35
III	10-15	1.552	-	0.414	0.31
III	15-20	1.561	-	0.411	0.318
IV	0-5	1.111	-	0.581	0.48
IV	5-10	1.198	-	0.548	0.435
IV	10-15	1.232	-	0.535	0.468
IV	15-20	1.309	-	0.506	0.467
I	0-5	1.211	-	0.543	0.469
I	5-10	1.282	-	0.516	0.423
I	10-15	1.304	-	0.508	0.411
I	15-20	1.391	-	0.475	0.398
II	0-5	1.203	-	0.546	0.452
II	5-10	1.236	-	0.534	0.437
II	10-15	1.307	-	0.507	0.421
II	15-20	1.385	-	0.477	0.409
III	0-5	1.368	-	0.484	0.412
III	5-10	1.403	-	0.467	0.386
III	10-15	1.447	-	0.454	0.392

III	15-20	1.545	-	0.451	0.374
IV	0-5	1.092	-	0.588	0.496
IV	5-10	1.121	-	0.577	0.489
IV	10-15	1.168	-	0.559	0.476
IV	15-20	1.221	-	0.539	0.477
I	0-5	1.124	10.93	0.576	0.486
I	5-10	1.175	10.07	0.553	0.467
I	10-15	1.241	10.2	0.532	0.445
I	15-20	1.317	11.11	0.506	0.43
II	0-5	1.226	9.51	0.537	0.45
II	5-10	1.313	9.57	0.505	0.411
II	10-15	1.385	8.77	0.478	0.39
II	15-20	1.448	9.33	0.453	0.366
III	0-5	1.38	9.07	0.48	0.403
III	5-10	1.409	8.35	0.468	0.393
III	10-15	1.443	9.88	0.456	0.369
III	15-20	1.504	9.55	0.438	0.357
IV	0-5	1.095	13.11	0.587	0.49
IV	5-10	1.154	9.88	0.565	0.48
IV	10-15	1.215	10.82	0.542	0.478
IV	15-20	1.268	11.48	0.522	0.472

Appendix 4-Appendix 23 representing ANOVA and MCT Tests of mean values of soil compaction, while number 1, 2, 3, 4 representing lightly, medium, heavily use and control respectively.

Appendix 4. ANOVA Result of Bulk Density for Different Soil Depth

```
> out(1)
                Df Sum of Sq Mean Sq F Value       Pr(F) Dif
a intensity      3   0.2968 0.09893   40.99 9.923e-009   S
  Residuals     20   0.0483 0.00241
> out(2)
                Df Sum of Sq Mean Sq F Value       Pr(F) Dif
b intensity      3   0.2602 0.08674   16.79 0.00001095   S
  Residuals     20   0.1033 0.00517
> out(3)
                Df Sum of Sq Mean Sq F Value       Pr(F) Dif
c intensity      3   0.2203 0.07343   13.93 0.00003915   S
  Residuals     20   0.1054 0.00527
> out(4)
                Df Sum of Sq Mean Sq F Value       Pr(F) Dif
d intensity      3   0.2196 0.07321   16.86 0.00001064   S
  Residuals     20   0.0868 0.00434
```

Appendix 5. MCT Result of Bulk Density at Soil Depth of 0-5 cm.

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: bulk

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2  -0.1020    0.0284     -0.1810     -0.0224 ****
1-3  -0.2560    0.0284     -0.3350     -0.1760 ****
1-4   0.0287    0.0284     -0.0507      0.1080
2-3  -0.1540    0.0284     -0.2330     -0.0743 ****
2-4   0.1300    0.0284      0.0511      0.2100 ****
3-4   0.2840    0.0284      0.2050      0.3640 ****
```

Appendix 6. MCT Result of Bulk Density at Soil Depth of 5-10 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: bulk

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2  -0.1380    0.0415    -0.2540     -0.0219 ****
1-3  -0.2340    0.0415    -0.3500     -0.1180 ****
1-4   0.0207    0.0415    -0.0955      0.1370
2-3  -0.0960    0.0415    -0.2120      0.0201
2-4   0.1590    0.0415     0.0425      0.2750 ****
3-4   0.2550    0.0415     0.1390      0.3710 ****
```

Appendix 7. MCT Result of Bulk Density at Soil Depth of 10-15 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: bulk

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2  -0.1440    0.0419    -0.2620     -0.0272 ****
1-3  -0.2020    0.0419    -0.3190     -0.0847 ****
1-4   0.0262    0.0419    -0.0911      0.1430
2-3  -0.0575    0.0419    -0.1750      0.0598
2-4   0.1710    0.0419     0.0534      0.2880 ****
3-4   0.2280    0.0419     0.1110      0.3450 ****
```

Appendix 8. MCT Result of Bulk Density at Soil Depth of 15-20 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: bulk

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2  -0.1320    0.038     -0.2380     -0.0252 ****
1-3  -0.1870    0.038     -0.2940     -0.0809 ****
1-4   0.0490    0.038     -0.0575      0.1550
2-3  -0.0557    0.038     -0.1620      0.0508
2-4   0.1810    0.038      0.0742      0.2870 ****
3-4   0.2360    0.038      0.1300      0.3430 ****
```

Appendix 9. ANOVA Result of Total Pore Space for Different Soil Depth

```
                Df Sum of Sq Mean Sq F Value       Pr(F)  Dif
a   intensity  3   0.04238 0.01413   40.67 1.061e-008    S
    Residuals 20   0.00695 0.00035
    > out(2)
                Df Sum of Sq Mean Sq F Value       Pr(F)  Dif
b   intensity  3   0.03636 0.01212   16.14 0.00001446    S
    Residuals 20   0.01502 0.00075
    > out(3)
                Df Sum of Sq Mean Sq F Value       Pr(F)  Dif
c   intensity  3   0.03112 0.01037   13.81 0.00004144    S
    Residuals 20   0.01502 0.00075
    > out(4)
                Df Sum of Sq  Mean Sq F Value       Pr(F) Dif
d   intensity  3   0.02843 0.009477   15.48 0.00001929    S
    Residuals 20   0.01225 0.000612
```

Appendix 10. MCT Result of Total Pore Space at Soil Depth of 0-5 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: space

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0393    0.0108     0.00922      0.0694 ****
1-3   0.0963    0.0108     0.06620      0.1260 ****
1-4  -0.0110    0.0108    -0.04110      0.0191
2-3   0.0570    0.0108     0.02690      0.0871 ****
2-4  -0.0503    0.0108    -0.08040     -0.0202 ****
3-4  -0.1070    0.0108    -0.13700     -0.0772 ****
```

Appendix 11. MCT Result of Total Pore Space at Soil Depth of 5-10 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: space

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0488    0.0158     0.00455      0.0931 ****
1-3   0.0857    0.0158     0.04140      0.1300 ****
1-4  -0.0113    0.0158    -0.05560      0.0329
2-3   0.0368    0.0158    -0.00745      0.0811
2-4  -0.0602    0.0158    -0.10400     -0.0159 ****
3-4  -0.0970    0.0158    -0.14100     -0.0527 ****
```

Appendix 12. MCT Result of Total Pore Space at Soil Depth of 10-15 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: space

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2  0.05420    0.0158     0.00989      0.0984 ****
1-3  0.07600    0.0158     0.03170      0.1200 ****
1-4 -0.00983    0.0158    -0.05410      0.0344
2-3  0.02180    0.0158    -0.02240      0.0661
2-4 -0.06400    0.0158    -0.10800     -0.0197 ****
3-4 -0.08580    0.0158    -0.13000     -0.0416 ****
```

Appendix 13. MCT Result of Total Pore Space at Soil Depth of 15-20 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: space

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0500    0.0143      0.0100      0.0900 ****
1-3   0.0652    0.0143      0.0252      0.1050 ****
1-4  -0.0183    0.0143     -0.0583      0.0217
2-3   0.0152    0.0143     -0.0248      0.0552
2-4  -0.0683    0.0143     -0.1080     -0.0283 ****
3-4  -0.0835    0.0143     -0.1230     -0.0435 ****
```

Appendix 14. ANOVA Results of Air-Filled Pore Space for Different Soil Depth

```
                Df Sum of Sq  Mean Sq F Value        Pr(F) Dif
a  intensity  3   0.02968 0.009894   16.75 0.00001113   S
   Residuals 20   0.01181 0.000591
   > out(2)
                Df Sum of Sq Mean Sq F Value        Pr(F) Dif
b  intensity  3   0.03231 0.01077   12.56 0.00007687   S
   Residuals 20   0.01715 0.00086
   > out(3)
                Df Sum of Sq Mean Sq F Value        Pr(F) Dif
c  intensity  3   0.04486 0.01495   15.35 0.00002036   S
   Residuals 20   0.01948 0.00097
   > out(4)
                Df Sum of Sq Mean Sq F Value        Pr(F) Dif
d  intensity  3   0.05367 0.01789   19.82 3.315e-006   S
   Residuals 20   0.01805 0.00090
```

Appendix 15. MCT Results of Air-filled Pore Space at Soil Depth of 0-5 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: air

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0368    0.014    -0.00243     0.07610
1-3   0.0837    0.014     0.04440     0.12300 ****
1-4  -0.0035    0.014    -0.04280     0.03580
2-3   0.0468    0.014     0.00757     0.08610 ****
2-4  -0.0403    0.014    -0.07960    -0.00107 ****
3-4  -0.0872    0.014    -0.12600    -0.04790 ****
```

Appendix 16. MCT Results of Air-Filled Pore Space at Soil Depth of 5-10 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: air

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0562    0.0169     0.00885      0.1030 ****
1-3   0.0747    0.0169     0.02740      0.1220 ****
1-4  -0.0125    0.0169    -0.05980      0.0348
2-3   0.0185    0.0169    -0.02880      0.0658
2-4  -0.0687    0.0169    -0.11600     -0.0214 ****
3-4  -0.0872    0.0169    -0.13400     -0.0399 ****
```

Appendix 17. MCT Results of Air-Filled Pore Space at Soil Depth of 10-15 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: air

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2   0.0545    0.018     0.00408      0.1050 ****
1-3   0.0762    0.018     0.02570      0.1270 ****
1-4  -0.0330    0.018    -0.08340      0.0174
2-3   0.0217    0.018    -0.02880      0.0721
2-4  -0.0875    0.018    -0.13800     -0.0371 ****
3-4  -0.1090    0.018    -0.16000     -0.0587 ****
```

Appendix 18. MCT Results of Air-Filled Pore Space at Soil Depth of 15-20 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 2.7987
response variable: air

intervals excluding 0 are flagged by '****'

     Estimate Std.Error Lower Bound Upper Bound
1-2   0.0637    0.0173      0.0151      0.11200 ****
1-3   0.0732    0.0173      0.0246      0.12200 ****
1-4  -0.0422    0.0173     -0.0907      0.00638
2-3   0.0095    0.0173     -0.0390      0.05800
2-4  -0.1060    0.0173     -0.1540     -0.05730 ****
3-4  -0.1150    0.0173     -0.1640     -0.06680 ****
```

Appendix 19.ANOVA Results of Soil Moisture Content for Different Soil Depth

```
                Df Sum of Sq Mean Sq F Value   Pr(F) Dif
a  intensity  3      27.0    8.99  0.5124 0.6828 NS
   Residuals 10     175.4   17.54
   > out(2)
                Df Sum of Sq Mean Sq F Value   Pr(F) Dif
b  intensity  3      11.24   3.747  0.7262 0.5644 NS
   Residuals  8      41.28   5.160
   > out(3)
                Df Sum of Sq Mean Sq F Value   Pr(F) Dif
c  intensity  3      12.07   4.025   1.514 0.2835 NS
   Residuals  8      21.26   2.658
   > out(4)
                Df Sum of Sq Mean Sq F Value Pr(F)   Dif
d  intensity  3      13.70   4.567   1.157 0.384   NS
   Residuals  8      31.56   3.945
```

Appendix. 20. MCT Results of Soil Moisture Content at Soil Depth of 0-5 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 3.0597
response variable: moisture

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2    1.420      3.42       -9.04       11.90
1-3    3.720      3.20       -6.06       13.50
1-4    2.780      3.20       -7.01       12.60
2-3    2.310      3.20       -7.48       12.10
2-4    1.360      3.20       -8.42       11.10
3-4   -0.942      2.96      -10.00        8.12
```

Appendix 21. MCT Results of Soil Moisture Content at Soil Depth of 5-10 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 3.2025
response variable: moisture

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2    0.507      1.85       -5.43        6.45
1-3    0.897      1.85       -5.04        6.84
1-4   -1.640      1.85       -7.58        4.30
2-3    0.390      1.85       -5.55        6.33
2-4   -2.150      1.85       -8.09        3.79
3-4   -2.540      1.85       -8.48        3.40
```

Appendix 22. MCT Results of Soil Moisture Content at Soil Depth of 10-15 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 3.2025
response variable: moisture

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2    1.43      1.33       -2.84        5.69
1-3    1.68      1.33       -2.59        5.94
1-4   -0.75      1.33       -5.01        3.51
2-3    0.25      1.33       -4.01        4.51
2-4   -2.18      1.33       -6.44        2.09
3-4   -2.43      1.33       -6.69        1.84
```

Appendix 23. MCT Results of Soil Moisture Content at Soil Depth of 15-20 cm

```
95 % simultaneous confidence intervals for specified
linear combinations, by the Tukey method

critical point: 3.2025
response variable: moisture

intervals excluding 0 are flagged by '****'

    Estimate Std.Error Lower Bound Upper Bound
1-2    1.78      1.62       -3.42        6.97
1-3    1.12      1.62       -4.08        6.31
1-4   -1.02      1.62       -6.21        4.17
2-3   -0.66      1.62       -5.85        4.53
2-4   -2.80      1.62       -7.99        2.40
3-4   -2.14      1.62       -7.33        3.06
```

Appendix 24. Data Set for Vegetation Transect

Sampling Row No.	Dist. From Experimental Plot Centre	Zone* I						Zone II						Zone III						Zone IV					
		Point Quadrat (Species)						Point Quadrat (Species)						Point Quadrat (Species)						Point Quadrat (Species)					
	(m)	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total
1	0 - 0.5	Bd	Bd	Bd	Bd	Bd	5	-	-	-	-	Bd	1	-	-	-	-	-	0	Bd (2)	Bd (2)	Bd	Bd (2)	Bd (2)	9
2	0.5 - 1.0	Bd	Bd	Bd	-	Bd	4	-	-	-	-	Bd	1	-	-	-	-	-	0	Bd (2)	Bd (2)	Bd (2)	Bd (2)	Bd (2)	10
3	1.0 - 1.5	Bd	R. rep	Bd	Bd	Bd	5	Bd	Bd	-	-	-	2	-	-	Bd	-	-	1	Bd (2)	Bd	Bd (2)	Bd	Bd (2)	8
4	1.5 - 2.0	Bd	Bd	Bd	Bd	Bd	5	-	-	Bd	Bd	-	2	-	-	-	-	R. rep	1	Bd (2)	Bd (2)	Bd (2)	Bd	E. mollis	8
5	2.0 - 2.5	R. rep	Bau.	-	Bd	Bd	4	-	-	Bd	-	Bd	2	Bau.	Ag. mac	-	-	-	2	Bd, Mim	Bd (2)	Bd (2)	Bd (2)	Bd	9
6	2.5 - 3.0	Bd	Bd	R. rep	R. rep	R. rep	5	Bd	-	Bd	Bd	-	3	-	-	-	Zing	-	1	Bd	Bd (2)	Bd (2)	Bd (2)	Bd (2)	9
7	3.0 - 3.5	Sc. pur	Bd	Bau.	-	Pur.	4	Bd	Bd	-	-	-	2	Dipc.	-	-	-	-	1	Bd (2)	Bd (2)	M. cord.	Bd	Bd	7
8	3.5 - 4.0	Den.	Den.	-	Eug.	-	3	R. rep	R. rep	-	Bd	Bd	4	Eug.	Antho	-	-	-	2	Bd (2)	P. hor.	Bd (2)	Bd	Ays	7
9	4.0 - 4.5	V. arb	-	An. cad	-	P. hors	3	So. pur.	R. rep	R. rep	-	R. rep	4					S. lep.	1	Sh. lepro	R. rep	Bd (2)	Bd	Bd (2)	7
10	4.5 - 5.0	Pan.	Ciners	-	H. scy.	Dipc.	4	R. rep	R. rep	-	R. rep	R. rep	4	-	-	-	Sh. parv	-	1	R. rep(2)	Bd	Bd (2)	Bd	Ays	7

+ Zone I, II, III, IV representing Lightly, Medium, Heavily and Control sites respectively

Bd = *B. dactyloides*
R. rep = *R. repens*
Sc. pur. = *Sc. purpurascens*
An. cad = *A. cadamba*
Dendro = *Dendrocalamus spp*
Mim = *M. pudina*
M. cor = *M. cordata*
Ag. mac = *Ag. macrophylla*
Bau = *Bauhinia spp*
Pur = *Purera/Cantrosema*
Zing = *Zingiber spp*
Ays = *Ayssesia spp*
Dipc = *Dipcranopteris spp*
Ster = *Sterculia spp*
H. Scy = *H. scyphus*
P. hor = *P. horsfieldii*
Sh. parv = *Sh. parvifolia*
Sh. lepro = *Sh. leprosula*
Antho = *Anthocarpus spp*
Eug. = *Eugenia spp*
V. arb = *V. arborea*
Pan = *P. klossii*

Length of Overland flow, L_g

Is the horizontal distance between drainage divide and adjacent stream (the longest path of over land flow)

$$L_g = \frac{1}{2D_d}$$

Where D_d is drainage density

$$D_d = \frac{\text{Total stream length}}{\text{Catchment area}}$$

Form factor, R_f

$$R_f = \frac{A_u}{L_b^2}$$

Where:
A_u = basin area (km^2)
L_b = basin length (km) - the longest distance from outlet to the ridge (along the main river)

Circularity Ratio

$$R_r = \frac{A_u}{A_c}$$

Where: A_u = Catcment area
A_c = Area of a circle having equal perimeter

Elongation Ratio, R_l

$$R_l = \frac{D_c}{L_{bm}}$$

Where:
D_c= diameter of circle having same area as the given catchment
L_{bm} = maximum basin length (along the main stream)

Relief Ratio

$$R_h = \frac{H}{L}$$

Where: H=the relief
L= horizontal distance on which relief measurement was furnished

Source: Strahler (1996) and Zulkifli (1990)

Appendix 26. Water Quality Data Set for Sg. Tua FRA

TNT	Treatment Type	Sample 1					Sample 2					Sample 3					Sample 4				
		Temp (°C)	pH	Conductance (S/cm)	Dissolved O² (mg/l)	Turbidity (NTU)	Temp (°C)	pH	Conductivity (S/cm)	Dissolved O² (mg/l)	Turbidity (NTU)	Temp (°C)	pH	Conductance (S/cm)	Dissolved O² (mg/l)	Turbidity (NTU)	Temp (°C)	pH	Conductance (S/cm)	Dissolved O² (mg/l)	Turbidity (NTU)
1	L1	25.8	7.03	35.9	7.3	4.99	25.9	6.99	36.3	7.4	4.79	25.7	7.05	36.1	7.3	4.92	25.6	7.00	36.2	7.3	4.91
2	L2	25.9	7.03	36.2	7.3	4.92	25.8	6.98	36.1	7.4	4.99	25.7	7.02	36.2	7.4	5.00	25.8	7.04	36.0	7.3	4.98
3	L3	25.9	7.04	35.9	7.4	4.99	25.8	7.02	36.0	7.1	5.01	25.9	7.05	36.2	7.3	4.97	26.0	6.99	36.3	7.2	5.00
4	M1	26.1	7.06	36.2	7.3	5.01	26.0	7.12	36.1	7.2	5.00	25.9	7.02	36.2	7.3	4.98	25.9	6.99	36.2	7.1	4.97
5	M2	26.0	7.03	36.1	7.2	5.11	25.9	6.98	36.4	7.2	4.97	25.8	7.14	36.1	7.3	5.02	25.9	6.98	36.3	7.1	4.98
6	M3	26.0	7.11	36.0	7.3	5.12	26.1	7.03	35.8	7.2	4.87	25.9	7.05	36.1	7.2	5.02	25.7	7.00	36.4	7.1	5.01
7	H1	25.9	7.02	36.1	7.2	5.21	26.1	7.04	35.9	7.1	7.93	25.8	7.12	35.9	7.2	4.87	26.0	6.98	36.0	7.1	4.87
8	H2	25.8	7.12	36.0	6.9	4.98	26.1	7.03	36.0	6.9	4.96	26.1	6.99	36.2	7.2	5.00	26.0	7.03	36.3	7.3	5.00
9	H3	25.9	7.11	36.2	7.2	5.12	25.8	7.02	36.1	7.1	4.98	26.0	6.98	36.0	7.0	5.03	26.0	7.01	36.1	7.0	4.99
10	C1	25.8	7.12	35.9	7.3	4.98	26.0	7.05	36.0	7.2	5.05	25.9	7.09	37.2	7.2	5.02	25.9	7.02	36.1	7.1	5.00
11	C2	26.0	6.99	36.1	7.1	4.98	26.1	7.02	36.2	7.3	4.89	25.9	7.02	35.9	7.3	5.01	25.7	7.11	36.3	7.3	5.02
12	C3	25.0	6.98	35.9	7.2	5.02	25.8	7.02	36.0	7.2	5.01	25.7	7.01	36.4	7.1	4.98	26.0	7.07	36.1	7.3	4.98

Appendix 27. Formatting of Sg. Tua FRA Water Quality

TMT	Treatment	Temp (°C)	pH	Conductance (S/cm²)	Dissolved Oxygen (mg/l)	Turbidity (NTU)
1	L1	25.8	7.03	35.9	7.3	4.89
1	L1	25.9	6.99	36.3	7.4	4.79
1	L1	25.7	7.05	36.1	7.3	4.92
1	L1	25.6	7.00	36.2	7.3	4.91
2	L2	25.9	7.03	36.2	7.3	4.92
2	L2	25.8	6.98	36.1	7.4	4.99
2	L2	25.7	7.02	36.2	7.4	5.00
2	L2	25.8	7.04	36.0	7.3	4.98
3	L3	25.9	7.04	35.9	7.4	4.99
3	L3	25.8	7.02	36.0	7.1	5.01
3	L3	25.9	7.05	36.2	7.3	4.97
3	L3	26.0	6.99	36.3	7.2	5.00
4	M1	26.1	7.06	36.2	7.3	5.01
4	M1	26.0	7.12	36.1	7.2	5.00
4	M1	25.9	7.02	36.2	7.2	4.98
4	M1	25.9	6.99	36.2	7.1	4.97
5	M2	26.0	7.03	36.1	7.2	5.11
5	M2	25.9	6.98	36.4	7.2	4.97
5	M2	25.8	7.14	36.1	7.3	5.02
5	M2	25.9	6.98	36.3	7.1	4.98
6	M3	26.0	7.11	36.0	7.3	5.12
6	M3	26.1	7.03	35.8	7.2	4.87
6	M3	25.9	7.05	36.1	7.2	5.02
6	M3	25.7	7.00	36.4	7.1	5.01
7	H1	25.9	7.02	36.1	7.2	5.21
7	H1	26.1	7.04	35.9	7.1	4.93
7	H1	25.8	7.12	35.9	7.2	4.87
7	H1	26.0	6.98	36.0	7.1	4.89
8	H2	25.8	7.12	36.0	6.9	4.98
8	H2	26.1	7.03	36.0	6.9	4.96
8	H2	26.1	6.99	36.2	7.2	5.00
8	H2	26.0	7.03	36.3	7.3	5.00
9	H3	25.9	7.11	36.2	7.2	5.12
9	H3	25.8	7.02	36.1	7.1	4.98
9	H3	26.0	6.98	36.0	7.0	5.03
9	H3	26.0	7.01	36.1	7.0	4.99
10	C1	25.8	7.12	35.9	7.3	4.98
10	C1	26.0	7.05	36.0	7.2	5.05
10	C1	25.9	7.09	37.2	7.2	5.02
10	C1	25.9	7.02	36.1	7.1	5.00

11	C2	26.0	6.99	36.1	7.1	4.98
11	C2	26.1	7.02	36.2	7.3	4.89
11	C2	25.9	7.02	35.9	7.3	5.01
11	C2	25.7	7.11	36.3	7.3	5.02
12	C3	25.0	6.98	35.9	7.2	5.02
12	C3	25.8	7.02	36.0	7.2	5.01
12	C3	25.7	7.01	36.4	7.1	4.98
12	C3	26.0	7.07	36.1	7.3	4.88

Appendix 28. Management Recommendations for Sg. Tua FRA

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
Undisturbed/Control	Little/None	High	- Good vegetation cover, with large abundance of plant and species diversity	- Refuge for animals and birds	- No management action needed since current activities are sufficient to sustain the habitats in terms of abundance and variety of plant species.
			- Aesthetically pleasing	- Maintain aesthetically qualities of FRA	- Natural conditions sustainable, no management action needed. Plant species/communities respond positively to existing habitats.
			- Ground springly due to presence of thick vegetation mat	- Maintain naturalness of environment	- No management action needed. Plant community continue to proliferate in response to existing conditions
			- Ground uncompacted, run-off not noticeable	- Maintain current soil conditions	- Maintain current vegetation cover - Riparian vegetation be encouraged as it will stabilise the bank and shade the water
			- Water quality good, with little sedimentation	- Maintain hydrological balance	- No management action needed
Light	Difficult	Medium to high	- Good vegetation cover with abundance of plant and species diversity	- Maintaining ecological balance	- Monitor to detect signs of site deterioration and carry out immediate remedial measures to restore balance

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
			- Aesthetically pleasing	- Continue to maintain aesthetically qualities of FRA	- Light use is encouraged as it increases plant diversity. Sucession is in favour of the more hardy species. Discontinue practice of cutting down undergrowth to ground level as this eliminates slow growing herbs and shrubs, as well as seedlings of canopy trees which can lead to degradation of environment. This practice also prevent regeneration of canopy species, while allowing for weedy species to invade site
			- Ground springly due to presence of thick vegetation mat	- Maintain naturalness of environment	- Extention services needed to ensure compatible land use such that it does not exceed carrying capacity
			- Soil compaction acceptible no major noticeable site deterioration	- Maintain current visitation rate	- Monitor to detect signs of site deterioration and carry-out immediate remedial measures such as soil aeration to a depth of 10 cm is sufficient, to restore balance
			- Water quality good, run-off not noticeable	- Maintain hydrological balance	- Maintain strips of dense vegetation along river bank as deterent against sediments from overland flow into river as well as provision of shade to river

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
			- Run-off not noticeable		- No solid waste be dispersed into water. Solid waste from visitor usage be collected and disposed off - Encourage visitors to bring out own rubbish when they leave - Sewrage be treated prior to released into environment, especially where toilets are built near water sources
Medium	Less easy	Low to medium	- Changes in ground vegetation noticeable, vegetation cover thinner and interceded with bare ground	- Lower density usage	- Control usage sparingly * Regular monitoring to detect visitors' impact * Modify management practices if needed to restore ground vegetation * Partial restriction of visitors to ensure compatible land use to prevent further site deterioration * Need to change or modify visitors' behaviour * Reduce visitor numbers * Repair damage

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
			- Vegetation deterioration continued, causing reduction in visitors' satisfaction	- Improved visitors recreational experience	- Restoration of denuded areas, as there sites are important buffer against further and unpleasuring site deterioration, as seen in the heavy used site * Soil (a) Amelioration of upper soil layer (up to 10cm depth) via soil scarification and soil aeration (b) Eroded sites restored by importing soil externally * Vegetation (a) Fertilizer application to improve cover (b) Undertake control measures; replanting, terracing, hydroseeding, hydrosprigging (c) Habitat improvement to encourage greater abundance and variety of vegetation

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
					* Improve litter distribution (a) Use leaves and other detrites to provide nutrients and organic matter cost effectively. (b) Use compost, mulches and manure to restore fertility
			- Soil compaction begining to be noticeable	- Lower soil compaction	- Restored compacted sites * Soil scarification or soil aeration required up to depth of 10 cm, followed by soil conditioning and fertilizer application to restore compacted sites. * Properly located trials to channel traffic into other designated sites to reduce congregation of visitors at site.
			- Water quality good , run-off not noticeable	- Maintain hydrological balance	- Maintain strip of dense vegetation along river bank as riparian against sediments from overland flow into river - No solid waste be dispersed into water, solid waste from visitor usage be collected and disposed off. - Encourage visitors to bring out own rubbish when they leave

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
					- Sewrage be treated prior to released into environment, especially where toilets are build near water resources.
Heavy	Easy	Low	- Minimal vegetational cover with abundance occurance of bare ground	- High density usage	- Undertake measures to control further site deterioration in order to maintain visitors' experience
			- Ground highly compacted		* Soil improvement measures
			- Turbidity and run-off not noticeable		(a) Amelioration of upper soil layer (up to 10 cm depth) via soil scarification and soil aeration
					(b) Eroded sites restored by importing soil externally
					(c) Improved litter redistribution
					* Vegetation restoration
					(a) Replanting vegetation using more resilient species. This aim at increasing durability of the biotic community as well as inducing recovery undertaken either by direct planting or hydroseeding or hydrosprigging

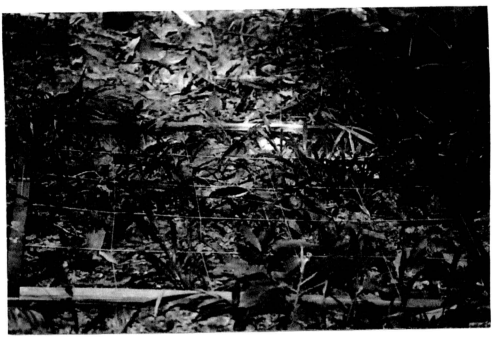
RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
					(b) Silvicultural practices to encourage ground cover at the expense of the overstorey. The openings will encourage the herbaceous and shrub layers to response to additional light emission. * Water quality (a) Maintain existing hydrological balance since water quality is not affected by heavy recreational use site improvement by retention of existing riparian vegetation * Physical conditioning (a) Rest and rotation of sites, such that some recreational opportunities are always available. (b) Leave open and culturally treat the site in keeping the site operating while implementing rehabilitation measures.

RECREATION USE CATEGORY	ACCESS	HABITAT SENTIVITY	CHARACTERISTIC	MANAGEMENT	
				OBJECTIVE	STRATEGY
					(c) Site hardening or surfacing intensively used areas, such as viewing points, rotation of site furniture (barbecues, picnic tables/chairs, shelters) (d) Create more 'edges' or border by breaking up such sites with artificial apron and buffers to boost the capacity of the landscape to 'absorb' visitors (e) Redistribution of heavy used sites by increasing access to previously under-used sites

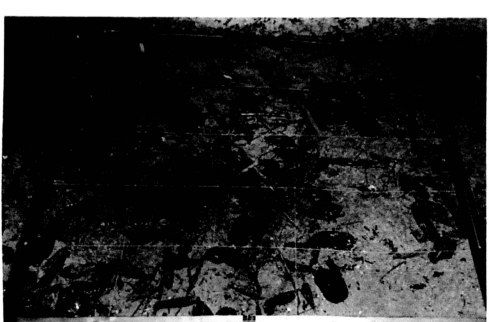
Appendix 29. Vegetation Cover, Control Site

Appendix 30. Vegetation Cover, Lightly Recreational Used Site

Appendix 31 Vegetation Cover, Medium Recreational Used Site



Appendix 32. Vegetation Cover, Heavily Recreational Used Site



Appendix 33. Overview of Medium Through to Heavily Recreational Used Site